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Chemical Reactions & Equations

Check Point 01

Q. 1. What is the name given for the substance that reacts and forms in a chemical reaction?

Answer: The substances which react are called Reactants of a chemical reaction. The substances which are formed are called Products of a chemical reaction.

Q. 2. State the law of conservation of mass.

Answer: "Mass can neither be created nor be destroyed in a chemical reaction"- This is known as the law of conservation of mass.

Q. 3. Write the skeletal equation and balanced equation for the following reaction:

Potassium bromide (aq) + Barium iodide (aq) → Potassium iodide (aq) + Barium bromide (s)

Answer: Skeletal Equation: $\text{KBr(aq)} + \text{BaI}_2\text{(aq)} \rightarrow \text{KI(aq)} + \text{BaBr}_2\text{(s)}$

Balanced Equation: $2\text{KBr(aq)} + \text{BaI}_2\text{(aq)} \rightarrow 2\text{KI(aq)} + \text{BaBr}_2\text{(s)}$

Verification:

There are 2 atoms of K present in LHS and 2 atoms in RHS. Similarly, atoms of I, Br, Ba are also the same in both sides. This is what a balanced equation means.

Q. 4. Balance the following chemical equations:

(i) $\text{Mg(OH)}_2 + \text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2\text{O}$

(ii) $\text{N}_2 + \text{H}_2 \rightarrow \text{NH}_3$

(iii) $\text{P}_4 + \text{O}_2 \rightarrow \text{P}_2\text{O}_5$

Answer: (i) $\text{Mg(OH)}_2 + 2\text{HCl} \rightarrow \text{MgCl}_2 + 2\text{H}_2\text{O}$

(ii) $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$

(iii) $\text{P}_4 + 5\text{O}_2 \rightarrow 2\text{P}_2\text{O}_5$

Reason: Number of atoms on both sides of the equation should be equal for balanced equations.

Q. 5. Which of the following reactions is balanced, A or B?

A: $2\text{NaCl} + 2\text{H}_2\text{O} \xrightarrow{\text{Electric current}} 2\text{NaOH} + 2\text{Cl}_2 + \text{H}_2$

B: $\text{Ca(OH)}_2 + \text{Cl}_2 \rightarrow \text{CaOCl}_2 + \text{H}_2\text{O}$

Answer: Equation B is Balanced.

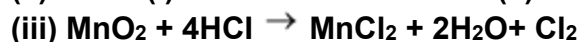
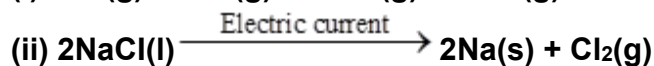
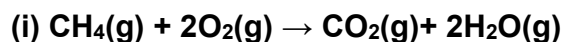
Reason: In equation, A number of Cl atoms in LHS is 2 But in RHS number of atoms is 4. Hence it is not balanced. But in equation B number of each atom in LHS is equal to number of that atom in RHS.

Q. 6. What do the symbols (aq) and (s) indicate in a balanced chemical equation?

Answer: These symbols refer to the phase of reactants and products which take part in the reaction. (aq) represents aqueous phase which means that this substance is in dissolved in water. (s) represents solid phase.

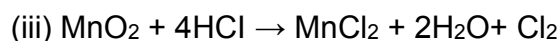
Check Point 02

Q. 1. Identify the type of reaction:



Answer: (i) $\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{g})$: This is an example of Exothermic reaction because it leads to release of HEAT as can be seen water is given in gaseous form.

(ii) $2\text{NaCl}(\text{l}) \xrightarrow{\text{Electric current}} 2\text{Na}(\text{s}) + \text{Cl}_2(\text{g})$: This is the example of Decomposition reaction of common salt using electricity. This reaction is also called Electrolysis of Bryn solution.



This reaction is the example of a redox reaction. Because MnO_2 has donated its oxygen atoms and hence got reduced. Also, Chlorine is converted into Cl^- to form Cl_2 and hence get oxidised. Since both oxidation and reduction has taken place. This is a redox reaction.

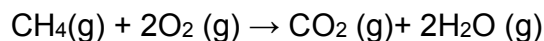
Q. 2. What happens when hydrogen gas is added to copper oxide?

Answer: When Hydrogen gas is added to copper oxide reduction of copper oxide to metallic copper takes Place. Following is the Reaction:



Q. 3. Name one reaction which is accompanied by the evolution of heat.

Answer: All reactions which are Exothermic are accompanied by evolution of heat. One such example is burning of methane. Reaction is as Follows:



Q. 4. Name the type of reaction for the following:

(i) Vegetable matter changing into compost.

(ii) Burning of natural gas.

Answer: i) Vegetable matter is changed into compost by microorganisms using Decomposition Reactions. The complex organic material of which Vegetable matter is made up of is broken down into simpler molecules during this process.

ii) Burning of natural gas leads to evolution of heat hence it is an example of an exothermic reaction. In this reaction Natural gas is also oxidized into CO_2 Hence it is also an example of redox reaction.

Q. 5. Write the four factors responsible for the corrosion of iron.

Answer: Following four factors are responsible for corrosion of Iron:

i) Moisture: Moisture reacts with iron to form rust (Mixture of Iron oxide and water)

ii) Oxygen: Oxygen reacts with iron to form Iron oxide which on combining with moisture becomes rust

iii) Poor maintenance: Poor maintenance leads to continuous exposure of iron to moisture and air which causes rust.

iv) Poorly built iron substances: If other substances like carbon, are not mixed while making iron substances in proper proportions, It gets rusted.

Q. 6. Name one element in which corrosion is not proved to be wasteful.

Answer: In the case of Aluminium, Corrosion is not harmful. Because the new layer of corroded aluminium itself acts as a prevention for further corrosion.

Chapter Exercise

Q. 1. What is breaking and making of bonds in chemical reaction called?

Answer: Breaking of bonds is called as Bond Dissociation [Dissociate means to break]. Bond Dissociation is an endothermic reaction which means that energy is absorbed in breaking of a bond.

Making of a bond is called as Bond Formation. This reaction is exothermic in nature which means that energy is given off or liberated while the formation of bonds.

Q. 2. Which product is formed when carbon dioxide and water react in the same ratio?

Answer: Carbon Dioxide when dissolved in water leads to the formation of a weak acid which is called carbonic acid.

Reaction is as follows:

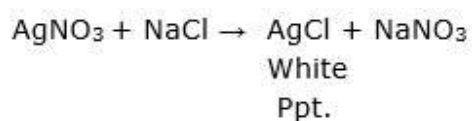


Q. 3. Give an example of a reaction which is double displacement reaction as well as precipitation reaction?

Answer: Double Displacement Reaction is a type of chemical reaction in which anions and cations of the reacting compounds exchange their positions to form different compounds.

The precipitation reaction is a type of reaction in which one of the reactants is solvent and one of the products formed is insoluble in the solvent.

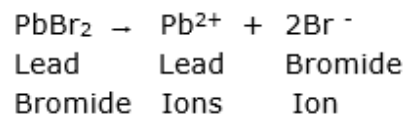
So the example of double displacement and precipitation reaction is as follows:



Q. 4. Which kind of chemical reaction takes place when an electric current is passed through fused lead bromide?

Answer: When an electric current is passed through fused lead bromide, lead bromide being an ionic compound gets dissociated into lead and bromide ions.

The reaction is as follows:

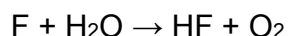


Q. 5. Silver article gets black coating. Name the phenomenon.

Answer: Whenever a metal is exposed to air and water for a long time it gets surrounded by a layer due to any type of chemical reactions and gets corroded. This process is called corrosion. So when a silver article gets a black coating, the phenomenon is called as corrosion.

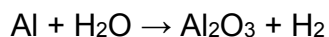
Q. 6. Write any two chemical reactions in which water acts as a reducing and oxidising agent respectively.

Answer: The reaction based on reducing property of water is as follows:



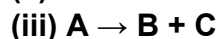
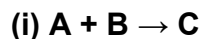
In the above reaction fluorine reacts with water to form hydrogen fluoride and oxygen gas is liberated.

The reaction based on oxidizing property of water is as follows:



In the above reaction aluminum reacts with water to aluminum oxide and hydrogen gas is liberated.

Q. 7. Identify the type of chemical reaction in the following:



Answer: (i) This reaction is a type of combination reaction in which reactants combine to form a single product.

(ii) This reaction is a type of displacement type of reaction in which a reactive reactant displaces the less reactive element from the compound.

In the above reaction reactant A displaces B from the compound BC to form a new compound AC.

(iii) This reaction is a decomposition reaction in which compound A gets dissociated or broken down to form simple products B and C.

(iv) Double Displacement Reaction is a type of chemical reaction in which anions and cations of the reacting compounds exchange their positions to form different compounds.

This reaction is a double displacement type of reaction.

Q. 8. Why is hydrogen peroxide kept in coloured bottles?

Answer: Hydrogen Peroxide or H_2O_2 is a highly reactive compound which gets dissociated in the presence of light to form water and oxygen.

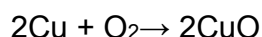
To prevent this dissociation reaction, H_2O_2 is stored in coloured bottles to prevent light from entering the bottles.

Q. 9. A shiny brown coin made up of an element turned black on heating. What was the element of the coin and what is the black compound formed?

Answer: From the description, it can be concluded that the element of the coin is copper.

On being heated copper gets oxidized due to the presence of oxygen in air which results in the formation of copper oxide (precisely cupric oxide) which is black in color.

The reaction is as follows:



Q. 10. Marble statues often slowly get corroded when kept in open for a long time. Give a suitable explanation.

Answer: Taj Mahal is an example of corrosion of marble. The discoloration of its marble is due to corrosion.

Air primarily consists of various pollutant gases like carbon dioxide, nitrogen dioxide, Sulphur dioxide etc which mix with moisture in air to form acids such as carbonic acid, nitric acid and sulphuric acid. This acid comes down as acid rain and causes corrosion of marble statues and monuments. Marble which is composed of calcium carbonate reacts with the different acids which is given as follow:-



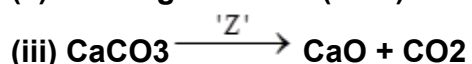
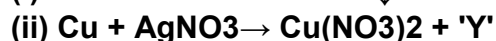
The compounds formed are water soluble and are easily washed away. Thus blackening of marble surface is the corrosion of marble surface due to the formation of soluble products of calcium.

Q. 11. What is the difference between skeletal equation and balanced chemical equation? Give example.

Answer: The difference between skeletal equation and balanced chemical equation is as follows:

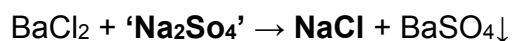
Skeletal Equation	Balanced Equation
• The number of atoms of each element is not same.	• The number of atoms of each element is same.
• These equations are needed to be balanced.	• These equations are not needed to be balanced.
• Mass is not same on the both sides of equation.	• Mass is same on the both sides of equation.
• E.g. $\text{Mg} + \text{O}_2 \rightarrow \text{MgO}$	• E.g. $3\text{Fe} + 4\text{H}_2\text{O} \rightarrow \text{Fe}_3\text{O}_4$

Q. 12. Complete the missing components/variables given as reactant and product in the following reactions:



Answer: (i) To get the missing component we have to think that in product we got sulphate salt (BaSO_4) so in reactant there must be some other sulphate must be present so that double displacement reaction could happen.

So, the complete reaction is:



(ii) In this reaction, we can clearly see displacement reaction is taking place in which copper displaces silver nitrate and forms copper nitrate and silver.

So, the complete reaction is: $\text{Cu} + \text{AgNO}_3 \rightarrow \text{Cu(NO}_3)_2 + \text{'Ag'}$

(iii) We can guess after seeing this reaction that it must be decomposition reaction as a single reactant breaks into 2 products but there is only one thing missing i.e. heat is not written on the arrow now it is thermal decomposition reaction.

So, the complete reaction is: $\text{CaCO}_3 \xrightarrow{\text{heat}} \text{CaO} + \text{CO}_2$

Q. 13. What is redox reaction? Identify the substance oxidized and the substance reduced in the following reactions.

(i) $\text{CuO} + \text{H}_2 \rightarrow \text{Cu} + \text{H}_2\text{O}$

(ii) $\text{MnO}_2 + 4\text{HCl} \rightarrow \text{MnCl}_2 + \text{Cl}_2 + 2\text{H}_2\text{O}$

Answer: The substance which gains oxygen or loses hydrogen during the reaction, it is said to be oxidised and the substance which loses oxygen or gains hydrogen during the reaction, it is said to be reduced.

i) $\text{CuO} + \text{H}_2 \rightarrow \text{Cu} + \text{H}_2\text{O}$

In the following reaction copper oxide loses oxygen and forms copper so copper is reduced and hydrogen gains oxygen and forms water so hydrogen is oxidised.

ii) $\text{MnO}_2 + 4\text{HCl} \rightarrow \text{MnCl}_2 + \text{Cl}_2 + 2\text{H}_2\text{O}$

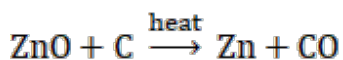
In the following reaction HCl is oxidised to Cl_2 as it loses hydrogen and MnO_2 is reduced to MnCl_2 as it loses oxygen.

Q. 14. Zinc oxide reacts with carbon, on heating to form zinc metal and carbon monoxide. Write a balanced chemical equation for this reaction. Name

(i) **Oxidising agent**

(ii) **The reducing agent in this reaction.**

Answer: The reaction mentioned in the question is as follows:



The oxidising agent is the substance which oxidises other substance and gets reduced.

Reducing agent is the substance which reduces other substance and gets oxidised.

i) In the reaction zinc oxide (ZnO) is oxidising agent as it oxidises the carbon to carbon monoxide (CO) and zinc oxide gets reduced to zinc.

ii) Carbon is the reducing agent as it reduces zinc oxide to zinc and gets oxidised to carbon monoxide.

Q. 15. With the help of an activity; demonstrate how do we know that a chemical reaction has taken place?

Answer: For a chemical reaction to take place some chemical change must occur. So, here is the activity to demonstrate a chemical reaction:

Step-1: Take a magnesium ribbon around 2cm long by rubbing it with sand paper.

Step-2: Hold it with tongs.

Step-3: Burn the ribbon and collect the ash in a watch glass which is white in pair.

Precaution must be taken while performing the experiment to keep the burning ribbon far away from eye. The experiment should be under some expert supervision.

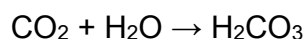
In the activity we observed that magnesium ribbon burns with a white flames and changes into white powder. This powder is magnesium oxide.

There was a change in state, change in colour, change in temperature all of these are chemical changes and this proves that chemical reaction takes places here in which magnesium was converted into magnesium dioxide.

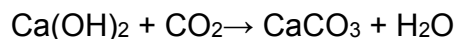
Q. 16. A water-insoluble substance X on reaction with dilute hydrochloric acid released a colourless and odourless gas accompanied by brisk effervescence. When the gas passed through water, the solution obtained turns blue litmus red. On bubbling the gas through lime water, it initially became milky and milkiness disappeared when the gas was passed in excess. Identify the substance X. Write the chemical equation of the reaction involved.

Answer: Here we will first find out the gas. It is stated that this gas turns lime water milky so it is sure that the gas is carbon dioxide (CO₂).

When CO₂ reacts with water then carbonic acid is formed (H₂CO₃), which turns blue litmus red.



When CO₂ is passed through lime water (Ca(OH)₂) it turns it milky and on excess passing of carbon dioxide it forms calcium bicarbonate which forms a colourless solution, so the reaction is:



On passing in an excess amount



For the identification of substance X, we know that in product carbon dioxide is there so there must be something of carbon must be there in reactant and X is water-insoluble so it should be calcium carbonate that is insoluble. So the reaction is:



Q. 17. On the occasion of Diwali, Rohan used solution of calcium hydroxide (slaked) for white washing walls. After two or three days of white washing a compound is formed. This formed compound gives a shiny appearance to the walls. Read the above passage and answer the following questions.

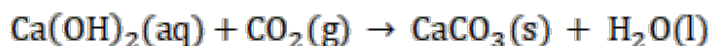
- (i) What is the chemical name of compound formed after 2-3 days of white washing?
- (ii) Write the chemical reaction occurring during calcium hydroxide to a shiny appearance to the walls.
- (iii) Name the type of reaction.

Answer: Slaked lime is the common name used for calcium hydroxide $\text{Ca}(\text{OH})_2$. It is formed by the reaction of quick lime CaO with water.

- (i) The chemical name of compound formed is calcium carbonate.

Explanation: The calcium hydroxide used for white washing the walls reacts with the carbon dioxide (CO_2) present in the air to form Calcium carbonate (CaCO_3) which gives shiny appearance to the walls.

- (ii) The chemical reaction occurring during the conversion of slaked lime (calcium hydroxide) to calcium carbonate which gives the shiny appearance to the walls is as follows:



- (iii) The Type of reaction is exothermic.

Explanation: A reaction which involves the release of heat when the product formation takes place is known as an exothermic reaction. The reaction of calcium hydroxide (base) with CO_2 (acidic non-metal oxide) is a neutralization reaction in which heat is evolved. Thus it is an exothermic reaction.

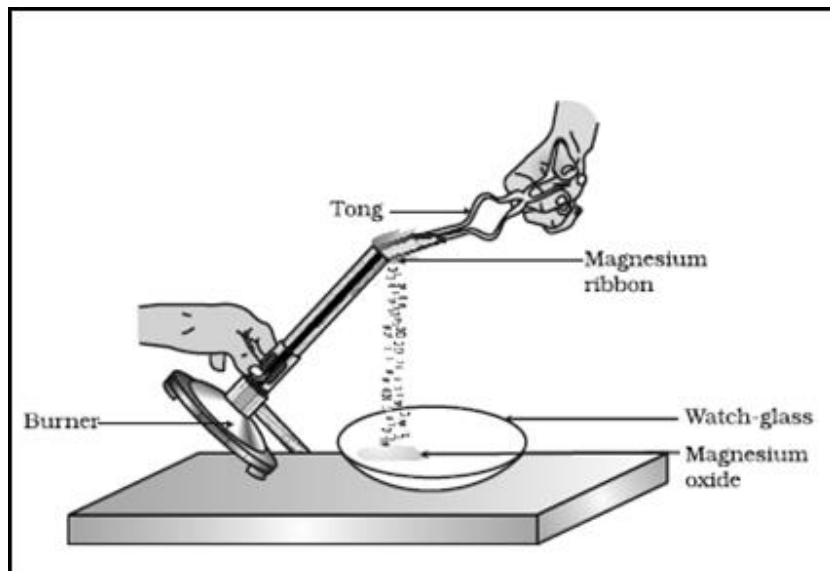
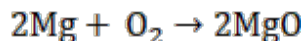
Challengers

Q. 1. Which one of the following involves a chemical reaction?

- A. Evaporation of water
- B. Storing of nitrogen gas under pressure
- C. Keeping petrol in a China dish in open
- D. Heating magnesium wire in the presence of air at high temperature

Answer: When the identity and nature of the product are different from that of the reactants then this change is known as chemical change and whenever a chemical change takes place, we can say that a chemical reaction has occurred. In the first three

options, only the physical state of the water, nitrogen and petrol changes thus they are physical changes. But when magnesium wire is heated in the presence of air, formation of a new substance (MgO) takes place. The chemical reaction involved is as follows:

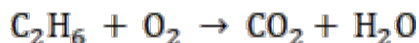


Q. 2. Ethane (C₂H₆) on complete combustion gave CO₂ and water. It shows that the results are in accordance with the law of conservation of mass. Then, the coefficient of oxygen is equal to

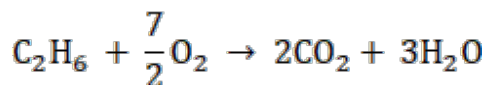
- A. 3
- B. 5/2
- C. 2
- D. 7/2

Answer: According to law of conservation of mass, the mass of the elements on the product side should be equal to the mass of the elements on reactant side. In simple words, the number of atoms of each element should be same on the both sides. This can be achieved by balancing a chemical reaction.

Unbalanced chemical equation for combustion of ethane:



The balanced chemical equation:



From the balanced chemical equation, we can observe that the coefficient of O_2 is $\frac{7}{2}$.

Q. 3. A powdered salt (X) in a dry test tube was heated that evolves brown fumes of nitrogen dioxide and a yellow residue of lead oxide is also formed. The salt (X) is

- A. $MgCO_3$**
- B. $Pb(NO_3)_2$**
- C. $(NH_4)_2SO_4$**
- D. $CaCO_3$**

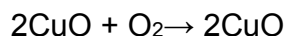
Answer: The salt (X) is undergoing thermal decomposition reaction as it breaks to give multiple products on heating. Release of brown fumed Nitrogen dioxide (NO_2) gas indicates that the salt is a nitrate salt. Moreover formation of a yellow lead oxide (PbO) residue indicates that the salt is a lead salt. Thus the salt is Lead Nitrate. The thermal decomposition reaction involved is:



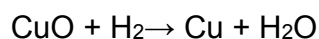
Q. 4. A reddish brown coloured metal used in electric wires, when powdered and heated strongly in an open China dish, its colour turns black. When hydrogen gas is passed over this black substance, it regains its original colour. Based on this information, the metal and black coloured substances are

- A. copper and copper nitrate**
- B. silver and silver oxide**
- C. copper and copper oxide**
- D. aluminium and aluminium oxide**

Answer: The only reddish brown colour metal among the given options is copper. When copper powder is heated in a china dish it gets oxidized and turns black due to the formation of copper oxide (CuO). The reaction involved is:



When H_2 gas is passed over CuO , it gets reduced to Cu and thus regains its original colour.



Q. 5. When dilute sulphuric acid is added to pieces of iron sulphide, hydrogen sulphide gas is produced and soluble ferrous sulphate is formed. The type of chemical reaction involved is

- A. decomposition reaction**
- B. combination reaction**

C. displacement reaction

D. double displacement reaction

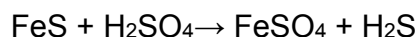
Answer: Dilute sulphuric acid: dil. H_2SO_4

Iron sulphide: FeS

Hydrogen sulphide: H_2S

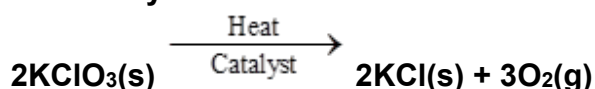
Ferrous sulphate: FeSO_4

The reaction involved can be written as:



We can see that there is the exchange of SO_4^{2-} and S^{2-} ions in the reactants. Thus it is a double displacement reaction.

Q. 6. Following reaction is used for the preparation of oxygen gas in the laboratory. Heat



Which of the following statement(s) is (are) correct about the reaction?

A. It is a decomposition reaction and endothermic in nature.

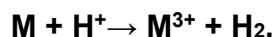
B. It is a combination reaction.

C. It is a decomposition reaction and accompanied by the release of heat.

D. It is a photochemical decomposition reaction and exothermic in nature.

Answer: Since the reaction involves the breaking down of a single reactant molecule into multiple products, it is a decomposition reaction. Moreover it involves the absorption of heat, so it is also an endothermic reaction.

Q. 7. A metal 'M' reacts with an acid according to the equation.



Which of the following is correct for metal M?

A. Calcium

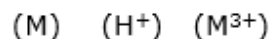
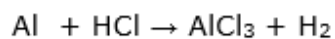
B. Aluminium

C. Barium

D. Potassium

Answer: Among the given metals, only aluminium has a stable +3 oxidation state. Aluminium reacts with acid to produce a metal salt and H_2 gas. For example: Al reacts with HCl to give AlCl_3 and H_2 gas.

Reaction:



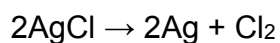
Q. 8. Which among the following statement (s) is/are true? Exposure of silver chloride to sunlight for a long duration turns grey due to

- (i) The formation of silver by decomposition of silver chloride.**
- (ii) Sublimation of silver chloride.**
- (iii) Evolution of chlorine gas from silver chloride. (iv) Oxidation of silver chloride.**

- A. (i) only**
- B. (i) and (iii)**
- C. (ii) and (iii)**
- D. (iv) only**

Answer: When silver chloride is exposed to sunlight it undergoes decomposition and turns grey due to the formation of silver metal which provides the grey colour. Although Cl_2 gas is also evolved but, it is not responsible for grey colour.

Reaction involved is:



Acids, Base & Salts

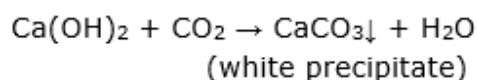
Check Point 01

Q. 1. Which type of chemical compound found in citrus fruits?

Answer: Citrus fruits contain an acid called citric acid. Lemon, orange are examples of citrus fruits. They also contain ascorbic acid which is commonly known as Vitamin C. In short, the chemical compound found in citrus fruits is acidic in nature.

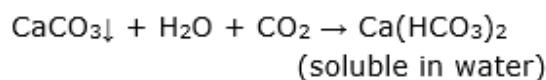
Q. 2. What happens when CO₂ gas is passed through lime water?

Answer: Lime water is a solution of calcium hydroxide (Ca(OH)₂). When CO₂ gas is passed through lime water, the following reaction occurs.



The solution of lime water turns milky due to the formation of calcium carbonate, which is a white precipitate insoluble in water.

If CO₂ gas is passed in excess amounts, then the above reaction occurs further.



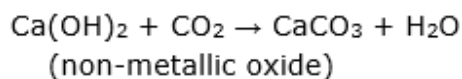
The product formed is calcium hydrogen carbonate, which is soluble in water. Hence the milky solution becomes a clear solution.

Q. 3. Bases should not be kept in active metal container. Why?

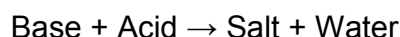
Answer: Containers should be selected such that they should not react with what is to be stored. Bases react with active metals (metals which are highly reactive) to form salt and hydrogen gas. Hence, metal containers cannot be used to store bases.

Q. 4. Give a chemical reaction to prove that non-metallic oxides are acidic in nature.

Answer: Consider the following reaction,



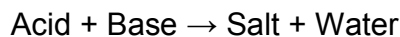
Here, calcium hydroxide (Ca(OH)₂) is a base, and it reacts with carbon dioxide (CO₂) to give salt (calcium carbonate) and water. Comparing the above reaction with,



One can see that CO₂ acts as an acid. Hence, one can prove that non-metallic oxides are acidic in nature.

Q. 5. Name the reaction in which acid reacts with base.

Answer: The reaction between an acid and a base is called neutralization. Neutralization can be represented by the equation,



Where the nature of salt (acidic or basic) depends upon the nature of acid and base used.

Q. 6. How H_3O^+ ion is formed in water solution?

Answer: When acid is added to water, H^+ ions are formed in the solution. These ions cannot exist alone and hence they readily combine with water molecules to form the hydronium ion (H_3O^+).



Q. 7. What is the effect of dilution on an acid or base?

Answer: Dilution is the process of decreasing the strength of an acid or base. We know that acids and bases produce H_3O^+ and OH^- ions in water. When they are diluted (by having more amount of water), the concentration of H_3O^+ or OH^- ions per unit volume decreases. This results in decrease of the strength of the acid or base.

Check Point 02

Q. 1. Which indicator gives pink colour in basic solution?

Answer: Phenolphthalein is a colourless indicator which gives pink colour in basic solution. It does not give any colour for acidic solutions.

Q. 2. In which pH range our body works?

Answer: The human body works in a slightly basic nature. The pH range within which our body works is 7.0-7.8. A slight pH change from this range can cause severe effects to our body.

Q. 3. How toothpaste prevents tooth decay?

Answer: Tooth decay occurs when the pH of the mouth falls less than 5.5. The bacteria present in the mouth degrade the food remaining in the mouth after eating and produce acids. These acids lower the pH of the mouth, causing tooth decay.

Toothpastes are basic in nature, and therefore cleaning the teeth with toothpastes would result in neutralization of excess acids. Thus toothpaste prevents tooth decay.

Q. 4. Name the chemical which is injected into the skin of a person during wasp's sting and during the nettle leaf hair sting.

Answer: A wasp sting is alkaline in nature. The nettle leaf sting contains methanoic acid (or formic acid) which is acidic in nature.

Q. 5. How will you get relief if an insect bites?

Answer: The basic principle behind getting relief from an insect bite is neutralization. The insect sting/bite may produce a secretion which is acidic or basic in nature. Based on that, one can choose basic or acidic substance so as to neutralize the effect. This way, less pain is experienced. Apply an alkaline substance if the sting is acidic and an acidic substance if the sting is alkaline (basic).

For example, ant stings are acidic (methanoic acid). Hence it should be treated with an alkaline substance like baking soda.

Q. 6. Write the role of HCl present in the stomach.

Answer: HCl present in the stomach has multiple uses, and they are listed below.

- It provides an acidic medium for the enzymes present in the stomach to function properly. These enzymes are activated by the secretion of HCl.
- HCl in stomach is highly acidic (pH – 1 to 2) and helps in killing bacteria and other harmful microorganisms.

Check Point 03

Q. 1. Sea water contains many salts dissolved in it. How can the salt that we use in food is obtained?

Answer: First of all sea water is collected at a place having large surface area. Then it is left to let water evaporate due to heat of sunlight falling on it. And then the salts are left in place which are moved from there to other places.

The salt we use in our food is also obtained by same process.



Q. 2. What is 'chlor-alkali' process and what products are formed during this process?

Answer: The production of sodium hydroxide and chlorine from brine solution by through electricity is known as chlor-alkali process.

When electricity is passed through a highly concentrated solution of salt and water (Brine solution), the electrolysis of water takes place and we obtain three different products. We get chlorine gas on anode and hydrogen gas and sodium hydroxide solution on cathode.

Q. 3. Name the chemical compound which is used as a disinfectant for water.

Answer: Chlorine in form of tablets is used as disinfectant for water

Q. 4. When a sodium compound X which is also used in soda-fire extinguisher is heated, gives a sodium compound Y along with water and carbon dioxide. Y on crystallisation forms compound Z. Identify X, Y and Z.

Answer: The sodium compound X used in fire extinguisher is Sodium bicarbonate (NaHCO_3) and when it is heated it gives sodium carbonate (Na_2CO_3) as Y along with water (H_2O) and carbon dioxide (CO_2). Sodium carbonate on absorbs 10 molecules of water and crystallises into sodium decahydrate ($\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$).

Thus X is Sodium bicarbonate (NaHCO_3), Y is sodium carbonate (Na_2CO_3) and Z is sodium decahydrate ($\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$).

Q. 5. Write the chemical formula of blue vitriol.

Answer: Blue vitriol is common name for Copper sulphate solution which has chemical formula as CuSO_4 .

Chapter Exercise

Q. 1. Which acid is present in vinegar?

Answer: Acetic acid (CH_3COOH) is present in vinegar. In vinegar, about 5-20% acetic acid is present.

Q. 2. Which solution is more acidic, one with a pH of 4 or one with a pH of 1?

Answer: The solution which has pH of 1 is more acidic.

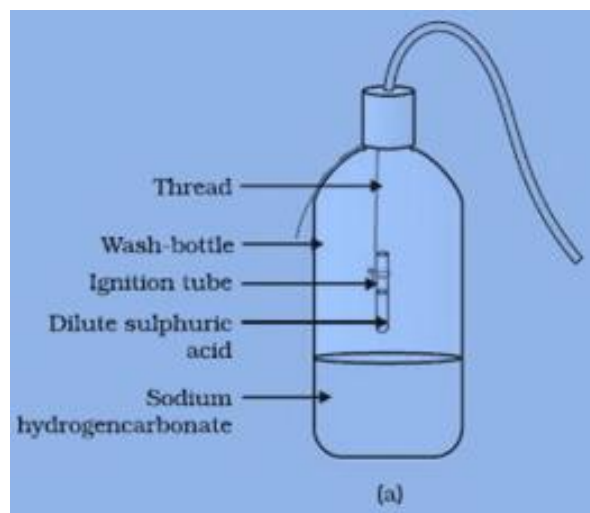
According to the pH scale, value less than 7 on the pH scale represents an acidic solution while value greater than 7 represents a basic solution. And pH value 7 represents a neutral solution. Also lesser pH indicates more acidic and more pH indicates more basic.

Q. 3. A student dipped pH paper in rain water. What would be the colour of the pH paper?

Answer: The colour of the pH paper would be red because rainwater is acidic in nature due to pollutant gases like Sulphur dioxide and nitrogen oxides. These gases react with water in clouds and form sulphuric acid and nitric acid.

Q. 4. Name the chemicals used in making fire extinguisher.

Answer: The chemicals used in making fire extinguisher are acid (Sulphuric acid) and Sodium hydrogen carbonate (NaHCO_3). This acid reacts with sodium hydrogen carbonate and CO_2 gas evolves. And this CO_2 gas helps to put off the fire.

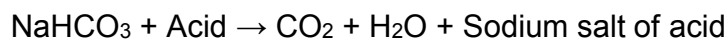


Q. 5. Why blue colour of copper sulphate crystals disappears on heating?

Answer: Copper sulphate crystals contain water of crystallisation. Water of crystallization is the fixed number of water molecules present in one formula unit of a compound. Copper sulphate crystal contains five water molecules in one formula unit. When we heat the copper sulphate crystals then this water is removed and the colour of crystals turn white.

Q. 6. Name an acid which is present in baking powder

Answer: The acid which is present in baking powder is tartaric acid. Baking soda (sodium hydrogen carbonate) reacts to tartaric acid and forms CO_2 gas, water and sodium salt of acid. This CO_2 gas makes bread or cake soft and spongy.



Q. 7. The pH of a sample of vegetable soup was found to be 6.5. How is this soup likely to taste?

Answer: Since the pH of a sample of vegetable soup is 6.5. So according to pH paper, it is acidic in nature. And acids are sour in taste. So vegetable soup will be sour in taste.

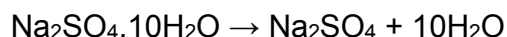
Q. 8. Write down the net ionic equation for the reaction of sodium hydroxide with hydrochloric acid.

Answer: $\text{H}^+(\text{aq}) + \text{Cl}^-(\text{aq}) + \text{Na}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{Na}^+(\text{aq}) + \text{Cl}^-(\text{aq}) + \text{H}_2\text{O}$

Explanation- When acid reacts to base then salt is formed. This reaction is called neutralization reaction.

Q. 9. What happens when crystals of washing soda are kept open in the air for long time?

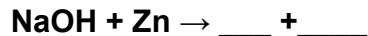
Answer: When crystals of washing soda ($\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$) are kept open in the air for long time then the water of crystallization will lose and the crystals will turn to white. This process of losing water of crystallization when kept in air is called efflorescence.



Q. 10. What is the use of common salt in soap industry?

Answer: The soap is washed with NaCl or brine solution to separate glycerin. Common salt is added to the neat soap after the saponification reaction. Common salt is added for precipitation to occur and to separate soap from aqueous solution. Salt is also used to separate glycerol from the water.

Q. 11. Complete the following equation:

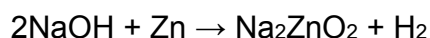


Answer: $2\text{NaOH} + \text{Zn} \rightarrow \text{Na}_2\text{ZnO}_2 + \text{H}_2$

Explanation- When metal reacts to base then metallic salt and hydrogen (H_2) gas are formed.

Balancing of chemical equation-

(i) Here one Na atom is in left side and 2 Na atoms are in right side. So to equate the Na atoms, we will multiply NaOH by 2.



(ii) And we shall check that other atoms are equal or not. If the other atoms are equal to both sides then the equation is balanced. If the other atoms are not equal then we shall make them equal.

Now Na atoms are equal, Zn atoms are equal, H atoms are equal and O atoms are also equal on both sides. So the chemical equation is balanced.

Q. 12. What happens when nitric acid is added to an egg shell?

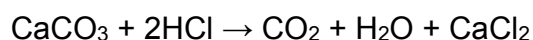
Answer: Since egg shell is made of calcium carbonate. And we know that when calcium carbonate (CaCO_3) reacts with nitric acid (HNO_3) then carbon dioxide, calcium

nitrate and water are formed. So same reaction happens when nitric acid is added to an eggshell.

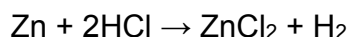


Q. 13. Which gas is evolved when hydrochloric acid is added in first test tube containing small pieces of marble and then in second test tube containing zinc granules?

Answer: We know that when calcium carbonate (CaCO_3) reacts with hydrochloric acid (HCl) then carbon dioxide, calcium chloride and water are formed. So when hydrochloric acid is added in first test tube containing small pieces of marble then CO_2 gas is evolved.

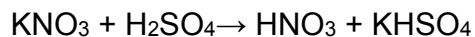


And when acid reacts with metal then salt and hydrogen (H_2) gas are formed. So when hydrochloric acid is added in second test tube containing zinc granules then H_2 gas is evolved.



Q. 14. Name the gas evolved when potassium nitrate crystals are heated with concentrated sulphuric acid.

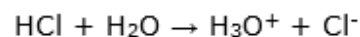
Answer: When potassium nitrate (KNO_3) crystals are heated with concentrated sulphuric acid (H_2SO_4) then vapours of nitric acid (HNO_3) are evolved and potassium bisulphate is also formed.



Q. 15. What happens when an acid or a base is added to the water? Why does the beaker appear warm? Why should we always add acid or base to the water and not water to the acid or base?

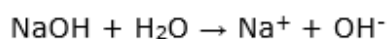
Answer: When an acid or base is added to water:

i. When we add acid to the water, acid gives H^+ or H_3O^+ (hydronium ion) in water. For example: If we add HCl (an acid) to water, the reaction takes place is given as:



Hydronium
ion

ii. When we add base to the water, base produces OH^- (hydroxide ions) in water. For example: If we add NaOH to water, the reaction takes place is given as:



Hydroxyl ion

The beaker appears warm because the process of dissolving an acid or base in water is a highly exothermic one (releases energy)

We should always add acid or base to the water with constant stirring because if water is added to acid or base, the heat generated may cause the mixture to splash (a small blast) and cause harmful burns.

Q. 16. Give reasons:

(i) Use of a mild base like baking soda provides relief on the area stung by honeybee.

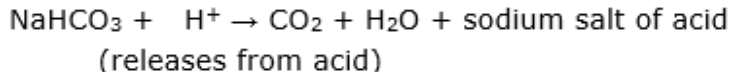
(ii) Baking powder is added to make the cakes spongy and soft.

(iii) The colour of blue copper sulphate crystals changes to white on heating.

Answer: (i) When a honeybee stings a person, this means it releases an acidic liquid (formic acid) into the body. This causes too much pain and irritation. As we know that baking soda (sodium hydrogen carbonate NaHCO_3) is a mild non-corrosive base. It can be used to neutralize an acid.

Hence, when it is applied to the stung area, it reduces the effect of acid by neutralizing the excess acid. As a result, the pain and irritation is reduced.

(ii) Baking powder, which is a mixture of baking soda and tartaric acid. When baking soda is heated or mixed in water, the reaction takes place is given as:



Carbon dioxide released during the reaction causes the bread or cake dough to rise which makes them soft and spongy.

(iii) The colour of blue copper sulphate crystals changes to white on heating because:

- a. Blue copper sulphate crystals contain water of crystallization.
- b. When we heat the crystals, the water is removed.
- c. As a result, the salt turns white.

Q. 17. Among sulphurous acid and sulphuric acid, which is stronger and why?

Answer: Sulphuric acid (H_2SO_4) is much stronger than sulphurous acid (H_2SO_3) because when sulphuric acid dissociates, it gives more number of H^+ ions i.e. 2 whereas on dissociation, sulphurous acid gives less number of H^+ ions i.e. 1.

Q. 18. Acetic acid is a weak acid and ammonia is a weak base. Discuss the term weak.

Answer: The strength of acids and bases depends on the number of H^+ ions and OH^- ions produced.

- i. Acids that give rise to more H^+ ions are said to be strong acids and acids that give less H^+ ions are said to be weak acids.
- ii. Bases that give rise to more OH^- ions are said to be strong bases and bases that give less OH^- ions are said to be weak bases.

Q. 19. Give reason why solution of sulphuric acid conduct electricity whereas, alcohol does not.

Answer: Sulphuric acid conducts electricity because:

- i. Sulphuric acid is a strong acid whereas alcohol is weak acid.
- ii. When sulphuric acid is mixed with water, it produces more number of H^+ ions and when alcohol is mixed with water, it produces less number of H^+ ions.
- iii. This means sulphuric acid has more number of free electrons or mobile ions than alcohol.
- iv. More the number of free electrons or mobile ions present, more will be the electricity.
- v. Hence, sulphuric acid conduct electricity whereas, alcohol does not.

Note: When an acid is dissolved in water, it produces number of ions. The presence of ions (free electrons) are mainly responsible for the conduction of electricity.

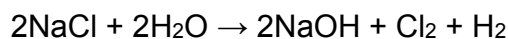
Q. 20. Answer the following:

- (i) What happens when a concentrated solution of sodium chloride is electrolysed? Write the equation of the reaction involved.
- (ii) Why is the electrolysis of a concentrated solution of sodium chloride known as chlor-alkali process?
- (iii) Name three products of the chlor-alkali process. State two uses of each product.

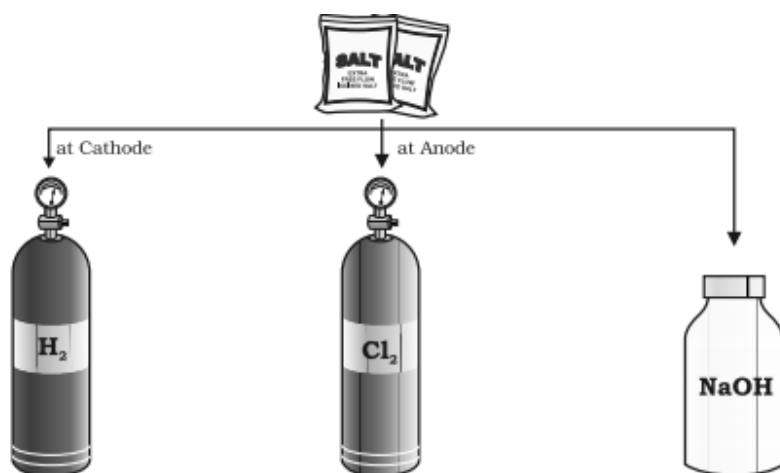
Answer: (i) When a concentrated solution of sodium chloride is electrolyzed, it forms sodium hydroxide (NaOH), chlorine gas and hydrogen gas.

Chlorine gas is formed at anode (positively charged) and hydrogen gas at cathode (negatively charged)

The reaction takes place is given as:



The above reaction is called chlor-alkali process.



Chlor-alkali process

(ii) The electrolysis of a concentrated solution of sodium chloride known as chlor-alkali process because of the products formed:

a. The products formed in this reaction are NaOH (a strong base/alkali), chlorine and hydrogen gas.

b. “Chlor” means chlorine and “alkali” means base i.e. NaOH.

(iii) The three products of the chlor-alkali process are:

Sodium hydroxide (NaOH)

Uses:

a. It is mostly used in soaps and detergents.

b. It is also used to make papers and artificial fibers.

Chlorine gas

Uses:

a. It is mostly used in medicines and in fuels.

b. It is used with ammonia for fertilizers.

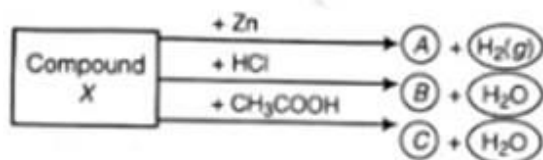
Hydrogen gas

Uses:

a. It is used in treatment of water in swimming pools.

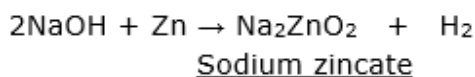
b. It is used as disinfectants and pesticides.

Q. 23. Identify the compound X on the basis of the reactions given below. Also, write the name and chemical formula of A, B and C.

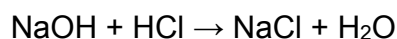


Answer: The X must be sodium hydroxide (NaOH) because of the following reactions:

i. When NaOH reacts with zinc (a metal), it gives sodium zincate (a salt) and hydrogen gas:

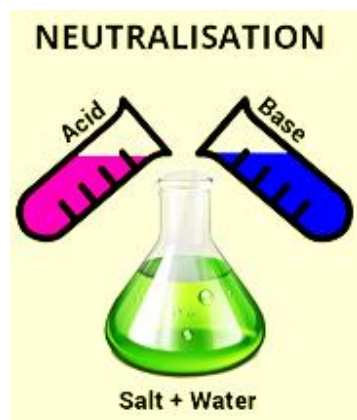


ii. When sodium hydroxide (a base) and HCl (an acid) reacts together, they form a common salt (NaCl) and water:

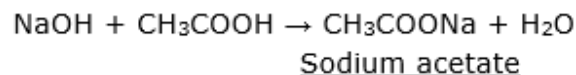


Note: The above reaction is a neutralization reaction. The reaction between an acid and a base to give a salt and water is called neutralization reaction.

Base + Acid $\rightarrow$ Salt + Water



iii. When NaOH and CH₃COOH (an acid) reacts together, they form a salt of sodium acetate and water:



The above reaction is also an example of neutralization reaction.

Thus, X is NaOH.

A is sodium zincate (Na_2ZnO_2)

B is common salt (NaCl)

C is sodium acetate (CH_3COONa)

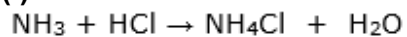
Q. 24. Fill in the missing data in the given table.

	Name of the salt	Formula	Salt obtained from	
			Base	Acid
(i)	Ammonium chloride	NH_4Cl		-
(ii)	Copper sulphate	-	-	H_2SO_4
(iii)	Sodium chloride	NaCl	NaOH	-
(iv)	Magnesium nitrate	$\text{Mg}(\text{NO}_3)_2$	-	HNO_3
(v)	Potassium sulphate	K_2SO_4	-	-
(vi)	Calcium nitrate	$\text{Ca}(\text{NO}_3)_2$	$\text{Ca}(\text{OH})_2$	-

Answer:

	Name of the salt	Formula	Salt obtained from	
			Base	Acid
(i)	Ammonium chloride	NH_4Cl	<u>NH_3</u>	<u>HCl</u>
(ii)	Copper sulphate	<u>CuSO_4</u>	<u>CuCO_3</u>	H_2SO_4
(iii)	Sodium chloride	NaCl	<u>NaOH</u>	<u>HCl</u>
(iv)	Magnesium nitrate	$\text{Mg}(\text{NO}_3)_2$	<u>$\text{Mg}(\text{OH})_2$</u>	<u>HNO_3</u>
(v)	Potassium sulphate	K_2SO_4	<u>KOH</u>	<u>H_2SO_4</u>
(vi)	Calcium nitrate	$\text{Ca}(\text{NO}_3)_2$	<u>$\text{Ca}(\text{OH})_2$</u>	<u>HNO_3</u>

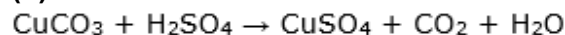
(i)



Base Acid Ammonium
 chloride(salt)

When ammonia reacts with hydrochloric acid, it forms ammonium chloride and water.

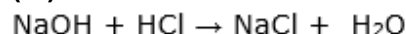
(ii)



Base Acid Copper
sulphate(salt)

When copper carbonate reacts with sulphuric acid, it forms copper sulphate, carbon dioxide and water.

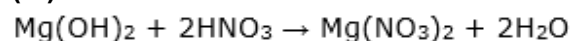
(iii)



Base Acid sodium
chloride(salt)

When sodium hydroxide reacts with hydrochloric acid, it forms sodium chloride and water.

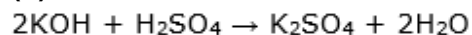
(iv)



Base Acid Magnesium
nitrate (salt)

When magnesium hydroxide (milk of magnesia) reacts with nitric acid, it forms magnesium nitrate and water.

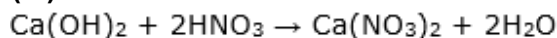
(v)



Base Acid Potassium
sulphate(salt)

When potassium hydroxide reacts with sulphuric acid, it forms potassium sulphate and water.

(vi)



Base Acid Calcium
nitrate (salt)

When calcium hydroxide reacts with nitric acid, it forms calcium nitrate and water.

Q. 25. Rohan was very angry because of the oil spot on his favourite shirt. His mother want to make him happy and doesn't know what to do. Her neighbour Mrs Sharma advised him to use bleach (bleaching powder, CaOCl_2) to remove the oil spot. Read the above passage and answer the following questions.

(i) Would you suggest the same thing to remove oil spot? Why or why not? Justify your answer.

(ii) Which substance, is available in the market to remove such spots?

(iii) What values are associated with Mrs Sharma?

Answer: (i) No, we will not suggest to use bleach (bleaching powder, CaOCl_2) to remove oil spot. Bleaching powder will hide oil spot but cause a discolouration. It would not draw oil out of the clothing at all.

Bleach is not used to remove greasy things out of the clothes as it can damage the fine fabrics in it

(ii) Detergents are available in the market to remove such oil spots

They show instant results. They have a property to remove any kind of stain. These are used to remove greasy things out of the clothes.

(iii) Mrs. Sharma is not aware of the damages caused by using bleach on the clothes.

Q. 26. Enamel has calcium phosphate $[\text{Ca}_3(\text{PO}_4)_2]$. When we eat sweets, they form acid in our mouth which reacts and tooth decay starts. To avoid tooth decay, we should brush our teeth after every meal. Sonu brushes his teeth twice a day whereas Monu brushes once a day only. Answer the following questions.

(i) Is toothpaste acidic, basic or neutral? Give reason.

(ii) What values are associated by Sonu, who brushes his teeth twice a day?

Answer: (i) Toothpaste is basic.

a. Our tooth is made up of calcium phosphate.

b. It gets corroded and damaged when the pH in the mouth falls to 5.5 (acidic).

c. Bacteria present in the mouth produce acids from food particles which remains in the mouth after eating.

d. The best way to prevent this is to clean the mouth by using toothpastes which can neutralize the effect of excess acid.

e. Toothpaste prevents tooth decay.

(ii) Sonu is concern and aware of the mouth problems caused by tooth decay. He is a well-mannered and a hygienic person.

Q. 27. Dinesh is a farmer. He got pH of his soil tested and followed advice of Agricultural Scientists of 'Kissan Centre' in growing crops. He got better quality of crops this year. Answer the following questions.

(i) Why should we get our soil tested?

(ii) If soil has pH less than 7, how can we make it neutral?

(iii) What values are possessed by Dinesh?

Answer: (i) Plants need a specific pH test, so that we can regularly check the pH range of the soil which is very important for its healthy growth.

a. By knowing the pH range, we can determine the appropriate amount of fertilizers to use so that the production of crop may be occurred instantly.

b. The soil pH is important because it affects the presence of nutrients in the soil.

(ii) If the soil has pH less than 7, we can make it neutral by using calcium carbonate (limestone) It increases the pH of soil.

(iii) Dinesh is concern and aware.

Challengers

Q. 1. Aqueous solution of copper sulphate reacts with aqueous ammonium hydroxide solution to give.

A. brown precipitate

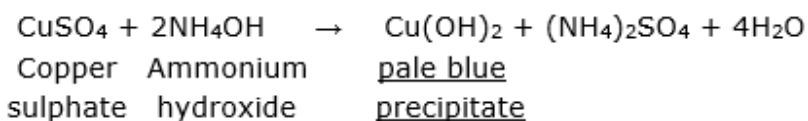
B. pale blue precipitate

C. white precipitate

D. green precipitate

Answer: When aqueous solution of copper sulphate reacts with aqueous ammonium hydroxide, it gives a precipitate of copper hydroxide which is pale blue in colour.

The reaction that takes place is:



Q. 2. Acetic acid was added to a solid X kept in a test tube. A colourless and odourless gas was evolved. The gas was passed through lime water which turned milky. It was concluded that.

A. Solid X is sodium hydroxide and the gas evolved is CO₂,

B. Solid X is sodium bicarbonate and the gas evolved is CO₂

C. Solid X is sodium acetate and the gas evolved is CO₂

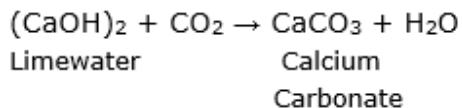
D. Solid X is sodium chloride and the gas evolved is CO₂

Answer: When any acid reacts with metal hydrogencarbonate, the products formed are salt, carbon dioxide (CO₂) and water.

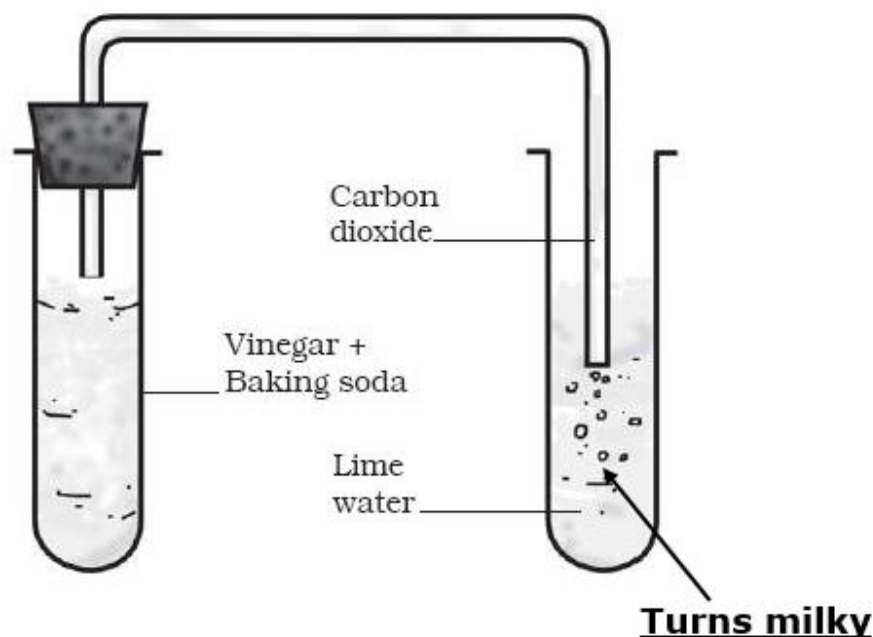
Metal hydrogencarbonate + Acid → Salt + Carbon dioxide + Water

Hence, when acetic acid reacts with sodium bicarbonate (NaHCO₃), a colourless and odourless of carbon dioxide gas is evolved.

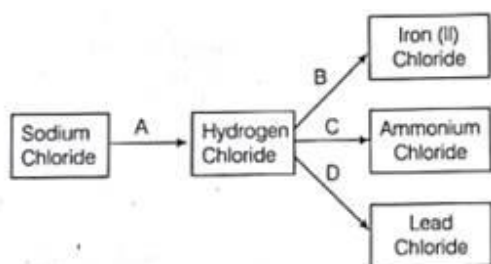
When carbon dioxide gas is passed through lime water $[(\text{CaOH})_2]$, the following reaction takes place:



- In this reaction, when limewater comes in contact with the gas released in the form of an effervescence, it turns milky. This is a chemical test for carbon dioxide gas.
- When limewater turns milky, it is confirmed that the effervescence is of carbon dioxide.



Q. 3. Consider the following reaction:



Here, A, B, C and D respectively are:

A. A = Conc. HCl; B = Fe; C = NH_4OH ; D = PbO

B. A = Conc. H_2SO_4 ; B = Fe; C = NH_4OH ; D = $\text{Pb}(\text{NO}_3)_2$

C. A = Conc. H_2SO_4 ; B = Fe; C = NH_3 ; D = $\text{Pb}(\text{NO}_3)_2$

D. A = Conc. HCl; B = Fe; C = NH_3 ; D = PbO

Answer: Step 1: When sodium chloride reacts with conc. H_2SO_4 , it forms hydrogen chloride (HCl) and sodium sulphate (Na_2SO_4).

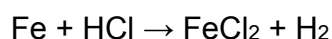
The reaction that takes place is:



Thus, A is concentrated H_2SO_4

Step 2: When hydrogen chloride reacts with iron metal (Fe), it forms iron (II) chloride (FeCl_2) and hydrogen gas (H_2).

The reaction that takes place is:



Thus, B is Fe.

Step 3: When hydrogen chloride reacts with ammonia (NH_3), it forms ammonium chloride (NH_4Cl).

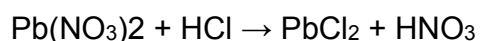
The reaction that takes place is:



Thus, C is ammonia (NH_3).

Step 4: When hydrogen chloride reacts with lead nitrate [$\text{Pb}(\text{NO}_3)_2$], it forms lead chloride (PbCl_2) and nitric acid (HNO_3).

The reaction that takes place is:



Thus, D is lead nitrate [$\text{Pb}(\text{NO}_3)_2$]

Q. 4. In one of the industrial processes used for manufacture of sodium hydroxide, a gas X is formed as by-product. The gas X reacts with lime water to give a compound Y which is used as a bleaching agent in chemical industry. The compound X and Y could be

A. H_2 and NaHCO_3 , respectively

B. CO_2 and CaOCl_2 respectively

C. Cl_2 and CaOCl_2 respectively

D. Cl_2 and NaHCO_3 respectively

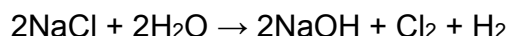
Answer: The process includes the following steps:

Step 1: Preparation of sodium hydroxide:

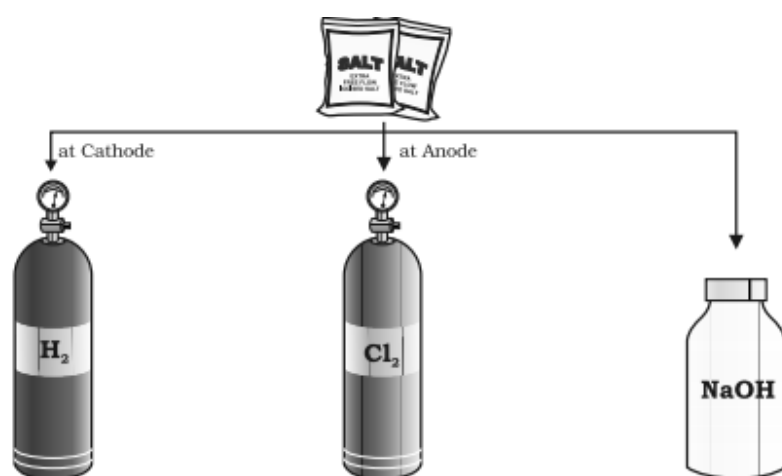
When a concentrated solution of sodium chloride is electrolyzed, it forms sodium hydroxide (NaOH), chlorine gas and hydrogen gas.

Chlorine gas (X) is formed at anode (positive charge) and hydrogen gas at cathode (negative charge)

The reaction takes place is given as:



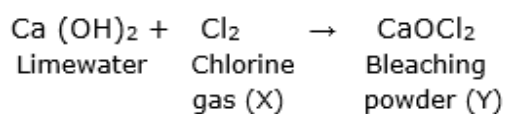
Note: The above reaction is called chlor-alkali process.



Chlor-alkali process

Step 2: Now, chlorine gas (X) reacts with lime water [$\text{Ca}(\text{OH})_2$] to form a compound (Y) that is bleaching powder which is used as bleaching agent in chemical industry.

The reaction that takes place is:



Thus, X is chlorine gas and Y is bleaching powder (CaOCl_2).

Q. 5. The organic acid present in tomato is

- A. oxalic acid
- B. lactic acid
- C. malic acid
- D. tartaric acid

Answer: The organic acid present in tomato is malic acid. Malic acid is the second organic acid present in tomato. The first organic acid is citric acid which is present in tomatoes.

Malic acid is responsible for the ripening of tomatoes. It plays an important role in the production of energy.

Q. 6. You are having five solutions A, B, C, D and E with pH values as follows:

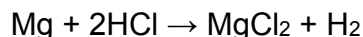
A = 1.8, B = 7, C = 8.5, D = 8 and E = 5

Which solution would be most likely to liberate hydrogen with magnesium powder?

- A. Solution A and B**
- B. Solution A**
- C. Solution C**
- D. All of the above**

Answer: When magnesium powder reacts with HCl, it forms magnesium chloride and liberated hydrogen gas.

The reaction that takes place is:



As we know that HCl is a strong acidic solution. The pH of acidic solution is less than 7. Being a strong acid, the pH of HCl is 1.8.

Q. 7. The reagent used to distinguish iron (II) chloride and iron (III) chloride is

- A. distilled water**
- B. NaOH**
- C. dil. HCl**
- D. Warm water**

Answer: We can distinguish between iron (II) chloride and iron (III) chloride by using NaOH.

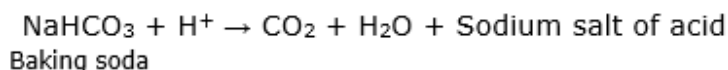
When NaOH reacts with iron (II) chloride, it forms a dirty green precipitate whereas when NaOH reacts with iron (III) chloride, it forms a brown gelatinous precipitate.

Q. 8. An acid (A) with sodium hydrogencarbonate is used in making the cakes fluffy and spongy. It is due to the release of (B) gas in the reaction. Here, A and B are

- A. A: Oxalic acid : B : CO₂**
- B. A: Tartaric acid : B : O₂**
- C. A : succinic acid : B : H₂**

D. A :Tartaric acid : B CO₂:

Answer: Baking powder contains a mixture of baking soda and an acid, i.e., tartaric acid (A). When baking powder is heated or mixed in water, the following reaction takes place:



Carbon dioxide gas (B) is produced during the reaction causes cake to rise making them soft, fluffy and spongy.

Thus, A is tartaric acid.

B is carbon dioxide (CO₂)

Q. 9. The pH of a solution is 4.0. What should be the change in the hydrogen ion concentration of the solution, if its pH is to be increased to 5.0.

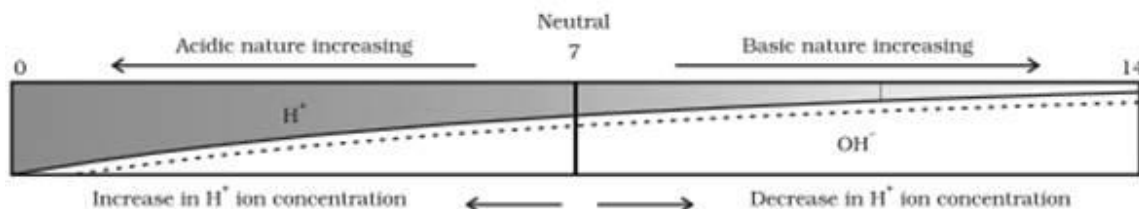
- A. decreases to 1/10 of its original concentration**
- B. halved**
- C. doubled**
- D. increases by 10 times**

Answer: As the pH value increases from 0 to 7, it represents a decrease in hydrogen ion concentration in the solution, that is, decrease in the strength of acid. Hence, when the pH = 4.0 is increased to 5.0, there is a decrease to 1/10 of its original concentration.

Q. 10. The pH of a solution is 5.0. Its hydrogen ion concentration is decreased by 100 times, the solution will be:

- A. more acidic**
- B. basic**
- C. neutral**
- D. unaffected**

Answer: The pH of a solution is 5.0 and if its hydrogen ion concentration is decreased by 100 times, the solution will be neutral because the decrease in hydrogen ion concentration represents an increase in the pH value.



Hence, if the hydrogen ion concentration is decreased by 100 times the solution will change its medium from acidic to neutral (5.0 to 7.0).

Metals and Non-Metals

Check Point 01

Q. 1. What are metalloids?

Answer: Metalloids refer to those class of material which possess properties of both the metals and non-metals. Examples of such materials are silicon, germanium etc. They possess fair conductivity of electricity or heat and are brittle in nature etc.

Q. 2. Which metal has highest melting point?

Answer: Among all the metals in their pure form, Tungsten has the highest melting point which is around 3422°C and this is the reason why it is used in the making of incandescent bulb filaments.

Q. 3. Some metals melt on keeping them on palm. Why? Also give an example.

Answer: Some metals melt on keeping them on palm because such metals have very low melting point compared to other metals. Examples of such metals are Gallium and caesium.

Q. 4. To avoid accidental fires, some metals are kept immersed in kerosene oil. Why?

Answer: Reactive metals like sodium and potassium react very violently with oxygen or water and hence the reaction can even catch fire. To prevent such an accidental reaction or fires, metals are kept immersed in kerosene oil.

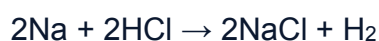
Q. 5. An element X is soft and can be cut with a knife easily. This is very reactive with air and cannot be kept open with air. It reacts vigorously with water. Name the element X.

Answer: Based on the description of the metal that it is reactive with water or air and it can be cut with a knife, the metal X is surely sodium as sodium possess all these properties.

Q. 6. Write a chemical reaction for metals with dil. HCl.

Answer: Less reactive metals do not displace hydrogen from the acids. Reactive metals like sodium, magnesium etc displace hydrogen from acids to form respective chlorides.

Reaction:





Q. 7. Name the reagent which is able to dissolve gold and platinum.

Answer: Gold and Platinum belong to class of noble metals in the sense that gold and platinum do not react with almost any chemical reagent.

Aqua Regia is the chemical mixture which consists of 3 parts of concentrated hydrochloric acid and 1 part of concentrated nitric acid and this mixture can dissolve gold and platinum. The reaction is as follows:



Check Point 02

Q. 1. Do non-metals possess lustre? Give two exceptions of this property of non-metal.

Answer: Lustre means the shine which is possessed generally by all the metals. Non-metals generally do not possess any kind of lustre.

Example of non-metals which possess lustre are carbon as diamond and iodine.

Q. 2. Give an example of a non-metal which is

a. hardest known substance.

b. a good conductor of heat and electricity.

Answer: (a) Diamond is the hardest known naturally occurring non-metallic substance.

(b) Graphite, an allotrope of carbon is a non-metal which is a good conductor of heat and electricity.

Q. 3. Non-metals do not evolve hydrogen gas when react with water, steam or dilute acids. Why?

Answer: Except for carbon all the non-metals are below hydrogen in the activity series of the elements because of which Non-metals do not evolve hydrogen gas when react with water, steam or dilute acids.

Q. 4. Write a displacement reaction for non-metal.

Answer: The best example of a displacement reaction for a non-metal is the reaction in which the more reactive halogen replaces the less reactive ones. The reaction is as follows:



Q. 5. Write the product by giving balanced chemical equation

(i) When sulphur reacts with conc. nitric acid.

(ii) When phosphorus reacts with conc. sulphuric acid.

(iii) When phosphorus reacts with conc. nitric acid.

Answer: (i) When Sulphur reacts with concentrated nitric acid, sulphuric acid, nitrogen dioxide and water are formed as the products. The reaction is as follows:



(ii) When white phosphorous reacts with concentrated sulphuric acid the products formed are phosphorous acid and Sulphur dioxide. The reaction is as follows:



(iii) When phosphorous reacts with concentrated nitric acid formation of phosphoric acid, nitrogen dioxide and water takes place. The reaction is as follows:



Check Point 03

Q. 1. A non-metal gains electrons to form anions. What do you mean by this statement?

Answer: Non-metals typically have larger sizes as compared to the metals because of which to attain a stable noble gas configuration, it is difficult for a non-metal to lose electrons and on the other hand they can easily accept electrons with less energy involved to fill the octet.

Hence non-metals gain electrons to form anions.

Q. 2. What do you mean by ionic bond?

Answer: Ionic Bond is a type of chemical bond which exists between two oppositely charged species and the bond is mainly formed between electron donor element and electron acceptor element.

Example- NaCl, KBr etc.

In example of NaCl, Sodium atom donate one electron to chlorine atom to form ionic bond.

Q. 3. Water helps in separation of oppositely charged ions from their ionic compound. Give reason.

Answer: Water helps in separation of oppositely charged ions from their ionic state because when an ionic is dissolved in water the ions get attracted by the water molecules which leads to the dissociation of ionic compound.

Q. 4. Ionic compounds are crystalline solids and brittle. Why?

Answer: In ionic compounds, ions are held tightly together by strong electrostatic forces of attraction making them quite rigid and hence even when a small force is applied to the compound, the force causes the ions to get displaced from the lattice and they suffer repulsion from similar charged ions in the lattice causing the ionic solids to shatter.

Q. 5. Why ions move freely and conduct electricity in the molten form?

Answer: In ionic compounds, ions are held tightly together by strong electrostatic forces of attraction making them quite rigid. So these ions do not conduct electricity in solid state due to the immobility of the ions. But in molten state the ions get some free space to move as the electrostatic force of attraction weakens and hence allow the conduction of electricity.

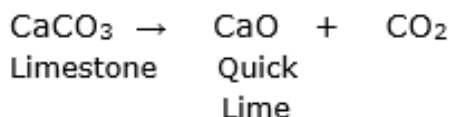
Check Point 04

Q. 1. What is calcination?

Answer: Calcination is one of the processes of metallurgy in which the metals are heated at high temperatures in the absence or limited supply of air to get rid of the volatile substances and to convert the metal to its oxide.

Carbonates, Bicarbonates and hydroxide ores generally undergo calcination.

Reaction:



Q. 2. In electrolytic reduction of NaCl, metal is deposited at the and chlorine is liberated at the

Answer: In electrolytic reduction of NaCl, metal is deposited at the cathode and chlorine is liberated at the anode.

Sodium being electropositive in nature gets attracted to the negative electrode cathode and chlorine being electronegative in nature gets attracted to positive electrode anode.

Q. 3. Name any two elements which can be refined electrolytically.

Answer: The two metals which can be refined electrolytically are copper and zinc.

Q. 4. What is electroplating?

Answer: The word electroplating can be broken into two words electro which means using electricity and plating means to coat.

Hence electroplating is a process of coating a metal object with another metal like zinc, chromium etc by the process of electrolytic deposition in order to protect the base metal.

Q. 5. Why should we paint on a metal surface?

Answer: Metal surface when exposed to environment, there are chances that the oxygen or moisture present in the environment to react with the metal making the metal corroded.

In order to protect the metal from environmental factors the metal is painted.

Q. 6. What is galvanization? Name the element used in the process.

Answer: Galvanization is a process of coating a metal especially iron object with zinc metal.

Zinc is the metal which is used for coating and iron objects are generally galvanized to protect them from rust.

Q. 7. Name the elements which are resistant to corrosion.

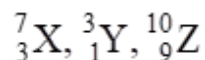
Answer: Noble metals like gold and platinum which are unreactive under normal conditions are the elements which are resistant to corrosion.

Q. 8. What is the special quality of iron pillar near Qutub Minar?

Answer: The special quality of the iron pillar at Qutub Minar is that the pillar is not rusted or rather the pillar is rust resistant which depicts the high-quality craftsmanship of Indian craftsman.

Chapter Exercise

Q. 1. Which of the following elements is a metal?



Answer: Atomic Number of X = 3

Atomic Number of Y = 1

Atomic Number of Z = 9

Among the given elements, element X is a metal as it can easily lose one electron to achieve the stable noble gas configuration of helium. Element X is Lithium.

Element Z will be a non-metal as it can easily accept an electron to achieve the stable noble gas configuration of neon.

Q. 2. Name one metal and one non-metal which are obtained on a large scale from sea water.

Answer: Sea water contains many dissolved salts but the salt which is abundant in seawater is sodium chloride.

So Sodium and chlorine are obtained on a large scale from sea water.

Other salts in sea water are MgCl_2 , CaCl_2 etc.

Q. 3. Name the process used for the concentration of the sulphide ore.

Answer: Concentration is a process of removal of impurities from the ores. Sulphide ores are normally concentrated by the process of Froth Flotation as these ores possess good wetting and froth forming properties when mixed with frothing agents.

Q. 4. For the reduction of metal oxide to metal, suggest a reducing agent cheaper than aluminium.

Answer: Element which is cheaper than aluminium and can be used for the reduction purposes is carbon. Carbon reacts with metallic oxides to form carbon dioxide and metal is obtained.

Q. 5. What is the purpose of adding carbon (C) to molten iron?

Answer: Carbon is added to the molten iron to improve the properties of iron and it basically enhances the strength, hardness and corrosion resistance property of iron.

Q. 6. Aluminium occurs in combined state the, whereas gold is found in free-state in nature. Why?

Answer: Noble metals like gold and platinum which are unreactive under normal conditions and hence are found in free-state.

On the other hand, aluminium is reactive in nature and hence react with environmental factors like oxygen or moisture to form corresponding products.

Q. 7. What is the difference between sodium atom and sodium ion?

Answer: Sodium atom contains total 11 electrons whereas sodium ion is formed by the loss of one electron and hence sodium ion contain total 10 electrons which is similar to the noble gas configuration of neon.

Q. 8. Why is it that non-metals do not displace hydrogen from dilute acids?

Answer: Except for carbon all the non-metals are below hydrogen in the activity series of the elements because of which Non-metals do not evolve hydrogen gas when reacting with water, steam or dilute acids. To displace hydrogen from the non-metal should be placed above hydrogen in the activity series.

Q. 9. Answer the following:

(i) Name a metal which does not stick to glass.

(ii) What is the nature of zinc oxide?

(iii) What is deposited at the cathode, a pure or impure metal?

(iv) Will carbon monoxide (CO) change the colour of blue litmus?

Answer: (i) Mercury is a metal which does not stick to glass as mercury lacks adhesive forces.

(ii) Zinc Oxide is amphoteric in nature which means it can act as an acid as well as a base in a chemical reaction depending upon the reaction conditions.

(iii) A pure metal will be deposited at cathode because cathode is a negative electrode and hence it attracts the positive metal ions from the electrolyte.

(iv) Carbon Monoxide will change the color of the blue litmus if the litmus paper is moist as carbon monoxide will dissolve in the water molecules to form weak acid.

Q. 10. Zn is more electropositive than Fe. Therefore, it should get corroded faster than Fe. But it does not happen. Instead, it is used to galvanize iron. Explain why does it happen so?

Answer: Though zinc is more reactive than iron but when a layer of zinc is exposed to the atmosphere zinc reacts with the oxygen in the atmosphere to form zinc oxide. This zinc oxide forms a protective layer on the surface of zinc which prevents the further attack. Hence zinc is used to galvanize iron.

Q. 11. Write the equations for the reactions of

(i) Iron with steam

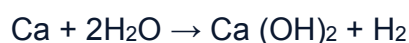
(ii) Calcium with water

(iii) Potassium with water

Answer: (i) The reaction is as follows:



(ii) The reaction is as follows:



(iii) The reaction is as follows:



Q. 12. Why Al metal cannot be obtained by the reduction of Al_2O_3 with coke? Explain.

Answer: Aluminium has far greater affinity for oxygen as compared to carbon because of which carbon cannot separate oxygen from aluminium oxide. Hence Al metal cannot be obtained by the reduction of Al_2O_3 with coke.

Q. 13. A solution of CuSO_4 was kept in an iron pot. After few days, the iron pot was found to have a number of holes in it. Explain the reason in terms of reactivity. Write the equation of the reaction involved.

Answer: In terms of reactivity of iron and copper, iron is more reactive than copper because of which iron reacts with the copper sulphate solution to form ferrous sulphate leaving holes in the iron pot. The reaction is as follows:



Q. 14. List three properties of sodium in which it differs from the general physical properties of most of the metals.

Answer: The three properties of sodium are as follows:

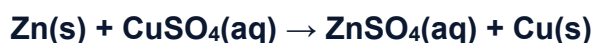
1. Sodium is very soft in nature and it can be easily cut with the help of a knife.
2. It is non-sonorous metal which means it does not make sound on being hit by hard object.
3. It has low melting and boiling points.

Q. 15.A. An ore, on heating in air, give Sulphur dioxide gas. Name the method in each metallurgical step that will be required to extract this metal from its ore.

Answer: Since the ore on heating in air gives Sulphur dioxide which means that the ore is a sulphide ore. The various methods involved in the extraction of metals from sulphide ores are as follows:

1. The ore is concentrated by the process of froth flotation to remove the impurities.
2. The concentrated ore is then heated in presence of air to convert the ore to corresponding metal oxide.
3. The metal oxide is then made to react with carbon to reduce the metal oxide to corresponding metal.
4. The metal is then purified by electrolytic reduction.

Q. 15. B. State which of the following reactions will take place or which will not, giving a suitable reason for each?



Answer: In the first reaction zinc is more reactive than copper and hence the above reaction is possible as zinc can replace copper from copper sulphate to form zinc sulphate.

In the second reaction, it is known that iron is less reactive than zinc and hence iron cannot replace zinc from zinc sulphate.

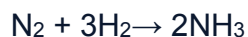
Q. 16. A non-metal A which is the largest constituent of air, when heated with H_2 in 1:3 ratio in the presence of catalyst (Fe) gives a gas B. On heating with O_2 , it gives an oxide C. If this oxide is passed into water in the presence of air, it gives an acid D which acts as a strong oxidizing agent.

(i) Identify A, B, C and D.

(ii) To which group of the periodic table, does this non-metal belongs?

Answer: The non-metal which is the largest constituent of air is Nitrogen.

When nitrogen is heated with hydrogen in the ratio of 1:3 in presence of iron as a catalyst we get ammonia as the product. This process of ammonia production is called as Haber's process. The reaction is as follows:



When nitrogen is heated with oxygen, it gives nitrogen dioxide. The reaction is as follows:



When nitrogen dioxide is dissolved in water, it gives nitric acid which is a strong oxidizing agent. The reaction is as follows:



(i) Therefore from above reactions we can easily state that,

A is Nitrogen B is Ammonia

C is Nitrogen Dioxide

D is Nitric Acid

(ii) The non-metal that is nitrogen belongs to the group 15 of the periodic table.

Q. 17. Noble gases, which have a completely filled valence shell, show little chemical activity. At ordinary temperature they do not show chemical reactivity. However, a large number of compounds of these gases particularly those of xenon and krypton have been prepared. Read the above passage and answer the following questions.

(i) Write one use of each Ar and Kr.

(ii) What are the values associated with the use of helium in artificial respiration in deep sea diving?

Answer: (i) The use of argon is as follows:

Argon is inert in its nature and hence it is used in filament bulbs to provide the inert medium and to avoid the burning of the metal.

The use of Krypton is as follows:

Krypton is also used in fluorescent bulbs, flashbulbs and lasers. Lamps filled with krypton are used as approach lights at airports as the light from these lamps can travel far even in dense fog.

(ii) Helium is generally added to protect the divers from the toxic effects of nitrogen and the percentage of helium is 11.7%.

Challengers

Q. 1. In each test tubes A, B, C and D, 2mL of solution of $Al_2(SO_4)_3$ in water was filled. Clean pieces of zinc were placed in test tube A, clean iron nail was put in test tube B, silver (Ag) was placed in test tube C and a clean copper wire was placed in test tube D.

Which of the following option (s) is/are correct about above experiment?

- A. Zinc is more reactive than aluminium
- B. Copper is more reactive than aluminium
- C. Zinc is more reactive than copper
- D. Zinc, iron, silver and copper are less reactive than aluminium.

Answer: Zinc, Copper as well as silver are less reactive as compared to aluminium and hence cannot displace aluminium from its salt as they are placed below aluminium in activity series.

So the correct answer is d.

The activity series of metals is as follows:

Reactivity Series of Metals			
These metals are more reactive than hydrogen	Potassium	K	(Most reactive metal)
	Sodium	Na	
	Calcium	Ca	
	Magnesium	Mg	
	Aluminium	Al	
	Zinc	Zn	
	Iron	Fe	
	Tin	Sn	
	Lead	Pb	
	[Hydrogen]	[H]	
These metals are less reactive than hydrogen	Copper	Cu	
	Mercury	Hg	
	Silver	Ag	
	Gold	Au	(Least reactive metal)

Q. 2. On the basis of the sequence of the given reactions identify the most and least reactive elements:



- A. X and Z
- B. Y and Z
- C. Z and X
- D. Z and Y

Answer: From the sets of reactions i, ii, iii, it can be observed from i and ii that X is more reactive than Y and hence it displaces Y from its salt.

From reaction iii it can be observed that Z is more reactive than X as it displaces X from its salt.

So the most reactive element is Z and the least reactive is Y.

So correct answer is d [Z and Y].

Q. 3. A metal M has electronic configuration 2, 8, 3 and occurs in earth's crust and its oxide M_2O_3 . It is more reactive than zinc. Which of the following options (s) is/are correct?

- A. The metal M is iron
- B. The metal M is lead
- C. The ore from which metal M is extracted is haematite.
- D. The ore from which metal M is extracted is bauxite.

Answer: The element with atomic number of 13 [$2 + 8 + 3 = 13$] is Aluminium and it is more reactive than zinc.

The ore of aluminium is called as bauxite and the oxide of aluminium is Al_2O_3 .

So the correct answer is d.

Q. 4. Metal M reacts with oxygen to form metallic oxide MO. This oxide reacts with moisture and carbon dioxide of the atmosphere to form a basic carbonate metal M. The metal 'M' is

- A. Cu
- B. Fe
- C. Zn
- D. Cr

Answer: The metallic oxide of type MO which reacts with moisture and carbon dioxide of atmosphere to form basic carbonate is copper oxide. Copper metal on exposed to atmosphere reacts with oxygen, moisture and carbon dioxide to form a green coloured coating of copper carbonate and copper hydroxide.

So the correct answer is a.

Q. 5. Beakers A, B and C contain zinc sulphate, silver nitrate and iron (II) sulphate solutions respectively. Copper pieces are added to each beaker. Blue colour will appear in case of

- A. beaker A**
- B. beaker B**
- C. beaker C**
- D. all the beakers.**

Answer: Among all the available metal solutions, copper is more reactive as compared to silver only. Copper cannot displace zinc or iron from its salt as it is less reactive as compared to both the metals. So blue colour will appear only in the beaker which has Silver nitrate solution in it.

So the correct answer is b.

Q. 6. A student puts one big iron nail each in four test tubes containing solutions of zinc sulphate, aluminium sulphate, copper sulphate and iron sulphate. A reddish brown coating was observed only on the surface of iron nail which was put in the solution of

- A. zinc sulphate**
- B. iron sulphate**
- C. copper sulphate**
- D. aluminium sulphate**

Answer: Iron is more reactive than copper and hence it can displace only copper from its salt. Iron is less reactive as compared to aluminium or zinc so they will not be displaced from their salts. Also iron will not react with its own salt. So the reddish brown coating on surface of nail is of copper deposition which will be observed only in case of iron nail dipped in copper sulphate solution.

So the correct answer is c.

Q. 7. Which of the following reactions not occur?

- A. $2\text{AgNO}_3(\text{aq}) + \text{Zn}(\text{s}) \rightarrow \text{Zn}(\text{NO}_3)_2(\text{aq}) + 2\text{Ag}(\text{s})$**
- B. $\text{CuSO}_4(\text{aq}) + \text{Zn}(\text{s}) \rightarrow \text{ZnSO}_4(\text{aq}) + \text{Cu}(\text{s})$**
- C. $2\text{AgNO}_3(\text{aq}) + \text{Fe}(\text{s}) \rightarrow \text{Fe}(\text{NO}_3)_2(\text{aq}) + 2\text{Ag}(\text{s})$**
- D. $\text{CuSO}_4(\text{aq}) + 2\text{Ag}(\text{s}) \rightarrow \text{Cu}(\text{s}) + \text{Ag}_2\text{SO}_4(\text{aq})$**

Answer: Among all the reactions, the reaction d is only not possible because silver is less reactive as compared to copper and hence it cannot displace copper from its salt.

So correct answer is d.

Q. 8. Hydrogen gas is not widely used as a reducing agent because

- A. hydrogen decomposes to atomic hydrogen at higher temperature**
- B. risk of explosion with water**
- C. hydrogen isomerises to ortho hydrogen at higher temperature.**
- D. many metals form hydrides at lower temperatures.**

Answer: Many of the metallic oxides react with the hydrogen to form respective hydrides and hence hydrogen is not widely used as reducing agent in metallurgy.

So the correct answer is d.

Q. 9. Alloys are homogeneous mixtures of a metal with a metal or non-metal. Which among the following alloys contain non-metal as one of its constituents?

- A. Brass**
- B. Bronze**
- C. Amalgam**
- D. Steel**

Answer: Among all the available options Steel is the alloy of iron which contains the non-metal carbon in it.

Bronze consists primarily of copper and 12% tin

Brass is an alloy of copper and zinc.

Amalgam is an alloy of mercury.

So the correct answer is d.

Q. 10. E is an element that's ore is rich in E_2O_3 . E_2O_3 is not affected by water. It forms two chlorides, ECl_2 and ECl_3 The element E is

- A. copper**
- B. zinc**
- C. aluminium**
- D. iron**

Answer: The metallic oxide of the form E_2O_3 is Iron [III] Oxide. Iron reacts with chlorine to form different Iron [II] Chloride and Iron [III] Chloride. The ore of Iron that is Fe_2O_3 Haematite does not react with water.

So the correct answer is d.

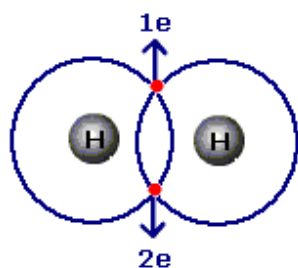
Carbon and its Compounds

Check Point 01

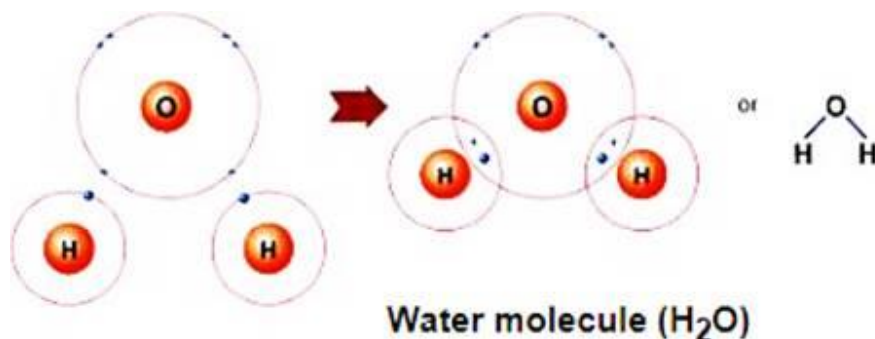
Q. 1. What do you mean by covalent bonding?

Answer: The bonding in which atoms mutually share the electron pair(s) to form molecules is called covalent bonding.

Example: Hydrogen molecule. In hydrogen molecule, both the electrons are shared to form a covalent bond.



Another very common example is the water molecule:



In water molecule, the two single hydrogen & oxygen bonds are formed.

Q. 2. An element X which has 6 electrons in its outermost shell, require 2 electrons to complete its octet for attaining noble gas configuration. X is an essential element for the survival of all living beings. What is X?

Answer: The element X is oxygen. The atomic number is 8, and its electronic configuration is 2,6. Oxygen is used for respiration by the living beings.

Q. 3. (i) The main constituent of marsh gas is

(ii) In case of a water molecule, hydrogen acquires a configuration.

Answer: (i) Methane

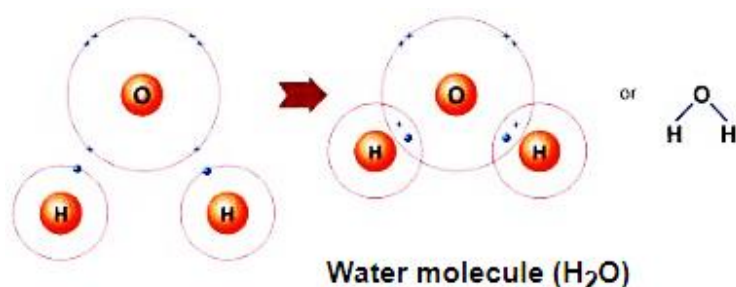
Explanation:

Marsh gas is a mixture of methane (CH_4), hydrogen sulfide (H_2S) and carbon dioxide (CO_2).

(ii) Single covalent bond configuration.

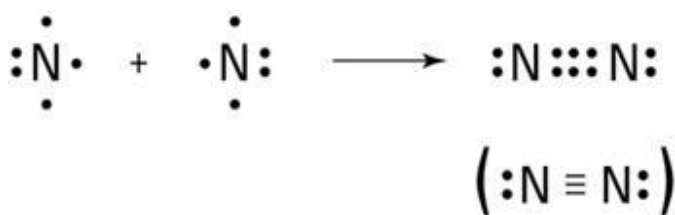
Explanation:

The water molecule is chemically written as:



Q. 4. Write the covalent bonding in nitrogen.

Answer: Nitrogen has the electronic configuration 2, 5. It shares 3 of the outermost electrons with another nitrogen atom to form a triple-bonded N_2 molecule, as shown below:



Q. 5. Why covalent compound are volatile in nature with low boiling and low melting point?

Answer: Covalent compounds have strong forces of attraction within the molecule, but the inter-molecular forces are very small due to which they are volatile. This results in the low melting and boiling point of compounds making them volatile.

Q. 6. Give two differences between ionic and covalent compounds.

Answer:

Ionic Compounds	Covalent Compounds
Formed by complete transfer of electrons from one atom to another	Formed by mutual sharing of electrons between atoms
High melting and boiling point	Low melting and boiling point
Example, NaCl (Sodium Chloride)	Example, CO ₂ (carbon dioxide)

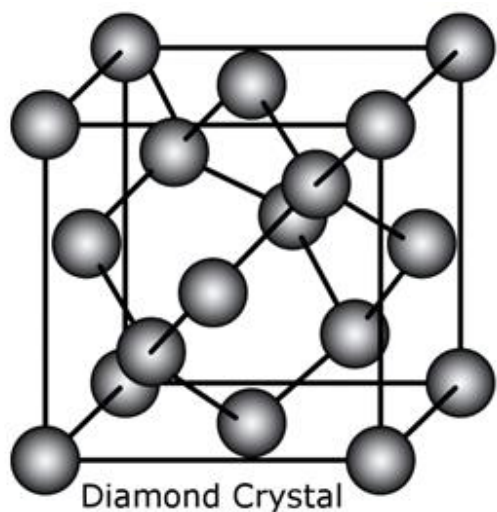
Check Point 02

Q. 1. Write the two examples of the crystalline form of carbon.

Answer: In the crystalline form of carbon, many atoms are bonded together in a repeating pattern. The arrangement of atoms in the crystal differs for each form of carbon. Two forms are:

i. Diamond.

Each carbon atom is covalently bonded to four other carbon atoms. The arrangement of carbon is shown below:



ii. Fullerene:

Each carbon atom is covalently bonded to four other carbon atoms. Each sphere contains 60 carbon atoms, and each carbon atom is bonded to three others by single covalent bonds.

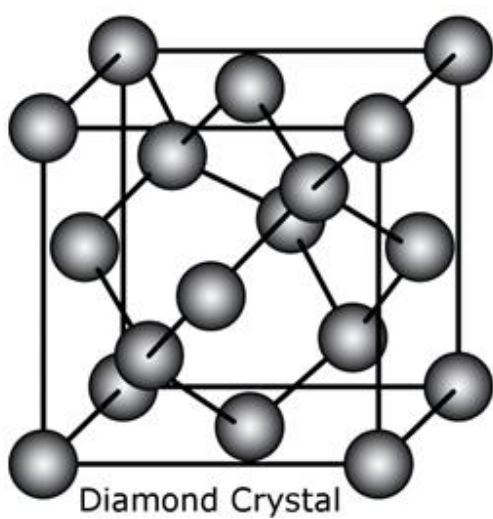


Fullerene

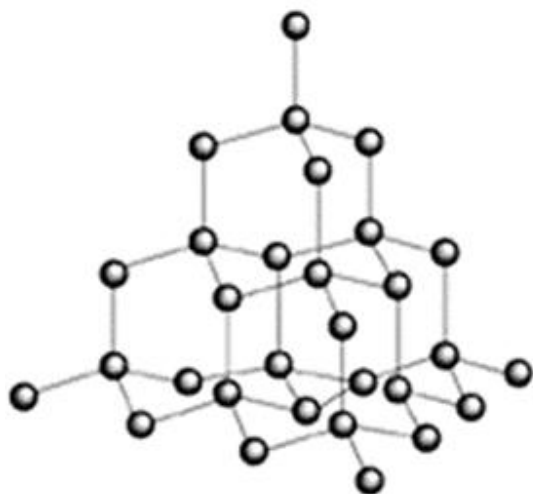
Q. 2. Draw the structure of diamond.

Answer: In diamond, each carbon atom is covalently bonded to four other carbon atoms.

The crystal structure is shown below:

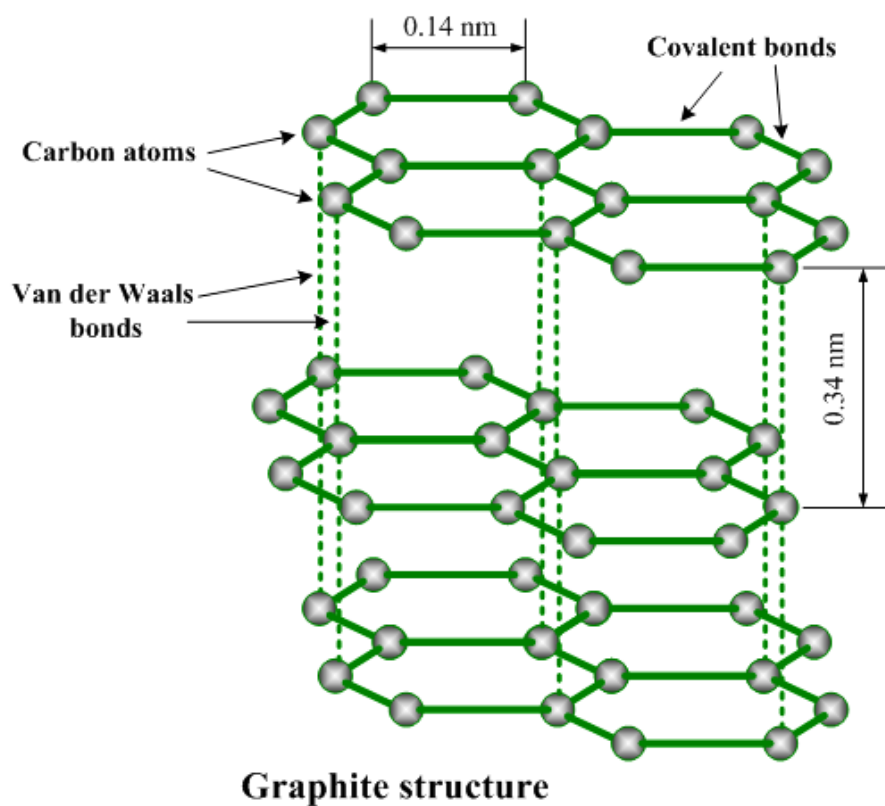


Diamond has a 3D structure.



Q. 3. Why is graphite smooth?

Answer: In graphite, each carbon atom is bonded to 3 other carbon atoms in the same plane giving rise to a hexagonal array. The structure of graphite is formed by stacking these hexagonal layers over one another and these layers have weak inter-molecular forces.

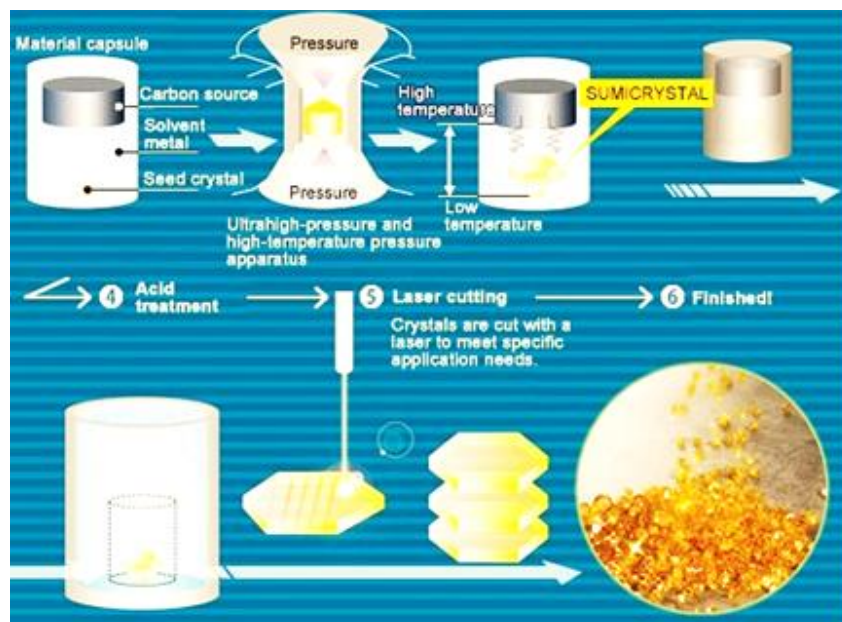


This structure results in the smoothness of graphite.

Q. 4. How do diamond can be prepared artificially?

Answer: Artificial diamonds can be artificially prepared by subjecting pure carbon to a very high temperature and pressure.

Note: Here is a description of the complete process for extra knowledge.



Q. 5. Give two differences between ionic and covalent compounds.

Answer:

Ionic compounds	Covalent Compounds
High melting and boiling point	Low melting and boiling point
Conduct electricity in the aqueous or molten state	Do not conduct electricity in the aqueous or molten state

Q. 6. Diamond is a covalent solid, yet has a high melting point. Why?

Answer: Diamond has a rigid 3D structure in which each carbon atom is covalently bonded to 4 other carbon atoms. This structure involves a network of strong C-C bonds which requires high energy to break the bonds. Hence, the diamond has a high melting point.

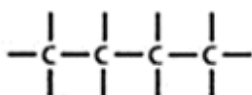
Check Point 03

Q. 1. What do you mean by catenation?

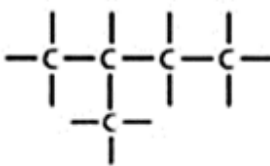
Answer: The ability of an element to form bonds with other atoms of the same element is called catenation.

The different types of bond chains are:

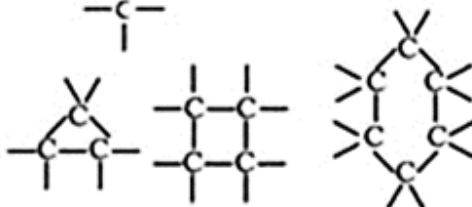
Straight Chain



Branched Chain



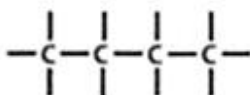
Closed Chain



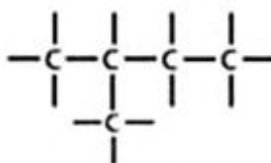
Q. 2. Why does carbon form a large number of compounds?

Answer: Carbon forms a large number of compounds because (a) Carbon exhibits catenation to a very large extent. It can form long chains, branched chains or ring structures.

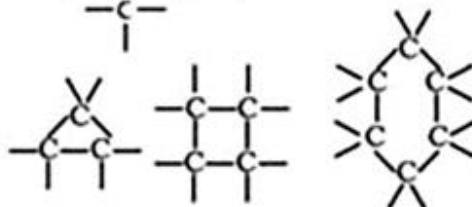
Straight Chain



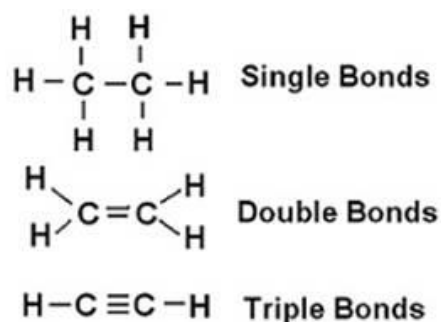
Branched Chain



Closed Chain



(b) Carbon has a valency of 4. It is satisfied by forming single, double or triple bonds with carbon or other elements such as oxygen, hydrogen, nitrogen etc. The bonds formed are strong and hence the compounds formed are stable.



Q. 3. Differentiate between saturated and unsaturated hydrocarbons.

Answer:

Saturated hydrocarbons	Unsaturated hydrocarbons
Compounds in which all the carbon-carbon bonds are single bonds	Compounds in which at least one carbon-carbon bond is a double or triple bond
Generally not very reactive. Shows substitution reaction(s)	More reactive than saturated hydrocarbons. Responds to addition reaction(s)
Burns with clean flame in sufficient amounts of oxygen	Burns with sooty flame in sufficient amounts of oxygen.

Q. 4. Write the electron dot structure of C₃H₈.

Answer: C₃H₈ contains 3 carbon atoms and 8 hydrogen atoms.

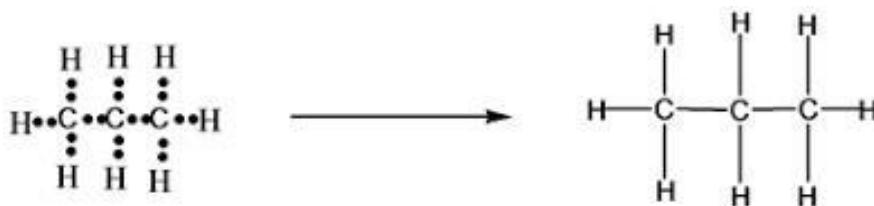
Now, each carbon atom has 4 electron and each hydrogen atom has 1 electron each.

So, in total $3 \times 4 + 1 \times 8 = 12 + 8 = 20$ electrons.

And, 1 single bond = 2 electrons.

$\therefore$ 10 single bonds.

There now plot the electrons on the atoms as shown, and then join the single bonds.



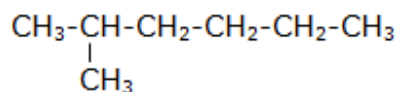
This is the final structure of propane i.e. C_3H_8

Check Point 04

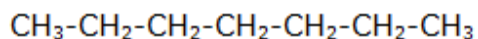
Q. 1. Write the structural formulae of all the isomers of an alkane with seven C-atoms (C_7H_{16})

Answer: There are 9 isomers for heptane (C_7H_{16}):

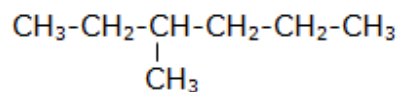
a. 2-methyl hexane (isoheptane)



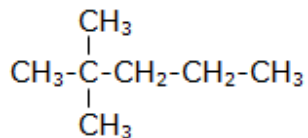
b. n-heptane



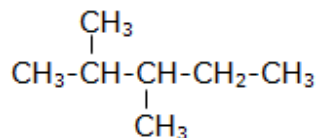
c. 3-methylhexane



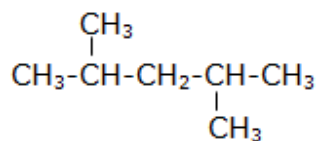
d. 2,2-dimethylpentane



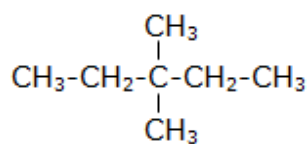
e. 2,3-dimethylpentane



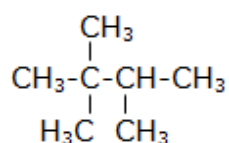
f. 2,4-dimethylpentane



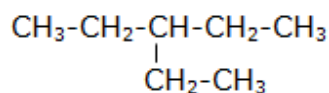
g. 3,3-dimethylpentane



h. 2,2,3-trimethylbutane



i. 3-ethylpentane



Q. 2. What is meant by homologous series?

Answer: A series of compounds in which the same functional group substitutes for the hydrogen in a carbon chain is called homologous series.

Example: Methane (CH_4) and ethane (C_2H_6).

There are a part of homologous series & the difference among these molecules is that they have different numbers of CH_2 groups.

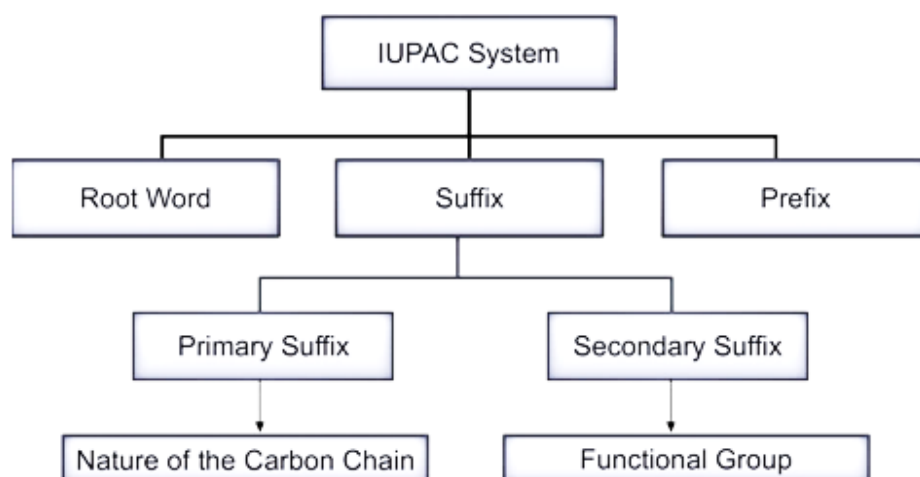
Q. 3. (i) The gradual change in the physical properties occurs with increase in the
(ii) IUPAC stands for.....

Answer: (i) Molecular mass

(ii) International Union of Pure and Applied Chemistry

Q. 4. What are primary and secondary suffixes as applied to IUPAC nomenclature?

Answer: In IUPAC nomenclature, the following subdivision is followed for naming the compounds.



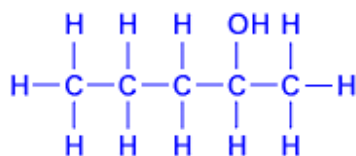
Primary suffixes are used to indicate the degree of unsaturation (i.e., presence of double or triple bonds) in a carbon compound.

e.g.: -ane (for alkanes), -ene (for alkenes), -yne (for alkynes)

Secondary suffixes are those suffixes which describe the main functional group of the compound. They are added after the primary suffix.

e.g.: -one (for ketones), -oic acid (for carboxylic acids)

Example:



Pentan-2-ol

Root Word	Primary Suffix	Secondary Suffix	Position of Functional Group
Pent	an ~~e~~	ol	2

Check Point 05

Q. 1. Which type of hydrocarbon gives sooty flame after burning?

Answer: Unsaturated hydrocarbons give sooty flame after burning even in sufficient amount of oxygen. Saturated hydrocarbons may give sooty flame upon burning if there is limited supply of oxygen.

**Q. 2. (i) Alcohols are converted into carboxylic acid only under
 (ii) In partial oxidation; alcohols are converted into**

Answer: (i) complete oxidation (in the presence of strong oxidizing agents like acidified potassium dichromate)

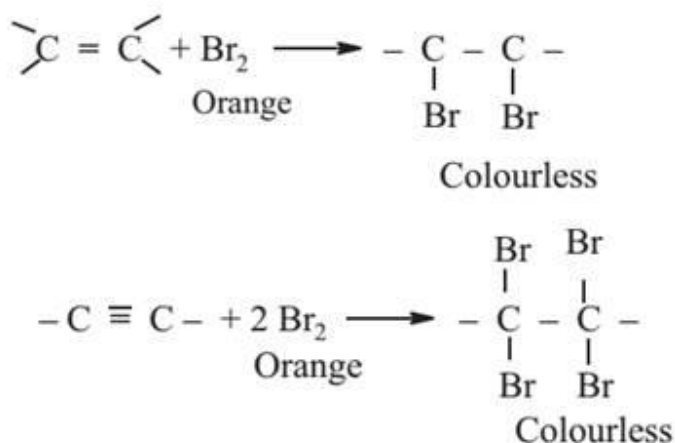
(ii) aldehydes

Q. 3. Give an example for the test of unsaturation.

Answer: Bromine water can be used for the test of unsaturation. If bromine water which is brown in colour is added to unsaturated compounds, then bromine water gets decolourised as a result of addition reaction.

Saturated compounds do not decolourise bromine water.

Example:



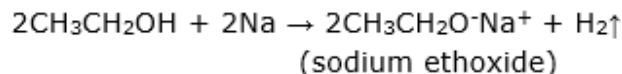
Q. 4. Why compounds like petrol, coal, etc generate heat or light or both on combustion?

Answer: Combustion is the process of burning of a substance in the presence of oxygen. The fuel (coal or petroleum) gets oxidized. As a result, the bonds present in the molecules of fuel break, releasing energy. Sometimes, the energy released falls in the visible range of the electromagnetic spectrum (which means the energy released is visible to human eye) which we call as light. Sometimes the energy released falls under infrared region, which we commonly call as heat. Basically, the compounds generate heat or light or both due to the release of energy from the breaking of molecular bonds.

Check Point 06

Q. 1. What happens when ethyl alcohol reacts with sodium metal?

Answer: When ethyl alcohol reacts with sodium metal, hydrogen gas is liberated along with the formation of sodium ethoxide.



Q. 2. Give any two examples of chemicals that are added to denature the alcohol.

Answer: Methanol and acetone are added to denature the alcohol to prevent the misuse of alcohol.

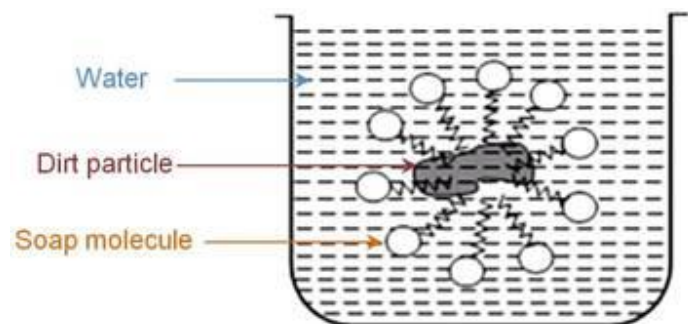
Q. 3. Mention two uses of ethanoic acid.

Answer: Ethanoic acid is used as a preservative in pickles.

It is also used in the production of esters which are used in making perfumes and as flavouring agents.

Q. 4. Why soap solution appears cloudy?

Answer: When soap is added to water, it forms clusters of molecules called micelles. These soap micelles are large enough to scatter light and therefore makes the soap solution cloudy.



Chapter Exercise

Q. 1. Which allotrope of carbon is soft, greasy and is used as solid lubricant for heavy machinery operating at a high temperature?

Answer: Graphite is the allotrope of carbon used for lubrication purposes.

Q. 2. Which property of diamond allows it to be used in knives for cutting marble?

Answer: Diamond is the hardest naturally occurring substance in the world. Its hardness is made use of in making knives to cut marbles.

Q. 3. Which of the following are alkenes?

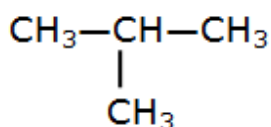
CH₄, C₂H₆, C₂H₄, C₃H₆ and C₃H₈

Answer: The general formula of alkenes is C_nH_{2n}, where 'n' is the number of carbon atoms.

Here, C₂H₄ and C₃H₆ are alkenes (put n=2, 3)

Q. 4. In order to form a branched organic compound, what should be the minimum number of carbon atoms?

Answer: The minimum number of carbon atoms to form a branched compound should be 4; 3 in the parent chain and 1 in the branched chain. The compound is 2-methylpropane (isobutane).



Q. 5. Which of the following two organic compounds belong to the same homologous series?

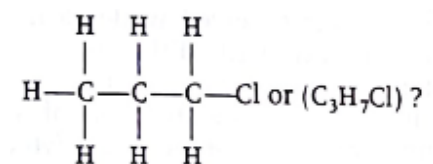
C₂H₆, C₂H₆O, C₂H₆O₂, CH₄O

Answer: CH₄O, C₂H₆O belong to the same homologous series as they differ only by a –CH₂ unit.

Q. 6. How two successive members of a homologous series differ from each other?

Answer: The successive members of a homologous series differ by a –CH₂ unit.

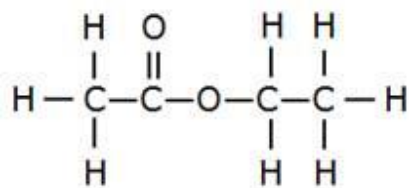
Q. 7. What is the common name of this compound



Answer: Propyl chloride

Q. 8. Draw the structural formula of ethyl ethanoate.

Answer:

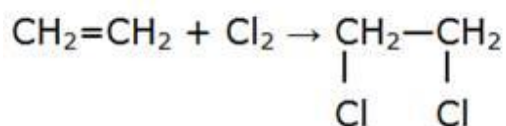


The molecular formula is $\text{C}_4\text{H}_8\text{O}_2$.

Q. 9. Complete the following reaction,



Answer: This is an example of addition reaction.



Q. 10. Which functional group can be detected by using sodium hydrogen carbonate test?

Answer: Carboxylic acid ($-\text{COOH}$) can be detected by using sodium hydrogen carbonate (NaHCO_3) test. Treating a carboxylic acid with NaHCO_3 causes effervescence due to the liberation of carbon dioxide (CO_2). The reaction is as follows:



Q. 11. Graphite is a covalent molecule but a good conductor of electricity. Why?

Answer: In graphite, each carbon is covalently bonded to 3 other carbon atoms in a hexagonal arrangement. That is 3 out of 4 valence electrons are used for covalent bonding. The remaining 1 electron from each carbon atom is free (or delocalized). This free electron helps in the conduction of electricity.

Q. 12. If water contains dissolved calcium hydrogen carbonate then out of soaps and synthetic detergents, which one will you use for cleaning the dirt of clothes?

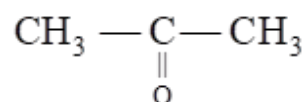
Answer: The given sample of water contains calcium ions and hence is hard water. Soaps are not effective in hard water as they produce scum (insoluble precipitate) with calcium ions. Therefore, synthetic detergents must be used to clean the dirt of clothes in hard water.

Q. 13. Write the names of the next homologues of $\text{CH}_3\text{CH}_2\text{OH}$ and HCOOH .

Answer: Homologues of $\text{CH}_3\text{CH}_2\text{OH}$: $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ (propanol), $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$ (butanol),...

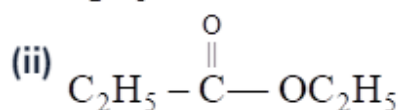
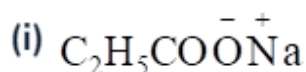
Homologues of HCOOH : CH_3COOH (ethanoic acid), $\text{CH}_3\text{CH}_2\text{COOH}$ (propanoic acid),...

Q. 14. Write the names of the following compounds.

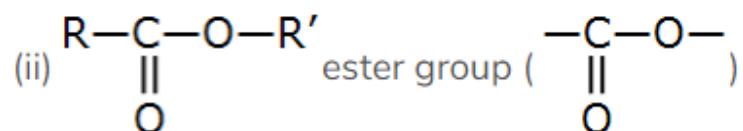


Answer: (i) Propanone (ii) ethyne

Q. 15. Identify the functional groups in the following compounds and name them.



Answer: (i) $-\text{COO}-$ group (carboxylic acid; the anion is called carboxylate ion)

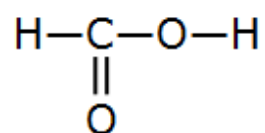


(iii) $-\text{OH}$ group – alcohol

(iv) $-\text{CHO}$ group – aldehyde

Q. 16. Mention the number of double bonds between carbon and oxygen in methanoic acid. Write its general formula.

Answer: Methanoic acid contains 1 $\text{C}=\text{O}$ bond and 1 $\text{C}-\text{O}$ bond.

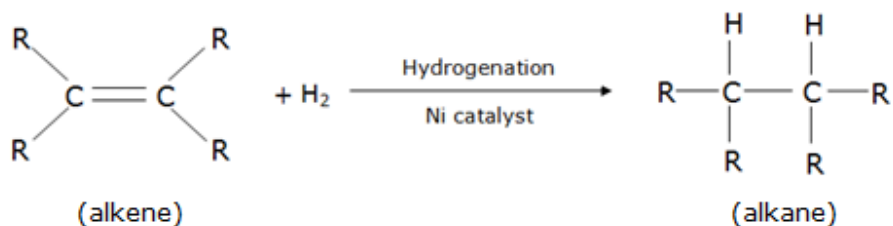


The general molecular formula of a carboxylic acid is $\text{C}_n\text{H}_{2n}\text{O}_2$.

Q. 17. Why vegetable oils are considered healthy as compared to vegetable ghee? How are they converted into ghee? What name is given to the reaction?

Answer: Vegetable oils contain unsaturated fatty acids which are good for the health, whereas vegetable ghee contains saturated fatty acids which are harmful to our health.

Vegetable oils are converted into ghee by the process of hydrogenation. Hydrogen is added to unsaturated compounds in the presence of a catalyst (such as nickel) to produce saturated compounds. The reaction is illustrated as:



Q. 18. How is glacial acetic acid different from acetic acid provided to you in laboratory? Write its one characteristic which resembles its name.

Answer: The water content present in acetic acid provided in the laboratory is higher than that of glacial acetic acid.

Pure ethanoic acid is often called glacial acetic acid because it freezes to form ice-like crystals when kept in cold surroundings (the melting point is 290K).

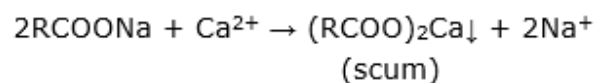
Q. 19. The gas/kerosene stoves used at home have inlets for air. What is the purpose of these inlets? What will happen, if these inlets are not provided?

Answer: Inlets are provided to supply air to ensure that the fuel burns completely and give a clean flame. If the inlets are absent, then the fuel may not burn completely and produce sooty flame. This will also result in wastage of fuel.

Q. 20. How would you predict whether a given water sample is of hard water or soft water? Give chemical equation.

Answer: To determine whether a given water sample is of hard water or soft water, one can use soap.

Soap produces lather in soft water whereas soap does not produce lather in hard water due to the formation of scum (insoluble precipitate). Scum is a result of reaction of soap with calcium and magnesium ions present in the hard water.



Q. 21. Soaps are prepared by treating the esters of fatty acid with alkali. Sometimes common salt is also added to it. Why is common salt added during this process?

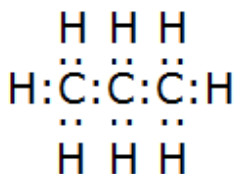
Answer: In the reaction of esters with alkali to prepare soap (saponification reaction), the product (soap) is obtained in a suspension form. To precipitate the soap out of the suspension form, common salt (NaCl) is added to it. This process is often referred to as “salting out” of soap.

Q. 22. Scientists detect the presence of sodium bicarbonate in a water sample. Can this water be used for washing clothes with soap? Justify your answer.

Answer: Yes, soap can be used for washing clothes in water containing sodium bicarbonate, as sodium ion will not contribute to the hardness of water.

Q. 23. Compound A has three carbon atoms, which burns with non-sooty flame. Predict what is A? Write its electron dot structure.

Answer: Non-sooty flame can be interpreted as clean flame. Clean flame is given out by burning of saturated compounds. Hence, A is propane (C_3H_8).



Q. 24. Two non-metals A and B combine with each other by sharing of electron to form compound C.

(i) What is the nature of compound C?

(ii) Will it dissolve in water or organic solvents? Give reason for your answer.

Answer: (i) C is a covalent compound, as the combining atoms form a bond by sharing of electrons.

(ii) Using “like dissolves like” rule, polar molecules dissolve in polar solvents, whereas non-polar molecules dissolve in non-polar solvents. C and organic solvents are both covalent (non-polar) in nature, but water is a polar solvent. Hence C will dissolve in organic solvents.

Q. 25. Account for the following.

(i) Sunlight is necessary for the substitution reactions of saturated hydrocarbons.

(ii) Ethyne burns with a yellow flame and lots of black smoke.

Answer: (i) Saturated hydrocarbons undergo substitution reaction through a mechanism called “free radical mechanism”, where the initial step of reaction is the formation of free radicals. Generation of free radicals requires sunlight, without which the reaction does not get initiated. So, sunlight is necessary for the substitution reactions of saturated hydrocarbons.

(ii) Ethyne ($\text{HC}\equiv\text{CH}$) is an unsaturated compound, and unsaturated compounds produce yellow sooty flame with lots of black smokes. This is due to incomplete combustion of ethyne in air.

Q. 26. Give reasons for the following.

(i) Ethanoic acid is used in the preservation of pickles.

(ii) CO_2 is released on burning diamond as well as graphite.

Answer: (i) Ethanoic acid provides an acidic environment where bacteria cannot survive, preserving the pickles for a longer time.

(ii) Both diamond and graphite are allotropes of the same element carbon. The only difference is in their physical properties due to the difference in their structure. The chemical properties remain the same. Carbon when burnt in the presence of oxygen gives carbon dioxide (CO_2). Since, diamond and graphite are chemically carbon, both release CO_2 upon burning.

Q. 27. An organic compound X of molecular formula $\text{C}_2\text{H}_4\text{O}_2$ turns blue litmus to red and gives brisk effervescence with Na_2CO_3 and NaHCO_3 . Identify X and name of the gas responsible for effervescence.

Answer: X is ethanoic acid (CH_3COOH). It is acidic and hence turns blue litmus red. It releases carbon dioxide (CO_2) when treated with Na_2CO_3 and NaHCO_3 which is responsible for effervescence.



Q. 28. (i) Why does carbon form largest number of compounds? Give two reasons.

(ii) Why are some of these called saturated and the other unsaturated compounds?

(iii) Which one of these two is more reactive and why?

Answer: (i) Carbon has the ability to form long, branched chains or ring structures with other carbon atoms. This self-linking capacity is referred to as catenation.

Also carbon has a valency of 4 and combines with 4 other monovalent atoms or shares its outermost electrons with different elements through single, double or triple bonds. The bonds formed are highly strong and stable. Hence carbon forms a large variety of compounds.

(ii) Compounds of carbon which are linked by only single bonds between the carbon atoms are called saturated compounds.

Compounds of carbon having double or triple bonds between the carbon atoms are called unsaturated compounds.

(iii) Unsaturated compounds are more reactive than saturated compounds because of the presence of double or triple bonds present in them. These bonds tend to break in the presence of some reacting species to become saturated compounds which are highly stable. The relative stability of hydrocarbons in the decreasing order is given by:

alkanes > alkenes > alkynes

Q. 29. Write the molecular formula of ethene and also give three succeeding members with their names.

Answer: The molecular formula of ethene is C_2H_4 . The three succeeding members in this homologous series are:

Propene (C_3H_6), Butene (C_4H_8), Pentene (C_5H_{10})

Q. 30. Give reasons for the following.

(i) Unsaturated hydrocarbons show addition reaction.

(ii) Alcohol supplied for industrial purpose is mixed with copper sulphate.

Answer: (i) $A + B \rightarrow C$

The above reaction occurs because the stability of C is higher than the stability of A and B. Molecules always tend to attain the most stable configuration in a reaction.

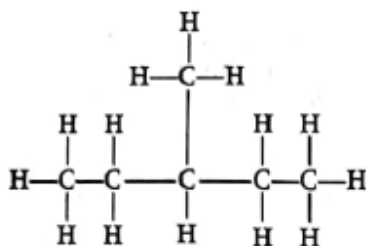
Here saturated compounds are more stable than unsaturated compounds. The double/triple bonds present in the unsaturated compound break to form single bonds by combining with the reactant to attain a highly stable product. Therefore, unsaturated hydrocarbons show addition reaction.

(ii) Alcohol supplied for industrial purpose is mixed with chemicals like methanol to prevent the misuse of it. It is a common practice to overuse this alcohol for recreational purposes, and addition of these chemicals would help prevent the misuse to an extent.

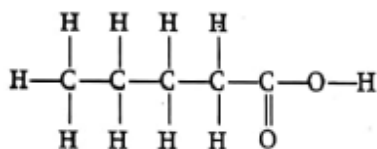
To identify such mixtures of alcohols, dyes or coloured substances are added to colour the alcohol blue. In this case, the coloured substance added is copper sulphate.

Q. 31. Name the following compounds.

(i)



(ii)



Answer: (i) 3-methylpentane

(ii) Pentanoic acid

Q. 32. (i) What is black gold and how is it formed? (ii) Why coal and petroleum are considered as air pollutants?

Answer: (i) Petroleum or crude oil is called black gold and it is formed from the remains of plants and animals that lived in the sea millions of years ago. The dead remains along with the silt which settled in the sea bed are attacked by bacteria and got converted to crude oil and gas under high pressure conditions. Slowly the silt compressed into rocks and the oil seeped into the porous parts of the rocks.

(ii) Fossil fuels such as coal and petroleum contain some amount of nitrogen and sulphur in them. The combustion of these fuels in air results in the formation of oxides of nitrogen and sulphur which are major pollutants of the environment. Therefore, coal and petroleum are considered to be pollutants of air.

Q. 33. A substance (X) be oxidised to acetic acid (CH_3COOH)? Name substance (X) and write two tests to demonstrate acidic nature of acetic acid.

Answer: The substance X is ethanol ($\text{C}_2\text{H}_5\text{OH}$).

The acidic nature of acetic acid can be shown using:

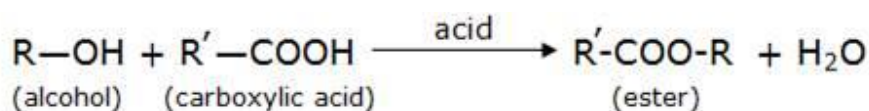
(a) Litmus test – Chemicals which are acidic in nature turn blue litmus red

(b) Sodium carbonate test – Acids when treated with sodium carbonate gives effervescence due to the liberation of carbon dioxide. Acetic acid also produces CO₂ in this reaction.



Q. 34. Explain giving chemical equation, how are esters prepared? Specify any one property and one use of esters.

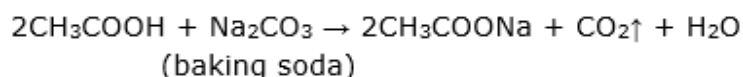
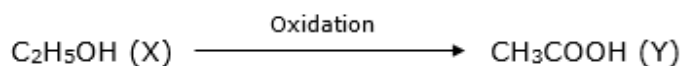
Answer: Esters are prepared by the reaction of an acid and an alcohol in the presence of an acid catalyst. The reaction is called esterification reaction.



Esters are sweet smelling substances and hence are used in making perfumes and as flavouring agents.

Q. 35. An organic compound X which is sometimes used as an antifreeze has the molecular formula C₂H₆O. X on oxidation gives a compound Y which gives effervescence with a baking soda solution. Identify X and Y. Write the chemical equation of reaction.

Answer: X is ethanol (C₂H₅OH) and Y is ethanoic acid (C₂H₄O₂)



Q. 36.A. Give a detailed explanation on the following.

Properties of acetic acid

Answer: Acetic acid (CH₃COOH) is a weak acid and belongs to the family of carboxylic acids.

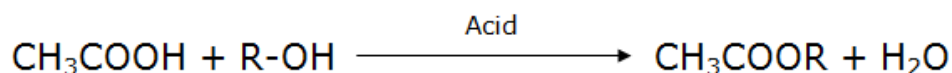
Physical Properties:

Acetic acid exists in liquid state at room temperature. Pure acetic acid has a melting point of 290K and often freezes when kept in cold climates.

Chemical Properties:

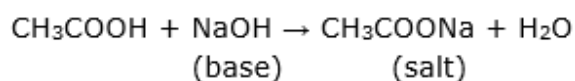
(a) Reaction with alcohol:

Acetic acids react with alcohols in the presence of an acidic medium to form esters. Esters are sweet smelling substances and are often used in perfumes and as flavouring agents.



(b) Reaction with base:

Like other acids, acetic acid reacts with base to form salt and water. The reaction is called neutralization reaction.



(c) Reaction with carbonates and bicarbonates:

Acetic acid reacts with carbonates and bicarbonates to form salt, carbon dioxide and water.



Q. 36.B. Give a detailed explanation on the following.

Versatile nature of carbon

Answer: The versatility of carbon can be explained in the following ways:

(a) Catenation:

The self-linking capacity of an element is referred to as catenation. Carbon can form long straight chains, branched chains, or ring structures by bonding with other carbon atoms. No other element exhibits catenation up to this extent. Carbon can link with other carbon atoms using single, double or triple bonds.

(b) Tetravalency:

Carbon has a valency of 4. It is satisfied by forming bonds with 4 other monovalent atoms. Carbon can also form multiple bonds (double or triple bonds) with atoms like

oxygen and nitrogen. The bonds formed are highly stable and thus forms stable compounds.

Q. 37. How are the following pairs related?

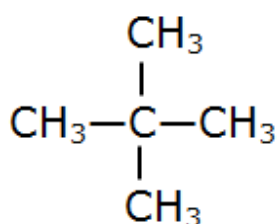
(i) 2, 2-dimethylpropane and 2-methylbutane

(ii) Ethane and propane

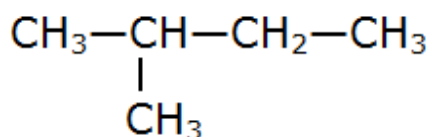
(iii) C_2H_5Cl and C_3H_7Cl

(iv) C_3H_4 and C_2H_4

Answer: (i) The structural formula of the two compounds are shown below.



2,2-dimethylpropane



2-methylbutane

Note that both compounds have the same molecular formula C_5H_{12} . Since they have same molecular formula but different structural formula, they are isomers.

(ii) Ethane (C_2H_6) and propane (C_3H_8) can be represented by the general formula C_nH_{2n+2} where 'n' is the number of carbon atoms. Also they differ by a $-CH_2$ unit. Hence they are homologues.

(iii) C_2H_5Cl and C_3H_7Cl differ by a $-CH_2$ unit. Also these 2 can be represented by the formula $C_nH_{2n+1}Cl$. Therefore they are homologues.

(iv) C_3H_4 is an alkyne and C_2H_4 is an alkene. Both the compounds contain double or triple bonds. Therefore, they belong to the family of unsaturated compounds.

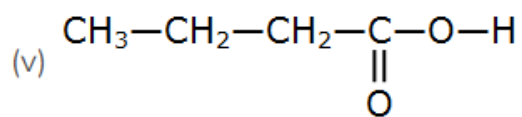
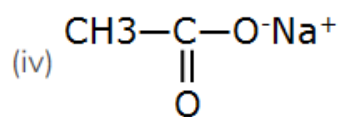
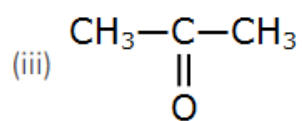
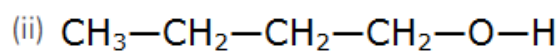
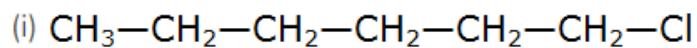
Q. 38. Draw the structures of

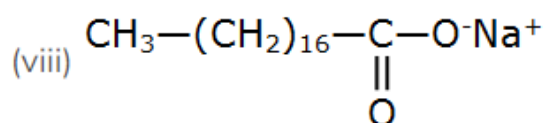
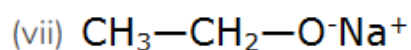
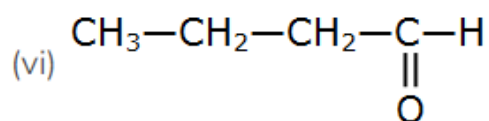
(i) chlorohexane (ii) butanol

(iii) propanone (iv) sodium ethanoate

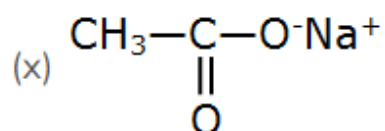
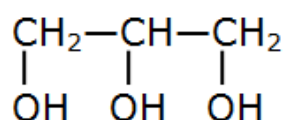
(v) butanoic acid (vi) butyraldehyde
(vii) sodium ethoxide (viii) sodium stearate
(ix) glycerol (x) sodium acetate

Answer:





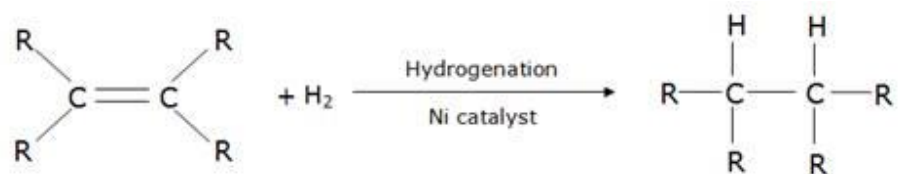
(ix) Glycerol is propane-1,2,3-triol



Q. 39. Give the reaction for the hydrogenation of unsaturated carbon compounds. Define the term catalyst and name the catalyst used in this reaction. Which oil should be chosen for cooking and why?

Answer: Hydrogenation is the process of addition of hydrogen to compounds containing double/triple bonds to form saturated compounds.

The hydrogenation of unsaturated carbon compounds is given by the reaction:



Catalyst is a substance which alters the rate of a chemical reaction, without undergoing any change to itself. Nickel, palladium can be used as the catalyst for hydrogenation.

Vegetable oil must be chosen for cooking as it contains unsaturated fatty acids which are good for health.

Q. 40. Give account of chemical properties?

(i) combustion of ethanol

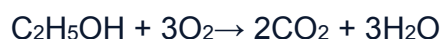
(ii) oxidation of ethanol

(iii) reaction of $\text{C}_2\text{H}_5\text{OH}$ with sodium metal

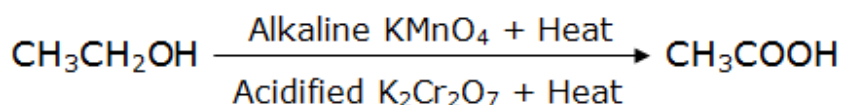
(iv) dehydration of $\text{C}_2\text{H}_5\text{OH}$

(v) reaction of $\text{C}_2\text{H}_5\text{OH}$ with ethanoic acid

Answer: (i) Ethanol upon combustion gives carbon dioxide and water.



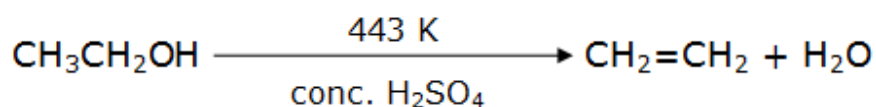
(ii) Ethanol is oxidized to ethanoic acid when treated with oxidizing agents like acidified potassium dichromate



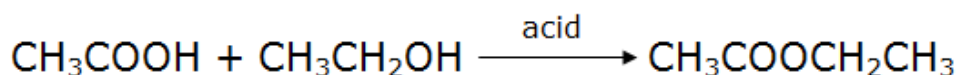
(iii) Ethanol reacts with sodium metal to liberate hydrogen gas.



(iv) Ethanol when dehydrated using conc. H_2SO_4 forms ethene.



(v) Ethanol ($\text{C}_2\text{H}_5\text{OH}$) reacts with ethanoic acid (CH_3COOH) in the presence of acidic medium to produce ethyl ethanoate which is an ester.



Q. 41. An organic compound A with molecular form $\text{C}_4\text{H}_8\text{O}_2$ on alkaline hydrolysis gives two compound B and C. C on acidification with dil. HCl gives D. Oxidation of B with $\text{K}_2\text{Cr}_2\text{O}_7/\text{H}_2\text{SO}_4$ also gives D. Identify A, B, C and D and explain all the reactions involved.

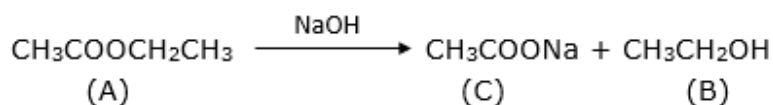
Answer: A – ethyl ethanoate

B – ethanol

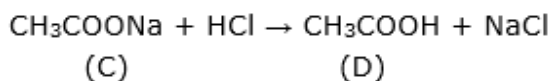
C – sodium ethanoate

D – ethanoic acid

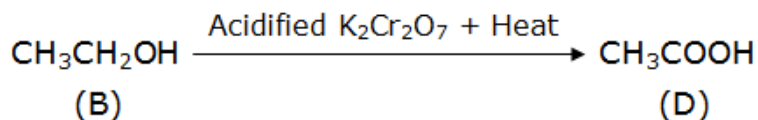
Esters upon alkaline hydrolysis gives back the carboxylic acid and the alcohol. The acid is initially obtained in its salt form. The reaction is called saponification.



The salt (sodium ethanoate) is treated with dil HCl to obtain the carboxylic acid.



Ethanol is oxidized to ethanoic acid in the presence of acidified potassium dichromate. Here, the acid used for acidification is H₂SO₄.



Q. 42. Have you ever observed while cleaning cloth that foam is formed with difficulty and an insoluble substance (scum) remains after washing with water? This is caused by the reaction of soap with the calcium and magnesium salts, which cause the hardness of water. Hence, you need to use a larger amount of soap. This problem is overcome by using another class of compounds called detergents as cleansing agents. Detergents are generally ammonium or sulphonate salts of long chain carboxylic acids. The charged ends of these compounds do not form insoluble precipitates with the calcium and magnesium ions in hard water. Thus, they remain effective in hard water. Detergents are usually used to make shampoos and products for cleaning clothes.

(i) How will you test the hardness of water?

(ii) Why soap forms scum (insoluble substance) with hard water?

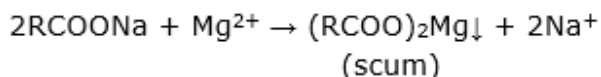
(iii) How one can overcome the problem of scum formation? What values do you identify in this context?

Answer: (i) The hardness of water can be determined using soap.

If the given amount of soap has difficulty in producing foam (lather) and produces an insoluble precipitate (scum) instead, in the water then the water is hard.

If the soap produces foam easily in the water, then the water is soft.

(ii) Hard water contains calcium and magnesium ions. Scum is formed as a result of reaction between calcium or magnesium ions with soap.



(iii) The problem of scum formation can be avoided by using detergents. The charged ends of these compounds do not form insoluble precipitates with calcium or magnesium ions in hard water which makes detergents effective in hard water.

From this, one can learn that soaps are ineffective in hard water (water containing calcium and magnesium ions) as they do not produce foam in hard water. This is rectified by the usage of another class of compounds called detergents. Thus one must not use soaps in hard water, as it will be a waste of time and money. At the same time one must also realize that detergents are non-biodegradable. These compounds cannot be degraded by bacteria and therefore can potentially harm the environment.

Challengers

Q. 1. Consider the following statements related to diamond and graphite.

- I. Both diamond and graphite are used as abrasives.**
- II. Diamond and graphite have different arrangements of carbon atoms.**
- III. The carbon atoms in graphite have a different number of neutrons from those in diamond.**
- IV. The carbon atoms in both graphite and diamond have four single covalent bonds. The incorrect statement(s) is/are**

- A. I and III**
- B. II and IV**
- C. I, III and IV**
- D. All of these**

Answer: Graphite is commonly used as an abrasive, but diamond is not used.

The number of neutrons in carbon atoms present in both graphite and diamond are the same. It only depends upon the nature of the element, and both are allotropes of the same element carbon.

In diamond, each carbon is covalently bonded to 4 other carbon atoms whereas in graphite, each carbon is covalently to 3 other carbon atoms.

Q. 2. What would happen if graphene is heated in sufficient supply of air?

- A. It aggregates to form graphite**
- B. It gets converted into diamond**
- C. Carbon dioxide gas is released**
- D. It becomes a non-conductor**

Answer: Graphene is an allotrope of carbon. Like diamond, and graphite, when subjected to sufficient supply of air, it burns to release carbon dioxide.

Q. 3. C^{4+} does not exist but Pb^{4+} exists although both belong to the same group. This is because

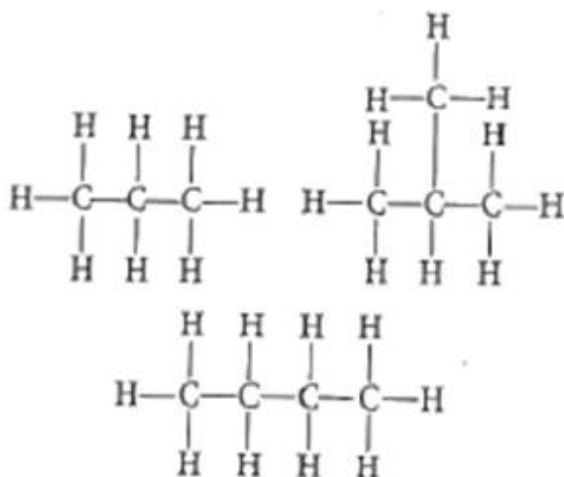
- I. size of carbon is much smaller than Pb.**
- II. large amount of energy is needed in case of carbon.**
- III. of inert pair effect.**
- IV. nucleus cannot hold such a large number of electrons.**

The correct statement(s) is/are

- A. Only I**
- B. I and II**
- C. Only III**
- D. II, III and IV**

Answer: As you go down a group, the size of the atom increases and the ionization enthalpy decreases due to the shielding of outermost electrons by the inner electrons.

Q. 4. The structures of three hydrocarbons are given below

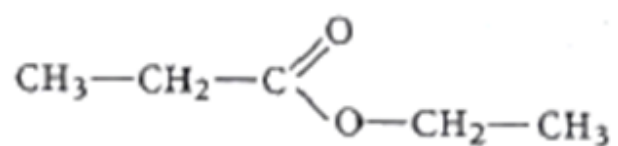


Which statement is correct for all the above three compounds?

- A. They are isomers of each other
- B. They have the same general formula
- C. They have the same physical properties
- D. They react with aqueous bromine

Answer: All the three compounds are alkanes and can be generally represented by C_nH_{2n+2} , where 'n' is the number of carbon atoms.

Q. 5. The diagram shows the molecule, ethyl propanoate.



How many bonding pairs of electrons are there in the molecule?

- A. 13
- B. 16
- C. 17
- D. 20

Answer: Number of C-H bonds = 10 = 10 bond pairs (bp) of electrons

Number of C-C bonds = 3 = 3 bp of electrons

Number of C-O bonds = 2 = 2 bp of electrons

Number of C=O bonds = 1 = 2 bp of electrons

Total number of bp = 10+3+2+2 = 17

Q. 6. Which compound has an addition reaction with - chlorine?

- A. C₂H₄
- B. C₂H₅OH
- C. C₂H₆
- D. CH₃CO₂H

Answer: C₂H₄ is an alkene which is an unsaturated compound. It gives addition reaction.

Q. 7. One mole of a hydrocarbon X reacted completely with one mole of hydrogen gas in the presence of a heated catalyst. What could be the formula of X?

- A. C_2H_6
- B. C_5H_{10}
- C. C_3H_8
- D. C_7H_{16}

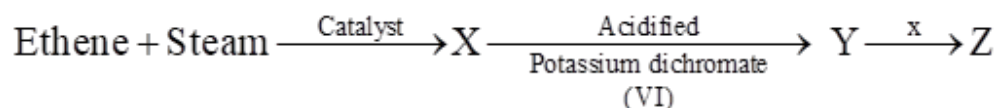
Answer: C_5H_{10} is an alkene which is an unsaturated hydrocarbon. Only unsaturated hydrocarbons react with hydrogen to form saturated hydrocarbons.

Q. 8. Compound X is a six carbon compound. When it is burnt, light is generated. Here, the colour of the flame is yellow because of the presence of carbon particles. Compound X cannot be

- A. C_6H_{12}
- B. C_6H_{14}
- C. C_6H_6
- D. C_6H_{10}

Answer: Only unsaturated carbon compounds produce yellow (and sooty) flame. C_6H_{14} is a saturated compound (hexane) and it will always produce clean blue flame (not yellow) when burnt in sufficient amount of oxygen.

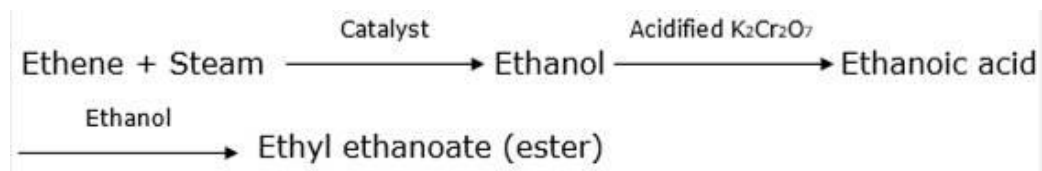
Q. 9. A reaction scheme is shown below:



What is the final product Z?

- A. A carboxylic acid
- B. An alcohol
- C. An alkene
- D. An ester

Answer:



Periodic Classification of Elements

Check Point 01

Q. 1. State Dobereiner's law of triads.

Answer: Dobereiner created some groups having three elements in each group. He called these groups triads. He stated that when the elements in a group are arranged in increasing order of their atomic masses then the atomic mass of the middle element is approximately the average of the atomic masses of two other elements.

Q. 2. What is Newlands' law of octaves? Why is it called so?

Answer: Newland arranged the known elements in increasing order of atomic mass. He found that the every eighth element had properties similar to that of first one. He compared it to the octaves found in music and thus it is called Newland's law of octaves.

Q. 3. On what basis Mendeleev classify the elements?

Answer: Mendeleev classified the elements on the basis of their fundamental property, i.e. atomic mass and chemical properties. He reacted the elements with hydrogen and oxygen and formulae of the hydrides and oxides of the elements were considered as a basic property for their classification.

Q. 4. Why did Mendeleev left some gaps in his periodic table?

Answer: Mendeleev left some gaps in his periodic table because he predicted the existence of some elements which had not been discovered at that time.

Q. 5. Why was the position of hydrogen not fixed in Mendeleev's periodic table?

Answer: Electronic configuration of hydrogen is similar to that of alkali metals. Just like alkali metals, it reacts with halogens, oxygen and sulphur to form compounds of similar formulae. For e.g.: H_2S and Na_2S . On the other hand, hydrogen reacts with metals and non-metals just like halogens. Due to this anomalous behaviour of hydrogen, Mendeleev was unable to fix a position for it.

Check Point 02

Q. 1. How many groups and periods are present in the modern periodic table?

Answer: Vertical columns in the periodic table are called "groups". There are 18 such groups in modern periodic table. Horizontal rows are called "periods". There are 7 such periods in modern periodic table.

Q. 2. What is the main difference between Mendeleev's and modern periodic law?

Answer: The main difference between the Mendeleev's and modern periodic law is that Mendeleev considered the properties of elements as periodic function of their atomic masses while modern periodic law considers the properties of elements as periodic function of their atomic numbers.

Q. 3. Elements of the same group have similar properties. Why?

Answer: Elements present in the same group have a same number of electrons in their valence shells. On moving down a group, the number of shells increases but the number of electrons in the valence shell remains the same. That's why the elements of the same group have similar properties.

Q. 4. In which period and group would you place the elements with the following electronic configurations.

(i) 2,8 (ii) 2,5

Answer:

(i) The electronic configuration is 2,8. It means that the given element contains 2 electrons in K shell and 8 electrons in L shell. Thus the element contains 2 shells. Thus it belongs to the second period. Secondly, there are 8 electrons in the valence shell (completely filled) which is true for the 18th group.

(ii) The electronic configuration is 2,5. It means that the given element contains two shells, thus the period is 2nd. Secondly, there are 5 electrons in the valence shell which is true for the 15th group.

Q. 5. How does the atomic size of the elements vary along a period?

Answer: The atomic size increases on moving down the group. This is because of the increase in a number of shells due to which the distance between the outermost electron and the nucleus increases.

The atomic size decreases on moving along a period. This is because of the increase in the effective nuclear charge on moving from left to right which tends to pull the electrons towards the nucleus.

Q. 6. A metal M forms an oxide having the formula M_2O_3 . It belongs to the third period in the modern periodic table. Write the atomic number and valency of the metal.

Answer: Since the Molecular formula of oxide of a metal (M) is M_2O_3 where valency of oxygen is 2 and the valency of the metal is 3. Since the metal has a valency of 3 and belongs to the third period, so the metal is Aluminium.

Chapter Exercise

Q. 1. Among the following elements F, Cl, Br and I, which does not fit in Dobereiner's triad.

Answer: F does not fit in Dobereiner's triad.

Dobereiner stated that when the elements in a group are arranged in increasing order of their atomic masses then the atomic mass of the middle element is approximately the average of atomic masses of two other elements. Fluorine doesn't fit into this rule while the atomic mass of Br is average of the atomic masses of Cl and I.

Q. 2. What is the basis for the classification of modern periodic table?

Answer: Elements were arranged in the increasing order of their atomic numbers. This leads to the modern periodic law that the properties of elements are the periodic function of their atomic numbers.

Q. 3. Name the two elements whose valencies are equal to their group number.

Answer: For group II elements, the group no. (2) is equal to the valency of the elements present in this group. So two such elements belonging to group II are Calcium and Magnesium.

Q. 4. Which element comes after (right) lithium in the periodic table?

Answer: Lithium is present in the 1st group and the 2nd period. On moving along the period from left to right, the atomic number increases. The atomic number of Li is 3 so the atomic number of next element will be 4. Thus the next element to Li is Beryllium.

Q. 5. Calcium is element with atomic number = 20. Is it more reactive or less reactive than Mg.

Answer: Both Mg and Ca belong to the same group (group II) and are capable of losing electrons which is responsible for their reactivity. Mg lies above Ca in Group II. As we move down a group, the effective nuclear charge on valence shell electrons decreases due to which losing electrons become easier. Thus Ca is more reactive than Mg.

Q. 6. Why does carbon has valency 4 and chlorine 1?

Answer: The electronic configuration of Carbon is: 2,4. We can see that there are 4 electrons in the valence shell of Carbon, thus it has a valency of 4.

The electronic configuration of Chlorine is: 2,8,7. Though there are 7 electrons in valence shell of Cl but instead of losing 7 electrons it tends to gain 1 electron. Thus its valency is 1.

Q. 7. A metal M belongs to 13th group in the modern periodic table. Write the valency of the metal.

Answer: Since the metal M belongs to the Group 13, so its valence shell will have 3 electrons. Thus the valency of the metal M belonging to 13th group is 3.

Q. 8. X is an element with Atomic number = 20. What will be the formula of its chloride?

Answer: The atomic number 20 indicates that the electronic configuration of element is 2,8,8,2. The number of electrons in valence shell is 2. Thus its valency is 2. So the formula of its chloride will be MCl_2 . Moreover we know that calcium has an atomic number=20, therefore the exact molecular formula will be CaCl_2 .

Q. 9. Out of the three elements Ca, Mg, Sr which one will have atom of biggest size?

Answer: Ca, Mg and Sr all three belong to the same group and are present in the order $\text{Mg} < \text{Ca} < \text{Sr}$. The atomic size increases on moving down the group. This is because of the increase in number of shells due to which the distance between the outermost electron and the nucleus increases. Thus Sr will have atoms of biggest size.

Q. 10. Out of Li, C and N, which element form the most basic oxide and which form the most acidic oxide?

Answer: Li, C and N all three belong to the same period. They are present in the order: $\text{Li} < \text{Be} < \text{B} < \text{C} < \text{N}$. On moving along a period from left to right, the metallic character decreases and non-metallic character increases. So Li has the most metallic character and N has the most non-metallic character. Since metal-oxides is basic in nature, therefore oxide of Li will be most basic and non-metal oxide is acidic in nature, therefore Oxide of Nitrogen will be most acidic.

Q. 11 Initially It was believed that atomic mass of beryllium was 13. But Mendeleev suggested that its atomic mass should be 9.

(i) was Mendeleev suggestion correct?

(ii) How had he reached to this Conclusion?

Answer: (i) yes, Mendeleev's suggestion was correct as it was found later on experimentally that beryllium's atomic mass is 9.

(ii) He studied the formula of hydrides and oxides of beryllium and observed that they had similarity with those of magnesium oxides and hydrides. Thus he placed the beryllium above Mg and predicted its atomic mass as 9.

Q. 12. An element X belongs to the second period and group 15 of the periodic table. Find out

(i) the number of valence electrons in its atoms.

(ii) valency of the elements.

Answer: (i) Since the element belong to the 15th group , so it must have 5 valence electrons in its atoms.

(ii) since the element is in 2nd period and belongs to 15th group, so it must be nitrogen. Nitrogen has a valency of 3.

Q. 13. Identify the similarity in the atoms of pairs of elements given below:

(i) Na (atomic number=11) and

K (atomic number=19)

(ii) B (atomic number=5) and

C (atomic number=6)

Answer: (i) Both Na and K belongs to the same group (group I). Both contains same number of electrons in their valence shells i.e. 1

(ii) Both B and C belong to the same period (2nd period). Both contains same number of shells i.e. 2

Q. 14. Write the trend of atomic size along a group and a period in the modern periodic table.

Answer: The atomic size increases on moving down the group. This is because of the increase in number of shells due to which the distance between the outermost electron and the nucleus increases.

The atomic size decreases on moving along a period. This is because of the increase in the effective nuclear charge on moving from left to right which tends to pull the electrons towards the nucleus.

Q. 15. An atom of some element has electronic configuration 2,8,6.

(i) What is the atomic number of this element?

(ii) Name the element that shows chemical similarity with it.

Answer: The electronic configuration tells about the number of electrons present in different shells. Thus total electrons can be found by adding the electrons present in all shells i.e. $2+8+6=16$. The number of electrons and protons are equal. Therefore, atomic number is 16.

(ii) The element with atomic number(Z)=16 is sulphur. The other element which show chemical similarity with sulphur is oxygen.

Q. 16. The order of metallic character of elements A, B, C and D is $D>A>C>B$

(i) What is the order of their electronegative character?

(ii) What is the nature of oxide of B If oxide of A is amphoteric?

Answer:

(i) As the metallic character decreases, the tendency to loose valence electrons also decreases. In other words the tendency to gain electron increases, so their electronegative character increases:

Order: $D<A<C<B$

(ii) Since the element B has least metallic character, so it will have maximum non-metallic character in it. Non-metal oxides are acidic in nature, therefore oxide of B will be acidic in nature.

Q. 17. Write the reason for the following (number in parenthesis is atomic number of the substance)

(i) Lithium (3) and sodium (11) are considered as active metals.

(ii) Fluorine (9) is more reactive than chlorine (17).

Answer: (i) Lithium and sodium contain only single electrons in their valence electrons which they can readily loose to react. Due to their high reactivity with water, they are considered as active metals.

(ii) Fluorine lies above chlorine in the 17th group. This indicates that fluorine has much higher electronegativity than chlorine due to which it tends to gain electron more easily. That's why fluorine is more reactive than chlorine.

Q. 18. The elements of second and third period of the periodic table are given below:

Li	Be	B	C	N	O	F
Na	Mg	Al	Si	P	S	Cl

(i) Which atom is bigger in size Li or Be? Why?

(ii) Which one element out of those given above is the most metallic and why?

Answer: (i) Li is bigger in size than beryllium. This is because the atomic size decreases on moving along a period as the effective nuclear charge increases on moving from left to right which tends to pull the electrons towards the nucleus.

(ii) Na is the most metallic element out of the given elements. This is because on moving along a period from left to right, the metallic character decreases and on moving down a group the metallic character increases. Thus Na is most metallic as it can easily lose its valence electron.

Q. 19 The atomic number of elements A, B, C, D and E are given below.

Element	A	B	C	D	E
Atomic Number	7	10	12	4	19

From the above table, answer the following questions.

(i) Which two elements are chemically similar?

(ii) Which element is an inert gas?

(iii) Which element belongs to 3rd period of periodic table?

(iv) Which element among these is a non-metal?

Answer: (i) C and D are the two elements which are chemically similar. This is because the electronic configuration of C is 2,8,2 and that of D is 2,2, so both the elements contain same number of valence electrons.

(ii) Element B is an inert gas. This can be concluded by writing its electronic configuration as 2,8. Both the shells are completely filled. Thus it is an inert gas.

(iii) The element E belongs to the 3rd period. Its electronic configuration is 2,8,9 from which we can see that there are 3 shells present in it. So it belongs to 3rd period.

(iv) Element A is a non-metal. Its atomic number is 7, so its electronic configuration will be 2,5, we can see that it contains 5 valence electrons so it belongs to 15th group and will lie on the right side of the second period. On moving from left to right in a period, non-metallic character increases. Thus A is a non-metal.

Q. 20. What are valence electrons? Does the number of valence electrons increase or decrease on moving from left to right in a period. How does valency of elements vary in the period?

Answer: • The electrons present in the outermost shell of an element are known as valence electrons.

• The number of valence electrons increases on moving from left to right in a period. This is because on moving from left to right the electrons are added in the same shell.

• The valency of elements first increases in the period and then decreases. For example the trend of valency can be illustrated as follows:

Element	Li	Be	B	C	N	O	F
Valency	1	2	3	4	3	2	1

Q. 21. The atomic number of three elements A, B and C are 11, 14 and 17 respectively.

(i) State the group to which these elements belong in the modern periodic table.

(ii) Write the formula of the compound formed when the elements B reacts with C.

Answer: (i) • The electronic configuration of element A is: 2,8,1. Number of valence electrons=1 So, it belongs to 1st group.

• electronic configuration of element B is:2,8,4. It contains 4 valence electrons, so it belongs to 14th group.

• electronic configuration of element C is: 2,8,7. It contains 7 valence electrons, so it belongs to 17th group.

(ii) The element B is Si and it has a valency of 4. The element C is Chlorine and it has a valency of 1. So the formula of compound when B reacts with C is SiCl₄.

Q. 22. The electronic configuration of an element X is 2, 8, 8, 2. To which (a) period and (b) group of the modern periodic table does X belong? State its valency. Justify your answer in each case.

Answer: (a) From electronic configuration, we can observe that the number of shells is 4. Thus it belongs to the 4th period.

(b) From electronic configuration, we can observe that the number of valence electrons is 2. Thus, it belongs to 2nd group.

Valency also depends on the number of valence electrons. Given element X tends to lose two electrons thus it has a valency of 2.

Q. 23. Arrange the following elements according to the instructions written in parenthesis.

(i) Cu, Mn, Ge, Sc (increasing atomic size)

(ii) Fe, Hs, Ru, Os (increasing number of valence shells)

(iii) Hf, Cs, Ba, Tl (increasing valency)

Answer: (i) Cu, Mn, Ge, Sc all belong to same period. The order in which they appear in the period in left to right direction is: Sc → Mn → Cu → Ge. The atomic size decreases on moving along a period. This is because of the increase in the effective nuclear charge on moving from left to right which tends to pull the electrons towards the nucleus. Therefore, the increasing order of atomic sizes is: Ge < Cu < Mn < Sc.

(ii) Fe, Hs, Ru, Os all belong to the same group. On moving down a group, the number of shells increases. Thus the increasing order for number of shells is Fe < Ru < Os < Hs.

(iii) Number of valence electrons in given elements is as follows:

Hf → 4

Cs → 1

Ba → 2

Tl → 3

So the order for increasing valency is : Cs < Ba < Tl < Hf

Q. 24. Four elements P, Q, R, and S have atomic numbers 12, 13, 14 and 15 respectively. Answer the following questions giving reasons.

(i) What is the valency of Q?

(ii) Classify these elements as metals and non-metals.

(iii) Which of these elements will form the most basic oxide?

Answer: (i) The electronic configuration of Q is :2,8,3. It has three valence electrons, so it has a valency of three.

(ii) We can classify an element as a metal or non-metal by looking at its position in periodic table. Those lying on left side of periodic table are metals and those lying on right side are non-metals.

Element	Electronic configuration	Group no.	Metal/non-metal
P	2,8,2	2 nd	Metal
Q	2,8,3	13 th	Metal
R	2,8,4	14 th	Metalloid(have properties of both metal and non-metal)
S	2,8,5	15 th	Non-metal

(iii) The element P is most metallic because it can easily loose two electrons and lies on the left side of the periodic table. Metal oxides are basic in nature, therefore oxide of P will be most basic.

Q. 25. Name

(i) two elements having valency 2 with respect to oxygen.

(ii) two elements forming oxides of the types XO_3 .

(iii) an element having number of electrons double in its L-shell than that present in its M-shell.

Answer: (i) Two elements that can show a valency of two with respect to oxygen are calcium and barium.

(ii) Two elements that can form oxides of type XO_3 are chromium (Cr) and sulphur (S). Formulae of their oxides are: CrO_3 and SO_3 .

(iii) The innermost shell is k shell, followed by L shell and then comes the M shell. We can write an electronic configuration which can satisfy the given condition as: 2,8,4. We

can see that the number of electrons present in L shell is double of the electrons present in M shell. This is possible for an element with atomic no.=14. Thus the element is Si.

Q. 26. X is an element with atomic number 20.

(i) Is it a metal or a non-metal?

(ii) Among X or Mg, which one is more reactive?

(iii) What is the valency of X?

Answer: (i) The element X has atomic number=20, it means that the element is Ca. It has electronic configuration as: 2,8,8,2. The number of valence electrons is 2 which it can lose easily. Thus element X (Ca) is a metal.

(ii) Mg has atomic number 12 and electronic configuration as: 2, 8, 2. Also, it has a lesser number of shell and thus its valence electrons lie closer to nucleus as compared to X(Ca) which has its valence electrons in 4th shell, so Mg is less reactive than X(Ca). Thus X(Ca) is more reactive than Mg.

(iii) Since X contains 2 electrons in last shell and it can readily lose them so its valency is 2.

Q. 27. X is an element of modern periodic table. It is surrounded by elements having atomic number 17, 34, 36 and 53.

(i) What is the atomic number of X?

(ii) Predict its position in the periodic table.

(iii) Which among these do not belong the same period?

Answer: (i) As we can see it is given that X is surrounded by all other elements given above and there are numbers given 34 and 36. So, X must have atomic number 35. And this can be verified with periodic table where atomic number 35 corresponds to Bromine.

(ii) As atomic no. 36 corresponds to Neon (Ne) having noble gas configuration: 2, 8, 18, 8 which means 18th group element so X (Br) with atomic no. 35 will lie in group just before this that is 17th group. Also, X (Br) has electronic configuration: 2, 8, 18, 7 which means it has 4 shells or n=4 and lies in 4th period. So X (Br) lies in 4th period and 17th group.

(iii) Electronic configuration of elements with given atomic numbers,

Z=17: 2, 8, 7

Z=34: 2, 8, 18, 6

Z=36: 2, 8, 18, 8

Z=53: 2, 8, 18, 18, 7

It can be easily seen that elements with atomic number 34 and 36 lie in same period as have same number of shells $n=4$ and all other elements are from different periods.

Q. 28. The position of five elements in the periodic table are shown below:

	Group 1	Group 2	Group 15	Group 16
Period 1		A		B
Period 3	C		D	E

What are the number of valence electrons in B?

Identify the element(s) which

(i) will have the smallest atomic radius?

(ii) will be the most metallic?

(iii) will form basic oxide?

(iv) will show valency three?

(v) will show greatest tendency to gain electron?

Answer: Since, we know that elements in 16th group have 6 electrons in their outer most shell i.e. the valence electrons are 6. Therefore, we can say that B has 6 valence electrons.

(Note: For this case ignore the period.)

(i) We know that element in lower period have smaller radius as compared other as they have less no. of shells. Also, going along period the size of atom decreases as the effective nuclear charge on outer electrons increases. So, B will have smallest size as it lies in 1st period and 16th group.

(ii) We know that, the metallic character increases going down the group and decreases going right along the period. Thus C will be most metallic of all.

(iii) Since C and A lie in 1st and 2nd group so these can readily lose electron and thus can form basic oxides.

(iv) We know that elements of 15th group need only three electrons to complete their octet configuration and thus show valency 3. So, D will show valency 3.

(v) We know that tendency to gain electron or electron gain enthalpy increases going right along period and decreases going down the group. Thus, B will show highest tendency to gain electrons

Q. 29. A non-metal A which is the largest constituent of air combines with hydrogen on heating in the presence of Fe (as catalyst) and forms a gas

B. When this gas B is treated with H₂SO₄, compound C is formed which is broadly used as chemical fertiliser.

(i) Identify A, B and C.

(ii) Locate the position of A in the modern periodic table.

(iii) Which elements are present before and after the element A?

(iv) Write the electronic configuration of element A.

Answer: (i) The largest non-metal constituent of air is nitrogen (N) and it is present as N₂ gas. It reacts with hydrogen in presence of Fe catalyst to give Ammonia (NH₃). Ammonia reacts with conc. H₂SO₄ to give ammonium sulphate (NH₄)₂SO₄.

Thus A= Nitrogen (N)

B=Ammonia (NH₃)

C= Ammonium sulphate (NH₄)₂SO₄

(ii) Element A is Nitrogen. It lies in the 2nd period and 15th group of the modern periodic table.

(iii) Carbon comes before nitrogen and oxygen comes after nitrogen in the 2nd period.

(iv) The atomic number of nitrogen is 7. So, its electronic configuration is 2,5.

Q. 30. A teacher of Xth class, during teaching explains the importance of the music in our daily life. She was telling to her students that in the Indian system of music, there are seven musical notes in a scale sa, re, ga, ma, pa, da, ni. And in the west notations used are do, re, mi, fa, so, la, ti. The notes in a scale are separated by whole frequency intervals of tones. Every eighth note is similar to

the first one and it is first note of next scale. A musician use these notes for composing music of a song.

Read the above passage carefully and answer the following questions accordingly.

(i) Is the situation discussed above is similar to something in chemistry? Explain.

(ii) What are the limitations of the above principle in case of chemistry?

(iii) What are the values you will infer from above passage?

Answer: (i) The situation discussed above is similar to the “Newlands’s law of octaves”. Newland arranged the known elements in increasing order of atomic mass. He found that the every eighth element had properties similar to that of first one. He compared it to the octaves found in music.

(ii) The limitations of “Newland’s law of octaves” are as follows:

- This law was only applicable till calcium. After calcium, every eighth element didn’t possess properties similar to first one.
- Newland assumed that no more elements would be discovered in future but new elements were discovered later on which couldn’t fit in this law.
- Newland put two dissimilar elements in the same slot.

(iii) The value we can infer from above passage is that music is important in our lives.

Q. 31. Every school has assembly Students stand in rows which should be straight, horizontally as well vertical. Each class stands in a single line, with schools. Each class has a name, e.g. class 1, 2, 3... etc. In general, height of students of class 1st is smallest and 12th is biggest. Everyone sings the prayer at the same time.

Read the above passage carefully and answer the following questions given below.

(i) Do you find similarity between rows of assembly with periodic table? Explain two points.

(ii) How can you compare qualities of students with elements of periodic table?

(iii) What values are inculcated during assembly of school?

Answer: (i) yes, we find the following similarities between rows of periodic table and that of assembly:

- In periodic table rows, elements are arranged in increasing order of atomic numbers just like in assembly rows students are made to stand in increasing order of their classes.

- Just like the height in assembly rows, the atomic size in rows also changes.

(ii) As the students of a same class have the same academic background similarly elements belonging to same group have same chemical properties.

(iii) The values of good morality and self-belief are inculcated during assembly of school.

Challengers

Q. 1. Consider the section of the periodic table:

Group Number	IA	IIA	IIIA	IVA
Period	1	2	13	14
Second	Li		C	
Third	A	Mg	Al	Si
Fourth	K	B		D

Identify A, B, C and D.

	A	B	C	D
(a)	Cs	Be	Ca	C
(b)	Na	Ca	B	Ge
(c)	Na	B	Ca	Ge
(d)	Cs	B	Ca	C

A. (a)

B. (b)

C. (c)

D. (d)

Answer: A=sodium (Na), B=Calcium (Ca), C= Boron (B), D=Germanium(Ge)

Q. 2. The correct order of increasing acidic nature of SO_2 , SiO_2 , P_2O_3 and Al_2O_3 is

A. $\text{Al}_2\text{O}_3 < \text{SiO}_2 < \text{P}_2\text{O}_3 < \text{SO}_2$

B. $\text{SO}_2 < \text{P}_2\text{O}_3 < \text{SiO}_2 < \text{Al}_2\text{O}_3$

C. $\text{Al}_2\text{O}_3 < \text{SiO}_2 < \text{P}_2\text{O}_3 < \text{SO}_2$

D. $\text{SiO}_2 < \text{SO}_2 < \text{Al}_2\text{O}_3 < \text{P}_2\text{O}_3$

Answer: The metallic character follows the order: $\text{Al} > \text{Si} > \text{P} > \text{S}$. The non-metallic character increases towards sulphur and oxides of non-metals are acidic in nature. So the acidic nature increases as: (c) $\text{Al}_2\text{O}_3 < \text{SiO}_2 < \text{P}_2\text{O}_3 < \text{SO}_2$

Q. 3. An element X combines with hydrogen to form a compound XH_3 . The element X is placed on the right side of the periodic table. Which of the following statements is correct for element X?

I. Has two valence electrons.

II. Is a metal and is solid.

III. Is a non-metal and is a gas.

IV. Has five valence electrons.

V. XH_3 reacts with water to form a basic compound.

A. I, II and III

B. II, III and IV

C. III, IV and V

D. V, I and II

Answer: The element X is nitrogen which reacts with hydrogen to form NH_3 . Nitrogen is a non-metal and a gas. It has 5 valence electrons (electronic configuration: 2,5) and reacts with water to form ammonium hydroxide (NH_4OH) which is basic in nature.

Q. 4. Listed below are the locations of certain elements in groups and periods of the periodic table. Arrange these elements in the expected order of increasing non-metallic character:

I. Element in the fourth period and group IV A

II. Element in the third period and group VI A

III. Element in the fourth period and group VI A

IV. Element in the six period and group III A

V. Element in the second period and group VII A

The correct order is:

A. I < II < III < IV < V

B. V < IV < III < II < I

C. IV < I < III < II < V

D. V < IV < II < I < III

Answer: I refers to the element Ge, II refers to the element S, III refers to the element Se, IV refers to the element Tl, V refers to the element F. Non-metallic character follows the order: $Tl < Ge < Se < S < F$

Q. 5. An element X belongs to group 2 and period 3 of the periodic table. The chemical formulae of its nitrate, sulphate and phosphate respectively will be

A. $X(NO_3)_3$, $X_2(SO_4)_3$, $X_2(PO_4)_3$

B. $X_3(NO_3)_2$, $X_2(SO_4)_2$, $X_2(PO_4)_3$

C. XNO_3 , XSO_4 , XPO_4

D. $X(NO_3)_2$, XSO_4 , $X_3(PO_4)_2$

Answer: The element X is magnesium. Its valency is 2 because it loses 2 electrons readily to combine with other reactants. Only d) option has the valency 2 for element X.

Q. 6. An element belongs to group 17. It is present in third period and its atomic number is 17. What is the atomic number of the element belonging to same group and present in fifth period?

A. 25

B. 33

C. 35

D. 53

Answer: The element with atomic number 17 is chlorine. It belongs to 17th group. The element belonging to 5th period of the same group is iodine which has an atomic number of 53.

Q. 7. Consider the following figure:

P	Q	r
Ru	Rh	s
Os	Lr	Pt

Here, p, q, r and s respectively are:

A. Fe, Co, Pd, Ni

B. Pd, Co, Ni, Fe

C. Fe, Co, Ni, Pd

D. Fe, Ni, Co, Pd

Answer: The given table consists of group no. 8, 9 and 10 respectively. So the element p=Iron, q=Cobalt, r=Nickel and s=palladium.

Life Processes (a) Nutrition

Check Point 01

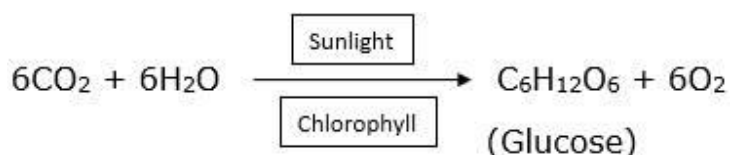
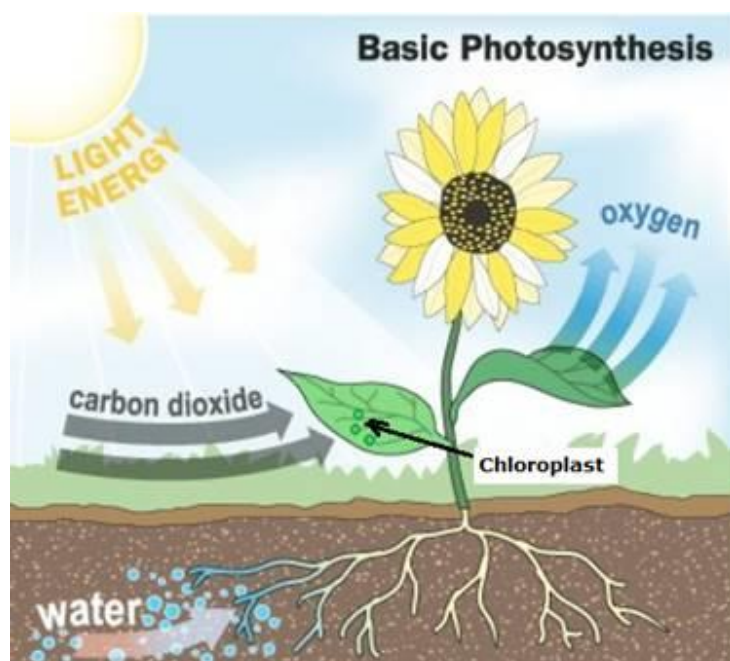
Q. 1. Identify the mode of nutrition where sunlight is used along with CO₂ and water to prepare food.

Answer: In photosynthesis, sunlight is used along with water, CO₂ and chlorophyll to prepare food. The mode of nutrition here is autotrophic. Example of autotrophic organisms is green plants that make their own food and do not depend on any organism for their nutrition.

Q. 2. State the photosynthetic reaction and where does it occur?

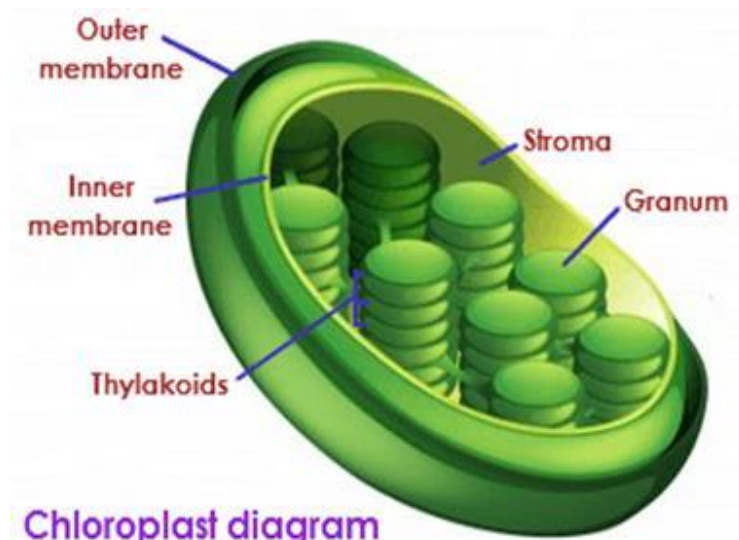
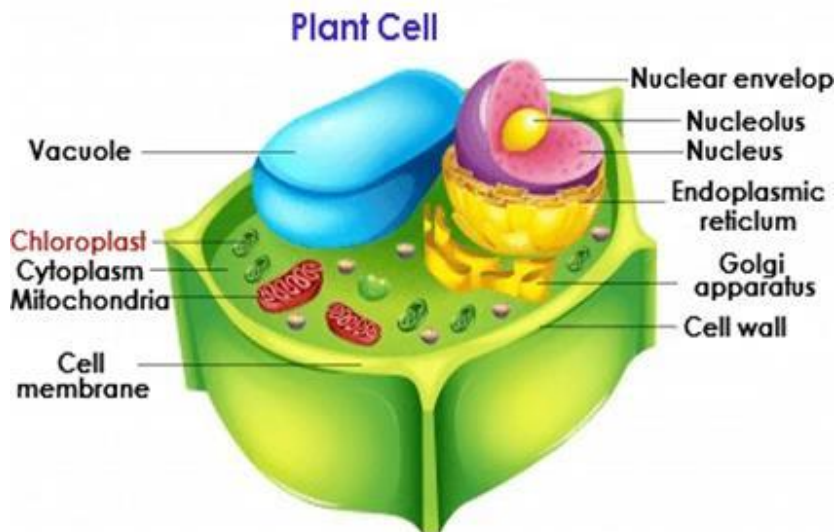
Answer: The process of photosynthesis occurs in green parts of a plant, basically leaves. The presence of chlorophyll (green pigment) is necessary for photosynthesis to occur and chlorophyll is present in leaves as green dots.

The process of the photosynthetic process is depicted here:



Q. 3. Which organelle acts as the site of photosynthesis?

Answer: The chloroplast acts as the site of photosynthesis. It is a cell organelle that is covered by a double membrane and it contains chlorophyll. It is present in green tissues of plants, especially leaves. Chloroplasts absorb sunlight to conduct photosynthesis.



Q. 4. Name the raw materials which are essential to carry out the process of photosynthesis in plants.

Answer: The raw materials needed to carry out photosynthesis are water (absorbed through roots), CO_2 (diffused in from the air through stomata). In addition to these, chlorophyll (green pigment present in chloroplasts) and sunlight are also required. Without these materials, photosynthesis cannot occur.

Check Point 02

Q. 1. What type of nutrition occurs in fungi?

Answer: Fungi are heterotrophic organisms. They depend on other organisms to obtain nutrition. They show the saprobic mode of nutrition or saprotrophic nutrition. They break down the food material outside their body by secreting digestive enzymes and absorb nutrition from it.



Q. 2. How do parasitic organisms derive their nutrition?

Answer: Parasitic organisms like tapeworms, leeches, orchids, etc obtain nutrition from other living organisms (plants or animals) called as host, without killing them. Parasites may live on the outside or inside the body of its host. They cause harm to the body of the host.



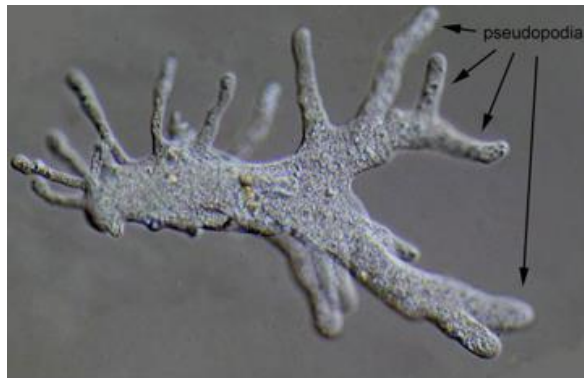
BLOOD SUCKING LEECH

Q. 3. Explain the term ingestion.

Answer: Ingestion refers to the consumption of food, water and other substances through the mouth into the gut. Ingestion is a general term used for taking in any substance into the digestive system.

Q. 4. What are pseudopodia?

Answer: Pseudopodia (singular: pseudopodium) are temporary finger-like elongated protrusions of cell surface of unicellular organisms (Amoeba) used for feeding and locomotion. They are formed by cytoplasmic streaming (streaming movement of cytoplasm). It is also called as false foot.



PSEUDOPODIA OF AMOEBIA

Check Point 03

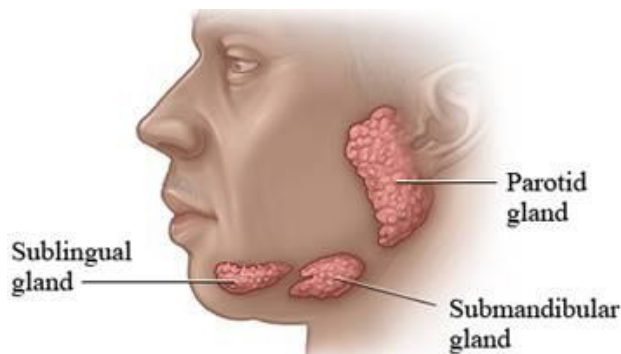
Q. 1. State the location of salivary glands.

Answer: There are 3 major salivary glands.

Parotid gland - largest salivary gland located in front of the ears, one on each side.

Sublingual gland – smallest salivary gland located beneath the tongue.

Submandibular gland – located beneath the floor of the mouth.

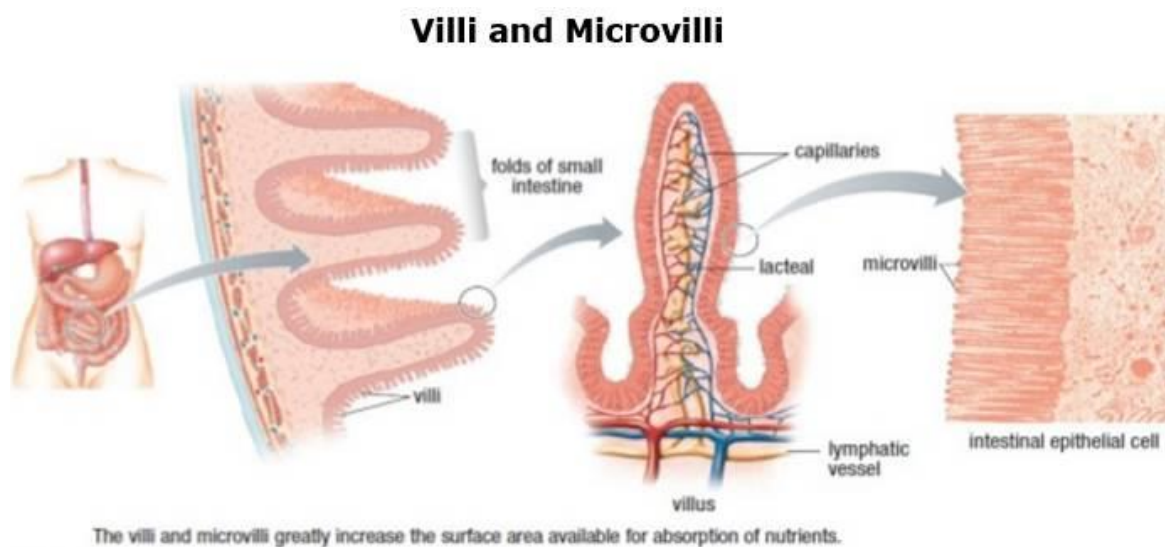


Q. 2. Why carnivores have shorter small intestine?

Answer: Carnivores have shorter small intestine, as compared to herbivores. Carnivores consume only flesh of other animals whereas herbivores consume plant products, which contain cellulose and fibre. Meat is relatively easier to digest and provide more energy. Cellulose and other plant products take longer to be digested. Hence, carnivores possess shorter small intestine.

Q. 3. How do villi increase the surface area?

Answer: Villi are small finger-like projections present in the inner lining of the small intestine. They increase the surface area of small intestine by providing more area for efficient absorption of nutrients. The presence of villi and micro-villi gives a brush border appearance. Villi also possess blood vessels and lacteals (lymphatic vessels).

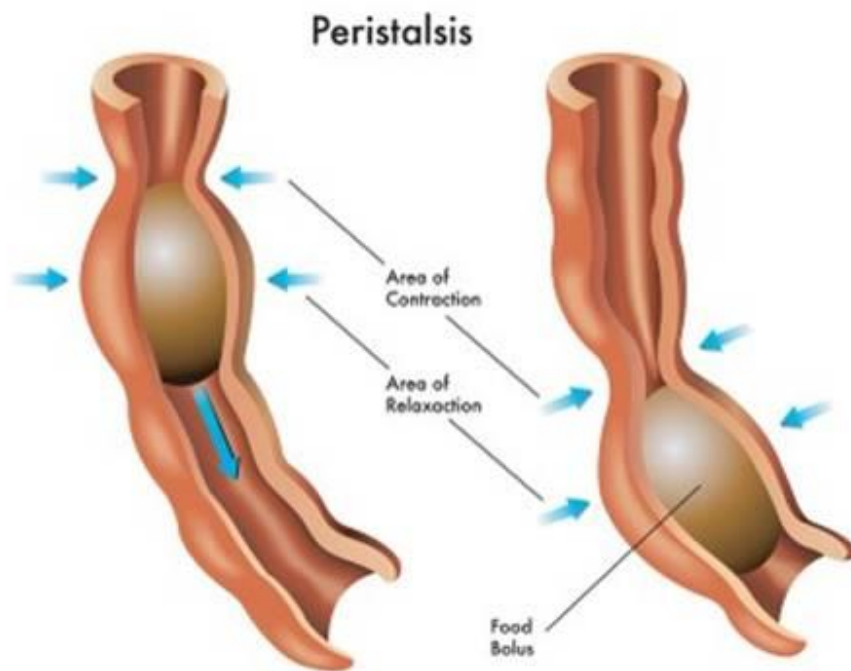


Q. 4. Where is bile juice produced?

Answer: Bile juice (dark green-yellow pigment) is produced by the liver. It helps in the digestion of lipids (fats) in small intestine. It emulsifies (breaks down) larger fat globules into smaller ones so that enzymes can act efficiently on fat globules.

Q. 5. Explain the significance of peristalsis.

Answer: The food that we eat must pass along the digestive system in a regulated manner so that it is processed properly. Peristalsis refers to the involuntary rhythmic wave-like contractions and relaxations of the smooth muscles of alimentary canal. This process is responsible to push the food forward along the gut. It aids in the smooth movement of food through different digestive organs.



Chapter Exercise

Q. 1. Which raw materials are responsible for the release of O_2 , in photosynthesis?

Answer: Water and carbon-dioxide are the two raw materials responsible for the release of oxygen during photosynthesis. Water is absorbed from soil through the roots and CO_2 diffuses from the air into the plant through stomata. These raw materials are then converted into energy-yielding glucose molecules.

Q. 2. What happens to extra glucose or carbohydrate in an animal body?

Answer: In an animal body, extra glucose or carbohydrate is stored in the liver as well as in skeletal muscles in the form of **glycogen**. Glucose is converted to glycogen (starch-like carbohydrate) in liver. When the body is in need of energy, glycogen is converted back into glucose.

Q. 3. Name an energy rich carbohydrate stored in large quantities in liver and muscle cells.

Answer: Glycogen is an energy rich carbohydrate that is stored in large quantities in the liver and skeletal muscles of the body. It is a branched-chain polymer of glucose. It serves as a reserve source of energy.

Q. 4. What is mainly digested by stomach of man?

Answer: The digestion of proteins occurs in the stomach. It is facilitated by digestive enzymes (pepsin, hydrochloric acid). HCl provides acidic medium while pepsin acts on proteins and breaks them into smaller peptides.

Q. 5. How does most CO₂, reach the photosynthesising cells of a green leaf?

Answer: Most CO₂ reach the photosynthesising cells of green leaves through diffusion. Stomata (tiny pores) present on leaf surface and stem facilitates gaseous exchange between the plant cells and the surrounding. CO₂ move into the cells through these small pores.

Q. 6. Name two molecules produced by the digestion of starch and fat respectively.

Answer: The digestion of starch (complex carbohydrate) produces glucose and maltose (simple sugars).

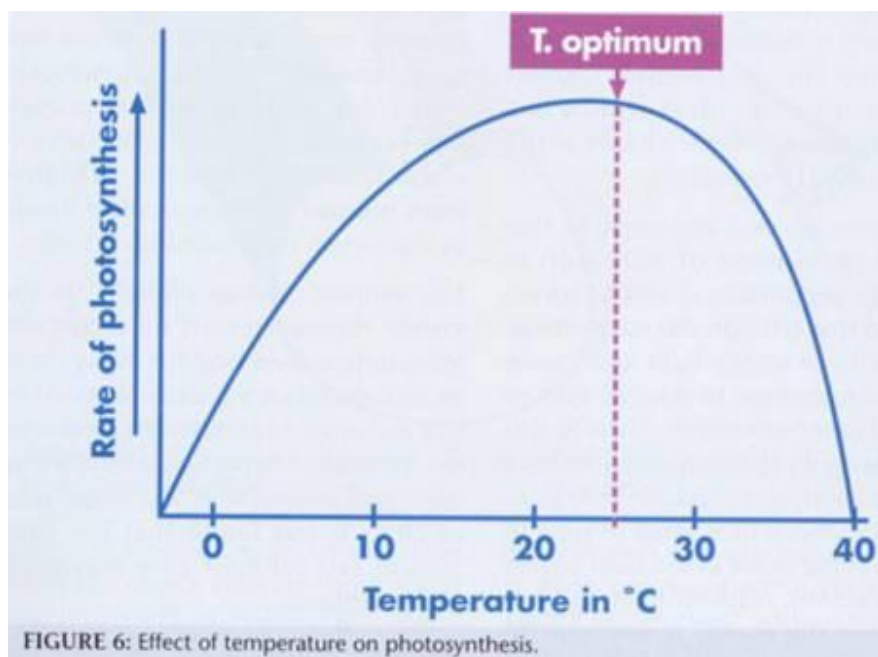
Fats are broken down to produce molecules of glycerol and fatty acids.

Q. 7. What will happen if the liver of a person gets damaged?

Answer: If the liver of a person get damaged, fat digestion would be affected. As a result, liver will not produce bile efficiently and the emulsification of fats will stop.

Q. 8. Draw a graph which shows the effects of temperature on the rate of photosynthesis.

Answer: The rate of photosynthesis increases with the increase in temperature, only upto a certain limit. For every 10° rise, the rate is almost doubled. The plants show maximum photosynthesis at optimum temperature. It is between 20-30° C. Further increase in temperature leads to decrease in the rate of photosynthesis as the enzymes get denatured at high temperature and do not work efficiently.

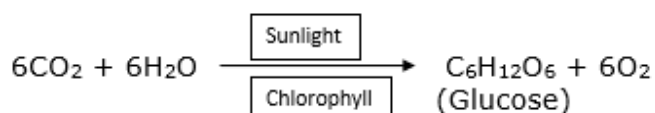


Q. 9. Stomata of desert plants remain closed during the day. Explain how and when they take up CO₂ to perform photosynthesis?

Answer: Desert plants close their stomata during the day to prevent transpiration and loss of water. To perform photosynthesis, CO₂ is necessary. They take up CO₂ during the night through stomata and store it in their photosynthesising cells in the form of an intermediate until the day. And when sunlight is available, they perform photosynthesis to make their food. This is called as **CAM** (Crassulacean acid metabolism) photosynthesis.

**Q. 10. (i) Write the reaction that represents the chemical changes which take place during photosynthesis.
(ii) State the function of chlorophyll.**

Answer: (i) This reaction represents the process of photosynthesis.



During photosynthesis, 1 molecule of glucose (carbohydrate) and 6 molecules of oxygen are produced using the raw materials water (6 molecules) and carbon dioxide (6 molecules) in the presence of chlorophyll and light energy. Here, reduction of CO₂ occurs.

(ii) The presence of chlorophyll is necessary for photosynthesis to occur. Its most important function is to absorb energy from incoming light and transfer this absorbed energy to the reaction centres (part of photo-system)

Q. 11. Which feature(s) help the plants to make food by the process of photosynthesis?

Answer: The leaves containing the green pigment chlorophyll (present in chloroplast) helps the plant to perform photosynthesis by trapping light energy. The plant absorbs CO₂ through stomata and reduces it to glucose. The presence of chloroplasts and stomata helps the plants to make food.

Q. 12.A. Give the steps involved in photosynthesis.

Answer: The process of photosynthesis involves a few events that may not occur immediately after one another. There might be a time lag between them.

- The chlorophyll present in chloroplasts absorbs energy from sunlight.
- This light energy is then converted into chemical energy which is used for making food.
- The water molecules split to give hydrogen and oxygen.
- Finally, CO₂ absorbed is reduced to form glucose (carbohydrate).

Q. 12.B. Write the difference between nutrition in plants and animals.

Answer: Plants and animals have a completely different mode of nutrition. Plants are autotrophic organisms that are capable of making their own food by performing photosynthesis using 2 raw materials (water + CO₂).

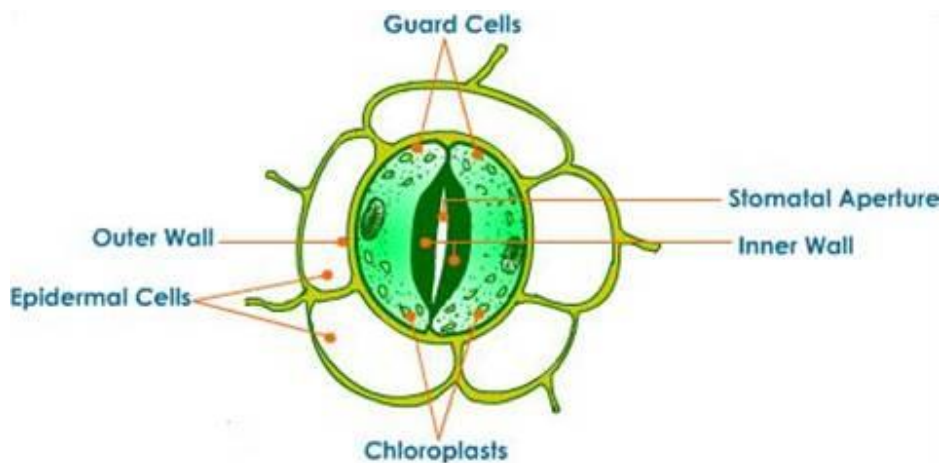
They need light energy to make their own food. Plants do not depend on any organism to obtain nutrition. On the other hand, animals are heterotrophic organisms that depend on other organisms (plants and other animals) to fulfill their nutrition requirements. They cannot make their own food.

Q. 13.A. Draw a labelled diagram of stomata. List two functions of stomata.

Answer: Stomata are tiny pores present on the surface of leaves and stems of plants. It performs the following function:

- It facilitates the exchange of gases between plant and its surroundings. It is through stomata that plant release oxygen and take up carbon dioxide.
- It helps the plant to get rid of excess water through transpiration. The stomata also close down to prevent loss of water. Thus, it regulates the water content in plant cells.

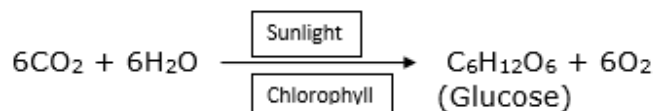
The figure for stomata is given below:



Q. 13.B. What are the raw materials required for photosynthesis to occur? Write the chemical equation of the process.

Answer: The raw materials needed to carry out photosynthesis are water (absorbed through roots), CO₂(diffused in from the air through stomata).

In addition to these, chlorophyll (green pigment present in chloroplasts) and sunlight are also required to make food. Without these materials, photosynthesis cannot occur. The reaction involved is given below.



Q. 14. Explain the digestion of chapati in human beings. Draw a diagram depicting human alimentary canal.

Answer: i. Chapati is a complex carbohydrate. The digestion of carbohydrates begins in the mouth.

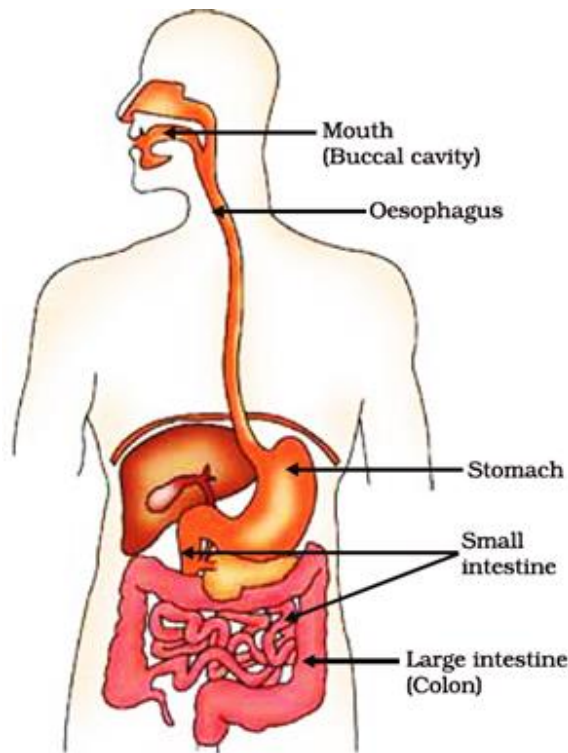
ii. The starch present is acted upon by salivary amylase (secreted by salivary glands) and is broken down to simpler sugars (e.g. maltose).

iii. It is then passed along the gut by peristaltic movements. It then reaches the stomach and gets mixed up with the gastric juices. But no digestion of carbohydrates occurs in stomach.

iv. The food is then passed into the small intestine, where major digestion of carbohydrates takes place.

v. The intestine receives enzymes from pancreas and liver. The pancreatic amylase further breaks down the sugars into glucose to be absorbed easily. Thus, the digestion of chapati is completed.

vi. The diagram is given below:



ALIMENTARY CANAL OF HUMAN

Q. 15. The general requirement for energy and materials is common to all living organisms. Living beings need plants and trees in order to survive, as most of their needs are met by them.

Read the passage and answer the questions.

- (i) Do plants also depend on some source for food production? Explain.**
- (ii) How do we derive nutrition for survival? How does this nutrition vary among different organisms?**
- (iii) What do we learn concerning the increased cutting of trees and removal of the green cover?**

Answer: (i) Yes, plants depend on solar energy to produce food. They require energy from sunlight to perform photosynthesis. If sunlight is not available, they will not be able to make their own food.

(ii) We (humans) are heterotrophic organisms. We obtain nutrition from plant and animal resources. We use plant products as food. All organisms require nutrition, but they use different strategies. Some organisms consume food by breaking down it into smaller parts. Unicellular organisms like Amoeba use pseudopodia to gather food.

(iii) Removal of green cover (deforestation) leads to serious problems. It has a negative impact on our environment and our lives. As we are directly dependent on plants and trees for our food, our survival will be at risk. Deforestation leads to climatic changes. It is a major cause for global warming. Moreover, animals are also badly affected. Their habitats are destroyed.

Q. 16. Reading about the digestive glands and their action, a student got confused about some facts. Given below are some questions, concerning the facts.

(i) Why cannot we digest raw green plants in our alimentary canal?

(ii) Why are digestive enzymes present in an inactive form in the body when we can require their action any time?

(iii) HCL is an acid which kills bacteria ingested with food, but does not harm the walls of stomach. Why?

(iv) What values do you think the student conveys from his questions?

Answer: **(i)** Raw green plants contain fibre and cellulose. Our digestive system does not secrete any enzyme capable of digesting cellulose. Cellulose is digested by enzyme cellulase present in ruminating animals like cow. Also, our oesophagus serves only as a pathway to transport food from mouth to stomach. It does not possess any digestive gland. Hence, no secretion of enzymes occurs.

(ii) Although we may require enzyme action any time, they must be produced in an inactive form. Enzymes are capable of digesting a variety of bio molecules (proteins, fats, etc). If produced in active form, they may act upon the body cells and tissues and digest them leading to degeneration of body tissues.

(iii) Although HCl provides a highly acidic medium in our stomach, but it does not harm the walls of the stomach. The mucus-secreting cells (goblet cells) present in the inner lining of stomach secrete mucus and lines the wall of stomach with a mucus layer. Thus, prevents it from the action of HCl.

(iv) The student has a thirst for knowledge. He is curious to know about the human body and what happens to the food that we eat.

Challengers

Q. 1. In photosynthesis, which substances are used up, which are produced and which are necessary, but remain unchanged after the reaction?

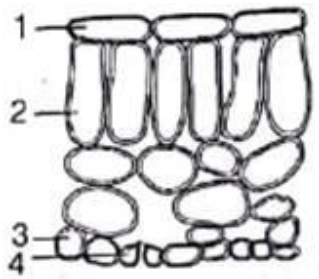
Used up	Produced	Remain
(a) Carbon dioxide	Water	Oxygen
(b) Chlorophyll	Carbon dioxide	Water
(c) Oxygen	Starch	Cellulose
(d) Water	Oxygen	Chlorophyll

- A. (a)
- B. (b)
- C. (c)
- D. (d)

Answer: In photosynthesis, water and carbon dioxide are used as raw materials to produce glucose and release out oxygen. This process occurs in the presence of green pigment chlorophyll present in leaves of the plant, which remains unchanged after the reaction.

Q. 2. The diagram shows the arrangement of cells inside the leaf of a green plant. (No cell contents are shown).

Which cells normally contain chloroplasts?



- A. 1 and 2
- B. 1 and 4
- C. 2 and 3
- D. 2 and 4

Answer: Chloroplasts are usually present in mesophyll cells of leaves placed near the upper epidermis. Guard cells surrounding the stomata also possess chloroplasts.

Q. 3. Choose the forms in which most plants absorb nitrogen:

- I. Proteins
- II. Nitrates and nitrites

III. Urea

IV. Atmospheric nitrogen

Choose the correct option.

A. I and II

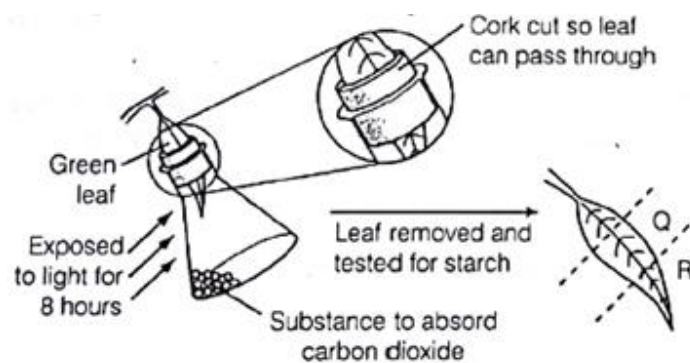
B. II and III

C. III and IV

D. I and IV

Answer: Most plants absorb nitrogen in the form of nitrates, nitrites and urea. They cannot use up atmospheric nitrogen as it is un-reactive. This nitrogen needs to be converted into absorbable forms by certain nitrogen-fixing bacteria so that they can be taken up by plants.

Q. 4. A plant is kept in the dark for two days. A leaf is used in an experiment to investigate the effect of two factors on photosynthesis as shown in the diagram.



What are the colours of Q and R, when the leaf is tested for starch, using iodine solution?

Q	R
(a) Blue/black	Brown
(b) Brown	Brown
(c) Blue/black	Blue/black
(d) Brown	Blue/black

A. (a)

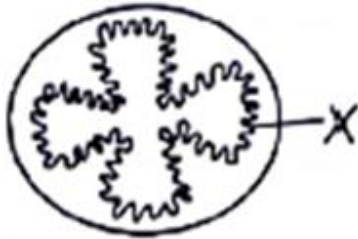
B. (b)

C. (c)

D. (d)

Answer: For photosynthesis to occur, both sunlight and CO₂ are required. The plant forms glucose (later on converted to starch) through photosynthesis. The part Q of leaf was covered and not exposed to light and part R was kept in absence of CO₂. Thus, both parts of leaf did not form starch and gave a negative test for starch. (**Note** - iodine solution gives a positive test for starch and turns blue-black in colour)

Q. 5. The diagram represents a section through the small intestine.



What is the role of the structure labelled X?

- A. They help to move the food along
- B. They make a large surface area for absorption
- C. They protect against bacteria
- D. They move mucus over the surface

Answer: The presence of villi and microvilli in the inner lining of small intestine increases the surface area for absorption. They allow more area for the enzymes to work efficiently.

Q. 6. When a person eats some egg white, proteins and water enter the stomach. Which substances are found leaving the stomach and leaving the small intestine?

Leaving the Stomach	Leaving the Small Intestine
(a) Amino acids and water	Amino acids and water
(b) Fatty acids, glycerol and water	Fatty acids, glycerol and water
(c) Protein and water	Fatty acids and glycerol
(d) Protein, amino acids and water	Water

- A. (a)
- B. (b)
- C. (c)
- D. (d)

Answer: Egg white contains only protein, and no fat. The digestion of proteins occurs in stomach and proteins are converted into amino acids. So amino acids will be found

leaving the stomach. The absorption of amino acids occurs in small intestine. So, only water will be found leaving the small intestine.

Q. 7. In which order do these events occur in human nutrition?

- A. Digestion → ingestion → absorption → assimilation
- B. Digestion → ingestion → assimilation → absorption
- C. Ingestion → digestion → absorption → assimilation
- D. Ingestion → digestion → assimilation → absorption

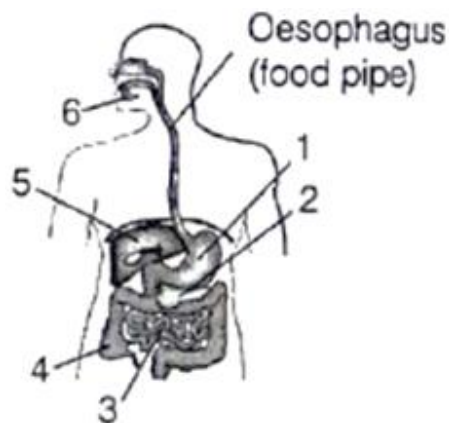
Answer: •Ingestion – consumption/taking in of food

•Digestion – breaking up of food particles into small fragments

•Absorption – absorption of broken down food particles into the blood

•Assimilation – soluble food molecules move to different organs to provide energy through blood

Q. 8. The diagram shows the human gut. Which numbered structures secrete digestive enzymes?



- A. 1, 2, 3 and 4
- B. 1, 2, 3 and 6
- C. 2, 3, 4 and 5
- D. 2, 3, 5 and 6

Answer: Digestive enzymes are secreted by salivary glands (salivary amylase), stomach (pepsin), pancreas (amylase, lipase) and small intestine (trypsin). Liver produces bile juice and it only emulsifies (breaks down) fats and does not digest them.

Q. 9. Only two of the following statements accurately describe what happens in the mouth.

1. Amylase breaks down large starch molecules into smaller maltose molecules.
2. Chewing increases the surface area of food for digestion
3. Saliva emulsifies fats into smaller droplets.
4. Teeth breakup large insoluble molecules into smaller soluble molecules.

Which statements are correct?

- A. 1 and 2
- B. 2 and 3
- C. 3 and 4
- D. 1 and 4

Answer: Chewing increases the surface area of food. Large food particles are broken down into small fragments. Salivary amylase secreted by salivary glands acts on carbohydrates (starch) present in food and converts it into maltose. Saliva does not act on fats.

Life Processes (b) Respiration

Check Point 01

Q. 1. What are respiratory substrates? Give one example.

Answer: Respiration is the process in which complex food particles breaks down into simpler ones through the process of oxidation to release enormous energy.

Substances which undergo respiration to release energy are known as respiratory substrates.

Example : Some respiratory substrates are glucose, proteins etc

Q. 2. Where does aerobic respiration occur? How many molecules of ATP are released during it?

Answer: Respiration on the basis of presence or absence of oxygen can be of two types: aerobic respiration and anaerobic respiration. Aerobic respiration occurs in the presence of oxygen while anaerobic occurs in the absence of oxygen.

Site of aerobic respiration is mitochondria.

During aerobic respiration 38 ATPs get released in complete oxidation of one glucose molecule.

Q. 3. The end product of a process is ethanol and carbon dioxide with the release of energy. Name this process and write the pathway involved in the reaction.

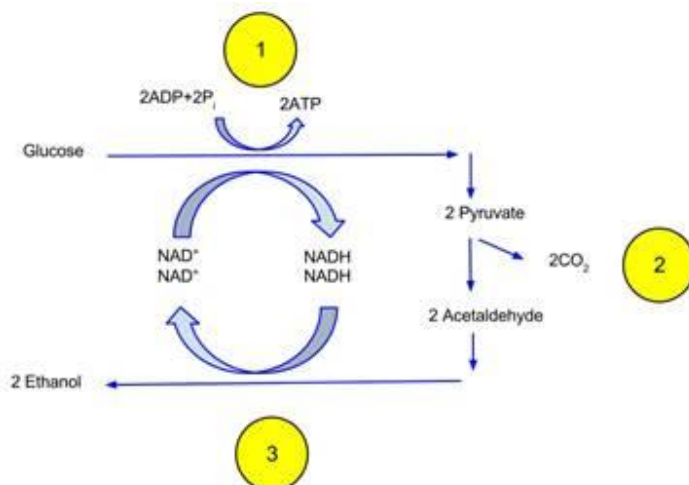
Answer: During aerobic respiration, the product is CO_2 & H_2O . While during anaerobic respiration, the product can be either lactic acid or ethanol+ CO_2 on the basis of enzyme involved.

If the product is ethanol & CO_2 , the process is termed as Fermentation.

Initially glucose gets converted into pyruvic acid (by the process of glycolysis-common in both aerobic & anaerobic respiration). In fermentation, this pyruvic acid produces ethanol & carbon-dioxide in the presence of enzyme alcohol dehydrogenase. This fermentation process is also used for industrial production of alcohol.

Q. 4. State the function of ATP.

Answer: ATP is an acronym of Adenosine Tri Phosphate. It is formed by the addition of 3 phosphate groups to adenosine (adenine+ pentose sugar). It is a highly energetic compound and thus is used to save energy in the chemical form. Thus it is called the energy currency of the cell.



Q. 5. Where does anaerobic respiration occur in human body?

Answer: Usually human body performs only aerobic respiration. But in certain conditions (like heavy exercises), when body needs enormous amount of energy but oxygen supply is not enough, our body gets bounded to perform anaerobic respiration. It occurs in our muscle cells where due to anaerobic respiration, lactic acid gets produced.

You might have experienced pain in arms or legs after doing some heavy physical exercise or work. It is because of accumulation of lactic acid in muscle cells.

Check Point 02

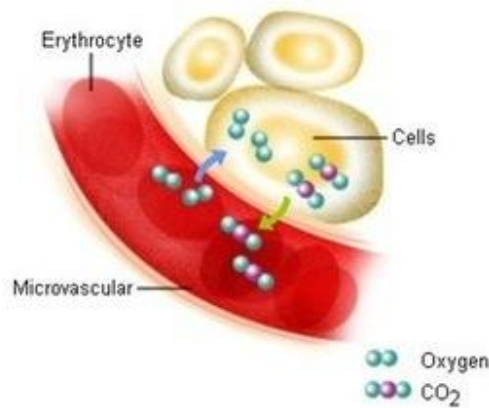
Q. 1. What is the difference between external and internal respiration.

Answer: External respiration is an alternate term used for breathing. It includes inhalation of O_2 & exhalation of CO_2 . While internal respiration occurs inside the body between blood and tissues where there is transfer of oxygen from blood to each and every tissue of body to fulfil its demand.

External



Internal



Q. 2. List the factors on which diffusion in the plants depends.

Answer: Diffusion is a phenomenon explaining movement of substances from its higher concentration to its lower concentration. In plants, diffusion of gases occurs. Factors affecting diffusion are:-

(i) Concentration gradient:- More steeper the concentration gradient, greater will be the diffusion.

(ii) Temperature:- Diffusion rate increase with increase in the temperature because speed of ions increases.

(iii) Size of molecules:- Molecules with smaller size can diffuse easily as compared to molecules with larger size.

Q. 3. What happens with CO_2 and O_2 in plants during daytime?

Answer: During day time, both respiration and photosynthesis occurs in plant. Both respiration & photosynthesis are opposite processes. In respiration, there is an intake of O_2 and release of CO_2 , while in photosynthesis CO_2 is taken inside and O_2 is released. But the rate of photosynthesis is much higher than the rate of respiration. Due to this reason, release of O_2 is also much higher than release of CO_2 .

Q. 4. What are lenticels?

Answer: Lenticels are pores present on the woody bark of a tree stem. Usually a stem is covered with a tough layer of suberin. The places where suberin is absent, some pores are develop. These pores are called as Lenticels. They help in the exchange of gases.

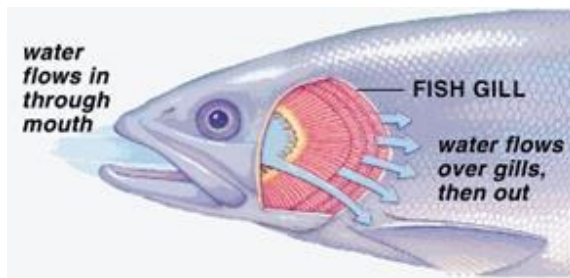
Check Point 03

Q. 1. Respiratory surface of animals must always be moist. Why?

Answer: The respiratory surface of animals must always be moist for better diffusion of gases. Both oxygen and carbon-dioxide gets dissolved in water quickly and their diffusion becomes easier & quicker. This is the reason for moist respiratory surfaces.

Q. 2. Why does the rate of breathing in aquatic animals is faster than others?

Answer: In aquatic animals, the respiration process involves the usage of oxygen dissolved in water. As the amount of oxygen dissolved in water is much less than the amount of O₂ available on land, aquatic animals have higher breathing rate.



Q. 3. What is the essential feature of respiratory organ of different terrestrial animals?

Answer: The essential feature of respiratory organs of terrestrial animals is that they must be protected under layers of tissue so as to avoid any shock or damage. They must also be supplied with a large number of blood vessels for easy and fast exchange of gases.

Q. 4. The surface across which breathing in animals occurs is very fine and delicate. How do the organisms protect their body by such surfaces?

Answer: In almost all the organisms the breathing surface is very fine and delicate for easy and fast exchange of gases. Since they are very delicate they must be protected from external environmental conditions. So for protection these structures are covered well in a layer of tissues. Like in human beings the exchange of gases take place

through alveoli which are present in the lungs which are further protected from environment by ribs and diaphragm.

Q. 5. In which organisms the cell membrane acts as the respiratory surface?

Answer: The organism in which the cell membrane acts as a respiratory surface is Amoeba. In amoeba, the unicellular animal, the exchange of gases takes place through the cell membrane or the plasma membrane. The cell membrane of amoeba absorbs oxygen from the surrounding area and release carbon dioxide by the process of diffusion.

Check Point 04

Q. 1. In human beings, where does the gaseous exchange take place?

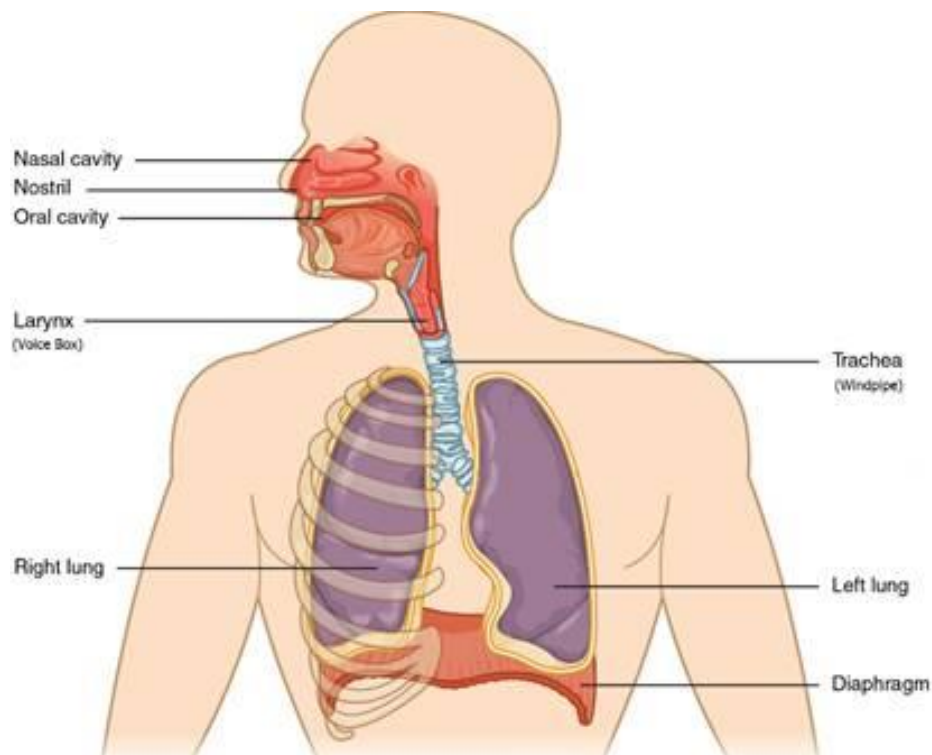
Answer: In humans, lungs are the major respiratory organ. Internally, lungs are divided into numerous sac like structures called as alveoli. These alveoli (sing. alveolus) are thin walled and are the major site for exchange of gases. They take up carbon dioxide from the deoxygenated blood and fill it with oxygen.

Q. 2. (i) How does the air necessary for breathing enter the body of a human being?

(ii) What other function is performed by this part of our respiratory system?

Answer: (i) Oxygen enters the body in the mouth and nose, passes through the larynx and the trachea.

As shown in the diagram given below:



(ii) Nose - The nose is the primary organ of smell and also functions as part of the body's respiratory system.

Mouth – Mostly the breathing is done through nose i.e. nasal cavity. But, it can be done through oral cavity as well.

Q. 3. Why do we need a respiratory pigment to perform respiration?

Answer: Respiratory pigments play a very important role in the body of an organism. It helps in the transportation of respiratory gases to the various body organs.

Respiratory pigment present in humans is haemoglobin. It is a red color pigment present in our blood. It helps in transporting oxygen from lungs to various body tissues and also helps in the removal of carbon-dioxide from cells.

Q. 4. Name the respiratory pigment present in human beings. Which major air pollutant has high affinity for this pigment?

Answer: Haemoglobin is the respiratory pigment present in the human beings. It helps in the transportation of respiratory gases; mainly O_2 & some amount of CO_2 also.

Carbon monoxide (CO) has a great affinity with haemoglobin. Increase in amount of CO in body can even cause the death of organism due to suffocation (insufficient blood supply).

Q. 5. (i) Name the substance which is oxidised in body during respiration.

(ii) Why lungs are divided into very small sac-like structures?

Answer: (i) The substances which gets oxidised during respiration are known as **respiratory substrates**. Examples of some respiratory substrates are glucose, proteins, fatty acids etc.

(ii) Lungs are divided into small sac like structures called alveoli. These alveoli increase the surface area of lungs **for better gaseous exchange**.

Chapter Exercise

Q. 1. What is common between respiration and transpiration process in plants?

Answer: Both in respiration and transpiration stomata are active. The only difference is that in respiration stomata helps in exchange of gases, while in transpiration, it helps in evaporation of water.

Q. 2. Write the events that occur during the process of breathing in humans.

Answer: Breathing in humans is divided into 2 steps

(i) **Inhalation**:- diaphragm contracts and move downwards, rib cage moves outward with the help of intercostal muscles. Thus the size of thoracic cavity increases, its pressure gets reduced and air rushes in.

(ii) **Exhalation**:- diaphragm gets relaxed and move outwards, rib cage moves inward with the help of intercostal muscles. Thus the size of thoracic cavity decreases, its pressure gets increased and air rushes out.

Q. 3. What will happen if a human being starts taking air with mouth instead of nose?

Answer: When we inspire, the air moves through our nasal passage where the presence of nasal hairs and mucus **prevents the entry of harmful** substances into the body with this air. Moreover, they also **reduce the temperature** of air.

If we start taking air from the mouth instead of nose, all these harmful substances will enter into our body and may cause disease.

Q. 4. Write any two differences between the different ways of oxidation of glucose in organisms.

Answer: The difference between the different ways of oxidation of glucose in organism are as follows:

Aerobic respiration	Anaerobic respiration
Occurs in the presence of oxygen	Occurs in the absence of oxygen
A large amount of energy is released	Very less amount of energy is released
Product are CO ₂ & H ₂ O	Product can be lactic acid or ethanol & CO ₂ .

Q. 5. Fermentation process in yeast is useful in food industry. Support this statement with examples.

Answer: **Fermentation** is a name given to anaerobic respiration in which the product is ethanol and CO₂.

Fermentation in **yeast** is very helpful for food industry as it helps in the formation of **alcohol & bread**. A fungi named *Saccharomyces cerevisiae* also called as bakers' yeast & brewers' yeast is extensively used commercially for the production of alcohol and bread.

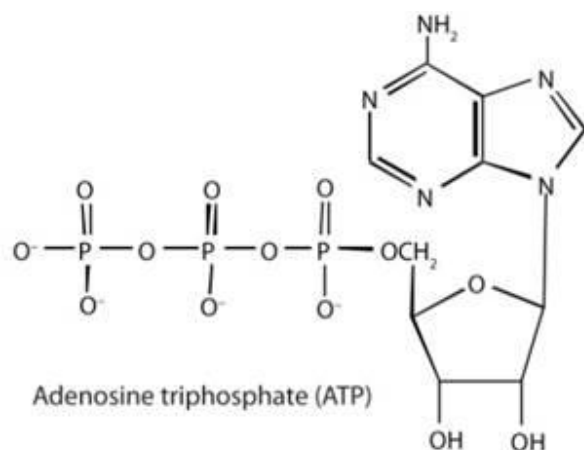
Q. 6. Compare between the process of respiration in plants during night and day time.

Answer: **Respiration** occurs at the same rate in both day & night. But the difference is because of photosynthesis. During day time both respiration & photosynthesis occurs in plant. Both **respiration & photosynthesis are opposite processes**. In respiration, there is an intake of O₂ and release of CO₂, while in photosynthesis CO₂ is taken inside and O₂ is released. But the rate of photosynthesis is much higher than the rate of respiration. Due to this reason, release of O₂ is also much higher than release of CO₂. Since there is no net release of CO₂, it seems that no respiration occurs in plant.

Q. 7. ATP produced in respiration is stored in mitochondria. How is it produced?

Answer: ATP - **Adenosine Tri Phosphate**. It is called the **energy currency of cell** because it helps in the storage of energy in chemical form.

ATP is released by a process called as **Oxidative Phosphorylation** which occurs in mitochondria during respiration. When oxidation of food occurs, it releases energy in the form of ATP.



Q. 8. 'Aerobic respiration produces more ATP than anaerobic respiration'. Justify this statement.

Answer: Aerobic respiration is that type of respiration in which respiration occurs in the presence of oxygen while anaerobic respiration occurs in the absence of oxygen. Aerobic respiration is more fruitful than anaerobic respiration. It is so because in aerobic respiration much more ATPs are released than anaerobic respiration.

Number of ATPs released in aerobic respiration = 38 molecules of ATP

Number of ATPs released in anaerobic respiration = 2 molecules of ATP

So a huge difference in ATP release in aerobic & anaerobic respiration can be observed.

Q. 9. Tabulate adaptations of terrestrial respiration in human being.

Answer: Different respiratory adaptations of human beings are as follows:

- The respiratory surface, which helps in exchange of gases must be very thin for easy and fast exchange of gases.
- The respiratory surface must be richly supplied with blood vessels for exchange of gases.
- The thin and delicate respiratory structures must be well protected under layers of tissues so as to protect them from the external environment.

Q. 10. Each and every respiration organ is structurally specialised in its function. Justify with examples.

Answer: Each and every respiration organ is designed by the nature in a specialised way. This all is done in order to maximise its functional capability.

For e.g. - **Nostrils have mucous lining** and hair so that it can prevent entry of harmful bacteria in the body.

Trachea gets divided into **bronchi & bronchioles** to supply air to each & every part of lungs.

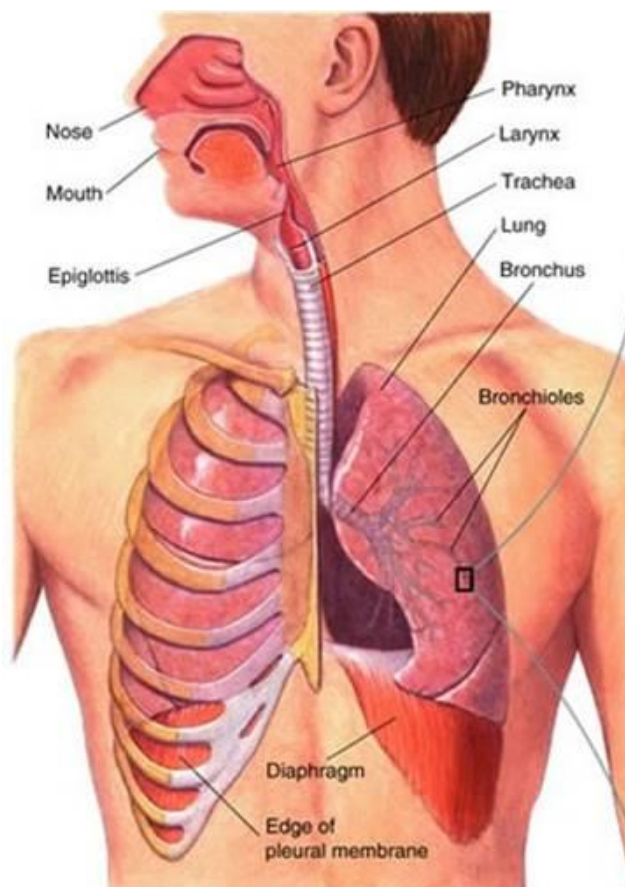
Lungs have numerous sac like structure called as **alveoli** which increases the surface area of lungs so that better **exchange of gases** can take place.

Alveoli are very thin walled in order to promote better and easier diffusion of gases.

Q. 11. Write the pathway of oxygen travelling from atmosphere into the human body.

Answer: Oxygen enters the body through **nostrils**, then it passes through the **nasal passage** and come in the **pharynx**. Now the oxygen travels into **trachea via larynx**. Trachea gets divided into left and right **bronchi** which further gets divided into **bronchioles**. Bronchioles get terminated into **alveolar sacs**.

Nostrils → nasal passage → pharynx → larynx → trachea → bronchi → bronchioles → alveoli



Q. 12. Diffusion pressure cannot deliver oxygen all over the body in bigger animals'. Comment on this statement.

Answer: Diffusion is a process of movement of substances from its higher concentration to its lower concentration. The pressure which is responsible for creating the diffusion ability of a molecule is called as diffusion pressure.

This diffusion pressure plays a major role in exchange of gases in plants and in smaller animals but fails in bigger animals. It is so because in bigger animals not every body part faces the external environment. That is why they cannot take part in the diffusion process. Due to this reason, diffusion pressure is unable to deliver O₂ to all over the body of bigger animals.

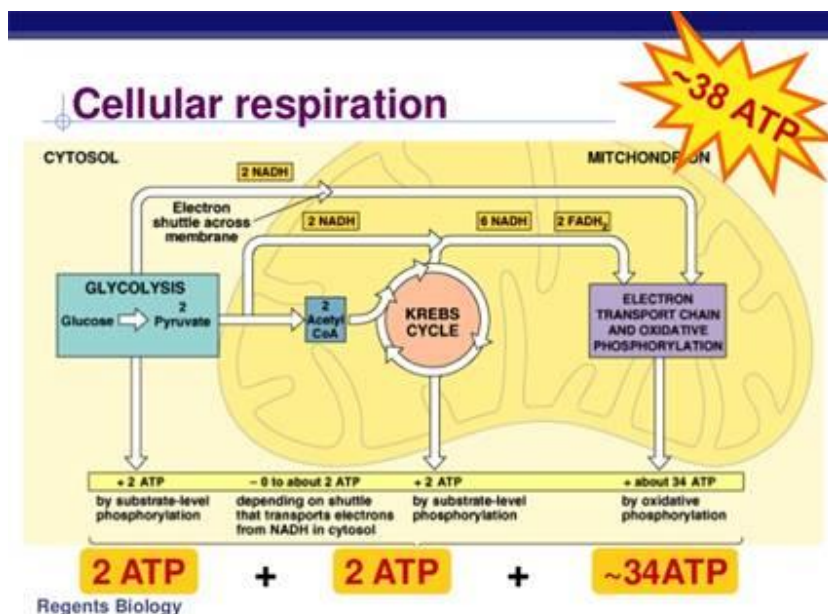
Q. 13. Distinguish between aquatic and terrestrial respiration.

Answer: The difference between aquatic and terrestrial respiration is as follows:

Aquatic respiration	Terrestrial respiration
Occurs in organisms living in water	Occurs in land organisms
Involve oxygen which is dissolved in water	Does not involved dissolved oxygen
Main respiratory organ is gills	Main respiratory organ is generally lungs
Gills are tough and spiny	Lungs are moist, slippery and soft
Breathing rate is comparatively higher	Breathing rate is comparatively lower

Q. 14. With a schematic diagram, explain the overall process of respiration in animals.

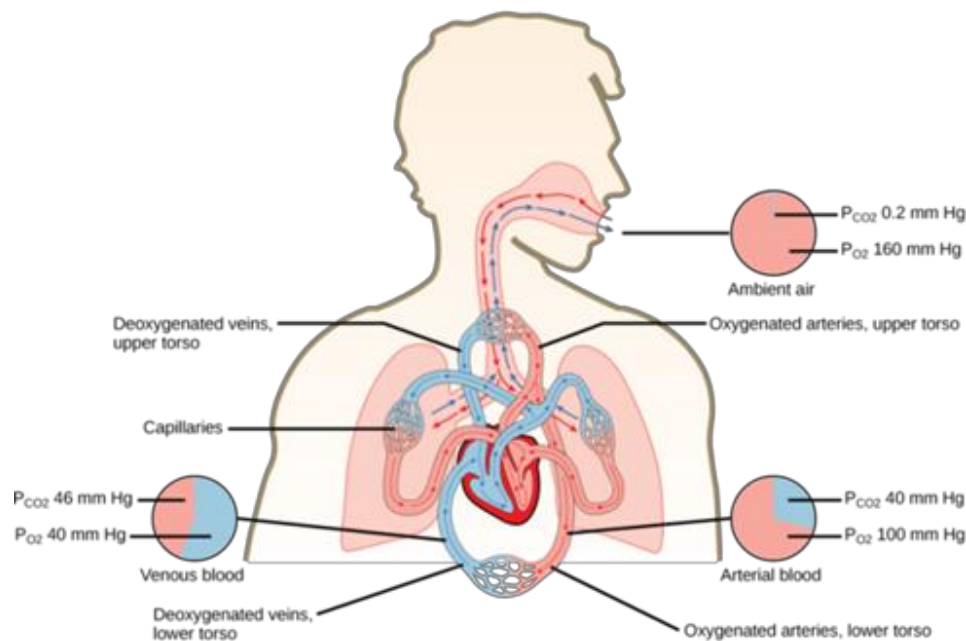
Answer: Respiration is a cellular process which occurs in each and every cell of body. It starts with glycolysis- a reaction in which breakdown of glucose occurs. Glucose gets converted into pyruvic acid. The process of glycolysis takes place in cytoplasm. Now this pyruvic acid enters into mitochondria via link reaction in which it gets converted into acetyl-CoA. Now this acetyl-CoA enters in the mitochondria where it performs kreb's cycle in mitochondria matrix. All the ATP and NADH₂ and FADH₂ produced till now performs ETS cycle (Electron transport chain) which is located in the mitochondrial membranes. Finally it undergoes oxidative phosphorylation and ATPs are released.



GLYCOLYSIS(in cytoplasm) → LINK REACTION(in cytoplasm) → KREB CYCLE(mitochondrial matrix) → ELECTRON TRANSPORT SYSTEM(mitochondrial membrane) → OXIDATIVE PHOSPHORYLATION(mitochondrial membrane)

Q. 15. Breathing cycle is an essential process for the exchange of gases'. Justify this statement.

Answer: Breathing involves intake of oxygen and release out of CO₂ from the body. If this process does not occur in the body, there will be no exchange of gases. Imagine a situation when we stop breathing, that is there will be no intake of oxygen and no release out of CO₂. In that situation, oxygen supply will be stopped in our body and there will be continuous accumulation of CO₂ inside the body. This can be fatal and the person may die because of suffocation. That is why it is said that breathing cycle is an essential process for the exchange of gases.



Q. 16. If a person holds his breath after expiration for about 25 sec, would there be occurrence of any exchange of respiratory gases in the lungs during this period? Explain.

Answer: If a person holds his breath for 25 seconds after expiration, even then exchange of respiratory gases would occur in lungs. It is so because, even after we exhale, some amount of air remains in the lungs. This volume of air is called as residual volume which has a quantity of about 1200ml. So even if a person hasn't inhale the air for 25 seconds, then also this residual volume will continue gaseous exchange in lungs for some time. But if this period last some more longer, then this can be lethal.

Q. 17. Raman kept a plant in his room. Adequate light was provided and the plant was extensively watered. Instead of flourishing the plant died. Raman asked his teacher for an explanation for the same.

Read the passage and answer the following questions.

(i) Even though the plant was watered, it soon died. Give reason.

(ii) How do plants respire? Name the organelle responsible for gaseous exchange in

(a) Herbaceous plants

(b) Woody plants

(iii) What values does Raman have in your opinion?

Answer: (i) The plant died because of excessive watering. Excessive watering causes water logging in the plant which blocks the proper supply of gases into it. That is the reason for plant's death.

(ii) Plants respire through the gaseous exchange occurring in stomata via diffusion process.

(a) In herbivorous plants, gaseous exchange occurs via stomata.

(b) In woody plants, gaseous exchange occurs via stomata and lenticels.

(iii) Raman has a good heart as he tried to grow a plant in his room and decided to take its care. But he is little careless and his carelessness has killed the plant. So he should little be more careful.

Q. 18. After being taught about respiration in living organisms, aditi got confused as to how organisms like earthworm respire. As these organisms lack any special organs for respiration and breathing.

(i) How does earthworm respire when no specialised system is present in them?

(ii) Mention the major function of respiratory pigment.

(iii) What values do you observe in Aditi?

Answer: (i) Earthworms do not have any specialised organ for respiration. Instead they respire through their moist skin.



(ii) Respiratory pigments play a very important role in the body of an organism. It helps in the transportation of respiratory gases to the various body organs.

(iii) Aditi is a keen observer. She applied her academic knowledge which she has gained from her books into practical life which is very good.

Challengers

Q. 1. Which process occurring in human body does not involve energy from respiration?

- A. contraction of heart muscle
- B. Diffusion of oxygen from the alveoli into the blood
- C. Digestion of bread
- D. Maintaining a constant body temperature

Answer: Contraction of heart, digestion and homeostasis (maintaining a constant body temperature) requires a lot amount of energy while diffusion is a passive process which occurs according to the concentration gradient. Thus it do not require energy expenditure.

Q. 2. Assertion (A) In the day time, CO₂ generated during respiration is used up for photosynthesis.

Reason (R) There is no CO₂ release during day.

- A. Both A and R are true and R is the correct explanation of A.
- B. Both A and R are true, but R is not the correct explanation of A
- C. A is true, but R is false
- D. A is false, but R is false

Answer: In respiration, O₂ is taken in and CO₂ is released while in photosynthesis, CO₂ is used up and O₂ is released. Both photosynthesis and respiration occurs in plant during daytime. But the rate of photosynthesis is much more than rate of respiration. Thus there is no net release of CO₂.

Q. 3. Which substances are produced by anaerobic respiration in yeast?

	<i>Carbon dioxide</i>	<i>Alcohol</i>	<i>Lactic Acid</i>	<i>Water</i>
(a)	✓	✓	×	×
(b)	✓	×	✓	×
(c)	×	✓	×	✓
(d)	×	×	✓	✓

- A. (a)
- B. (b)
- C. (c)
- D. (d)

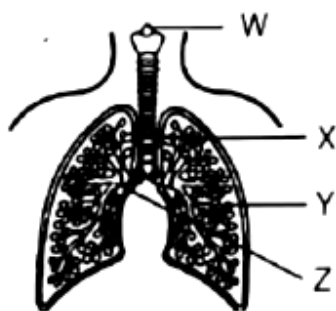
Answer: In anaerobic respiration, the product can be either lactic acid or ethanol + CO₂ on the basis of enzyme involved. Yeast contains the enzyme alcohol dehydrogenase which helps in the formation of alcohol. Due to this reason, fermentation will occur in yeast which will result in the formation of alcohol and CO₂.

Q. 4. The following changes take place in an athlete's body during a 100m race. Which change occurs first?

- A.** Increased availability of oxygen to muscles.
- B.** Increased breathing rate.
- C.** Increased carbon dioxide concentration in the blood
- D.** Increased production of carbon dioxide by muscles

Answer: Running is a heavy energy requiring process. Thus while running a 100m race, there will be a great need of energy to muscles. Thus they will start performing respiration at much higher rate. Due to this reason, there will be increased release of CO₂ by muscles.

Q. 5. The diagram shows part of the human gas exchange system.



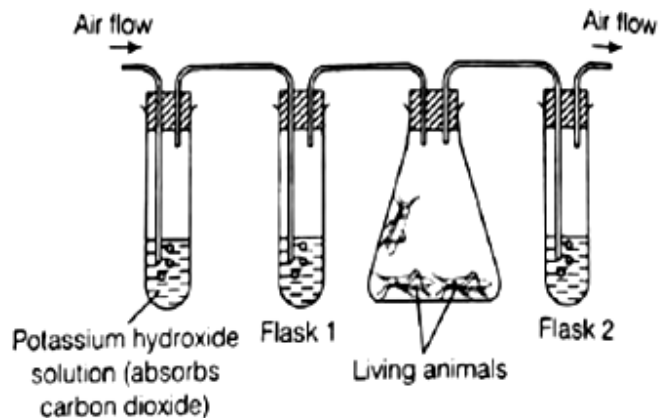
What are W, X, Y and Z?

	<i>Bronchus</i>	<i>Bronchiole</i>	<i>Larynx</i>	<i>Trachea</i>
(a)	W	X	Z	Y
(b)	X	Z	Y	W
(c)	Y	W	X	Z
(d)	Z	Y	W	X

- A.** (a)
- B.** (b)
- C.** (c)
- D.** (d)

Answer: Larynx (voice box) is present at the opening of trachea. Then the air goes into trachea-passage for air to lungs. Near the entry of trachea into lungs, it gets divided into bronchi (sing. bronchus) which further gets divided into bronchioles.

Q. 6. An experiment is set up as shown. Flasks 1 and 2 contain lime water. Air is pumped through the flasks.



What is the appearance of lime water flasks 1 and 2 after a period of ten minutes?

Flask 1	Flask 2
(a) Clear	Clear
(b) Clear	White/Cloudy
(c) White/Cloudy	Clear
(d) White/Cloudy	White/Cloudy

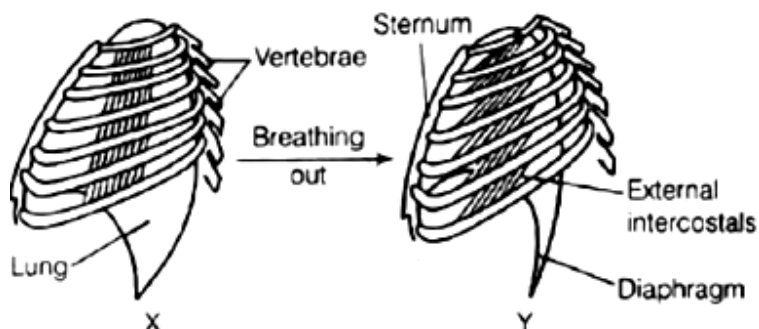
- A. (a)
- B. (b)
- C. (c)
- D. (d)

Answer: Lime water turns milky in the presence of CO_2 .

In flask-1, the air containing CO_2 enters into the flask, but due to the presence of KOH all the CO_2 gets absorbed by it. So, there will be no change in the lime water.

While flask 2 is connected with a flask containing live animals which means that these animals will respire and will release CO_2 . This CO_2 will turn the lime water present in flask-2 milky.

Q. 7. The diagram shows the ribs and some of the muscles used in breathing.



Which muscles relax in moving from position x to position y?

	Diaphragm	External Intercostals
(a)	No	No
(b)	No	Yes
(c)	Yes	No
(d)	Yes	Yes

- A. (a)
- B. (b)
- C. (c)
- D. (d)

Answer: While moving from position-x to position-y, the lungs are exhaling out the air. When lungs exhale out the air, both diaphragm & external intercostal muscles relax.

Q. 8. Which is the correct sequence of air passage during inhalation?

- A. Nostrils → Larynx → Pharynx → Trachea → Lungs
- B. Nasal Passage → Trachea → Pharynx → Larynx → Alveoli
- C. Larynx → Nostril → Pharynx → Lungs
- D. Nostrils → Pharynx → Larynx → Trachea → Alveoli

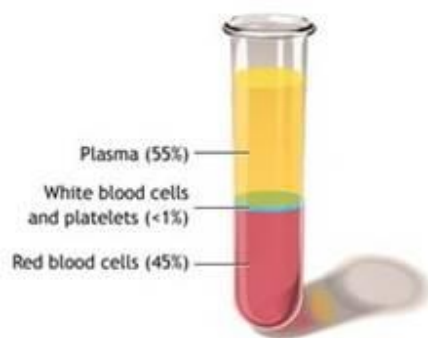
Answer: Air enters in our body through nostrils (external most portion of nose). From there it goes into pharynx (passage of air) and then into larynx (voice box). Then air comes into trachea and from here it reaches alveoli of lungs via bronchi and bronchioles.

Life Processes (c) Transportation

Check Point 01

Q. 1. Give one function of plasma.

Answer: Plasma is a straw colored liquid which comprises of almost 55% of the blood. It is a very important as it allows the medium to blood corpuscles to move freely in the body. Plasma constitutes water which is about 90-92% and nearly 6-8% proteins like fibrinogen, globulins and albumins and remaining some ions like Na^+ , Cl^- etc.

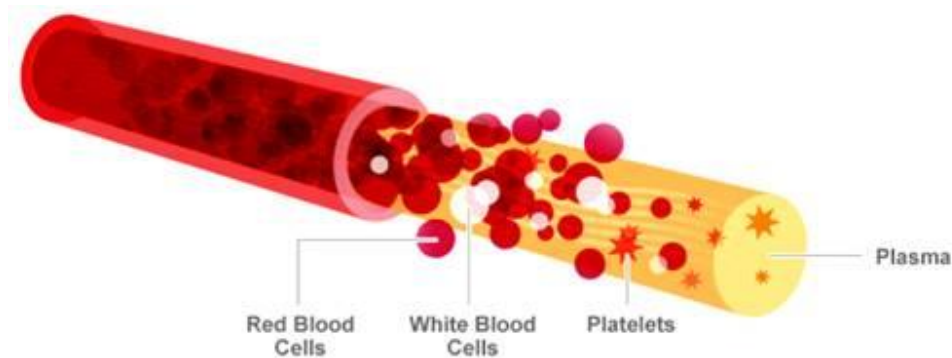


Q. 2. What are the main components of blood?

Answer: Blood is a very important connective tissue and has two main components which are:

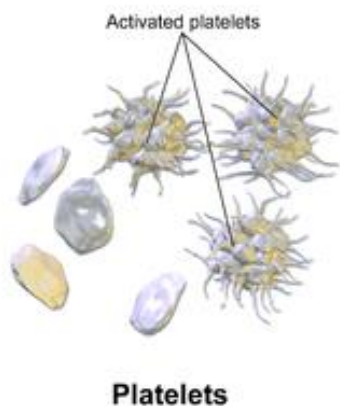
i) **Plasma**: It is the fluid part which is about 55% of the total blood. It is a straw colored liquid, viscous in nature. Plasma comprises of about 90-92% of water and 6-8% proteins.

ii) **Formed elements**: Blood cells/ corpuscles all the formed elements constitutes about 45% of the total blood. It include the red blood cells (erythrocytes), white blood cells (leucocytes) and the platelets (thrombocytes). Out of these platelets are not the proper cells but the cell fragments which play a major role in the process of blood clotting.



Q. 3. Name the type of cells that helps in blood clotting.

Answer: Platelets are the cells which help in coagulation clotting of blood. Platelets are also known as thrombocytes and instead of being proper cells they are the cell fragments which are produced by megakaryocytes. They are 1.5 lakh to 3.5 lakh per cubic millimeter of blood.



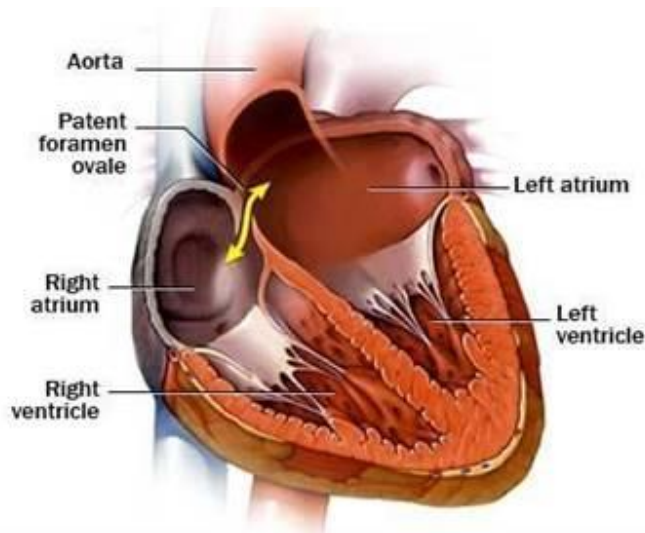
Q. 4. Platelets stop the blood at injury site by clotting it. How?

Answer: Blood platelets or thrombocytes are the cell fragments produced by megakaryocytes. During any injury, platelets release a substance called thromboplastin. This thromboplastin helps in the formation of a complex enzyme thrombokinase which converts prothrombin into active thrombin. This thrombin converts soluble fibrinogen into insoluble fibrin. This fibrin forms a network at the site of injury which traps the blood & form clot.

Check Point 02

Q. 1. Suggest a suitable reason for the heart having four separate chambers.

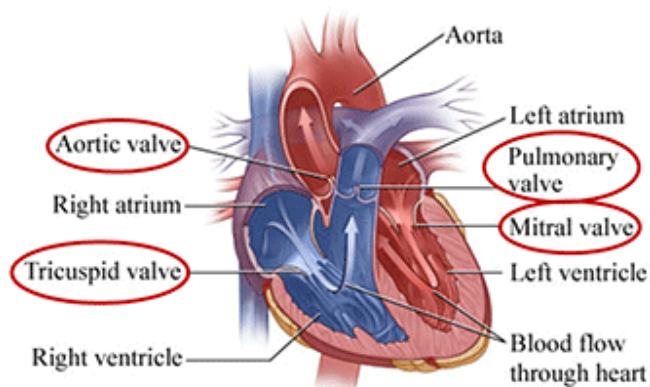
Answer: Human heart has four chambers that is two auricles and two ventricles. Auricles are the small chambers whereas ventricles are the bigger ones. Our heart has four chambers so as to prevent the mixing of oxygenated and deoxygenated blood. This increases the working efficiency of organism.



Q. 2. Valves are present in between the auricles and ventricles of the heart. Give one reason.

Answer: Human heart has various types of valves present in between the different chambers. Bicuspid valve is present between the left atrium and ventricle whereas tricuspid valve is present in between the right auricle and the right ventricle.

Semilunar valve is present between right ventricle & pulmonary artery and left ventricle & aorta. The important role of these valves is to prevent the backflow of blood from the ventricles to the auricles.



Q. 3. Name an animal having two-chambered heart.

Answer: Fishes have two chambered heart. The heart includes one auricle and one ventricle. But two chambered heart is less efficient because in two chambered heart mixing of oxygenated and deoxygenated blood occurs. That is why two chambered & three chambered heart evolved into four chambered heart in humans as it prevents mixing of oxygenated and deoxygenated blood.

Q. 4. Name the instrument used to measure blood pressure.

Answer: Sphygmomanometer is a device to monitor blood pressure in humans. It has a cuff which is tied on the arm of the patient and then the blood pressure is monitored by observing the rise and fall in the mercury level.



Q. 5. What is the color of lymphatic vessels?

Answer: Lymph is a colorless liquid which is released out of the tissues. It is so because lymph contains only WBCs and not RBCs. Since the WBCs are colorless, lymph is also colorless. It has the same mineral composition as that of the plasma.

Check Point 03

Q. 1. Why do we need a proper transportation system in plants?

Answer: We need a proper transportation system in almost all the organisms whether be it plant or animals. Roots take up water which is required by the whole plant body. In the same way food is produced by the leaves which is to be distributed to the whole plant, therefore, a proper transportation system is needed to fulfill all the requirements of the plant.

Q. 2. Name the conducting structures present in plants.

Answer: Xylem and phloem are the conducting structures which are present in plants. Xylem is responsible for transportation of water and minerals whereas phloem is responsible for translocation of food.

Q. 3. What is the significance of transpiration in plants?

Answer: The process of movement of water in the plants through xylem and its evaporation through leaves or stem is known as transpiration. It is done through stomata during the daytime. It is important as it creates a pull which is known as transpirational pull in the xylem which is responsible for uptake of water. It also produces a cooling effect on plants and maintains the temperature of plant. Moreover it also prevents water logging in the plant.



Q. 4. Define translocation.

Answer: Movement of carbohydrates (sugars) produced by the leaves of the plant in the whole plant body through phloem is known as translocation. It is an important process as other parts of the plant which do not synthesize food also get access to food produced by leaves.

Q. 5. Name the cells involved in translocation.

Answer: Translocation is the process of movement of carbohydrates (which act as food) produced by the leaves which is to be distributed to different parts of the plant. The process of translocation takes place in the phloem cells. Thus the cells involved would be companion cells, sieve elements & parenchymatous tissue.

Chapter Exercise

Q. 1. What stops blood from flowing backwards through the heart?

Answer: The valves present between the auricles and ventricles and between the ventricles and pulmonary artery and aorta prevent backflow of blood. Bicuspid or mitral

valve is present in between left auricle and left ventricle. Tricuspid valve is present in between right auricle and right ventricle. Semilunar valves are present in between right ventricles & left ventricle and pulmonary artery & aorta respectively.

Q. 2. The blood leaving the tissues becomes richer in a component. Name it.

Answer: The blood leaving the tissues becomes very rich in the carbon dioxide content. When the oxygenated blood reaches the tissues, it gives oxygen to the tissues and take up the carbon dioxide emitted from them and takes it back to the heart.

Q. 3. When the right atrium contracts, blood flow from it to which part of the heart?

Answer: The contraction of the right atrium results in to flow of blood from right atrium to the right ventricle. The flow of blood is guarded by the tricuspid valve which prevent the backflow of blood into the right atrium.

Q. 4. What is the systolic and diastolic pressure of a normal man?

Answer: When the muscles of heart contract it leads to systole and the relaxation of heart muscles after systole is known as diastole. The systolic and diastolic pressure of a normal man is 120/80 mmHg. In this, 120 mmHg represents the systolic pressure whereas 80 mmHg represents the diastolic pressure.

Q. 5. Give any four major roles played by RBCs.

Answer: Four major roles played by RBC are-

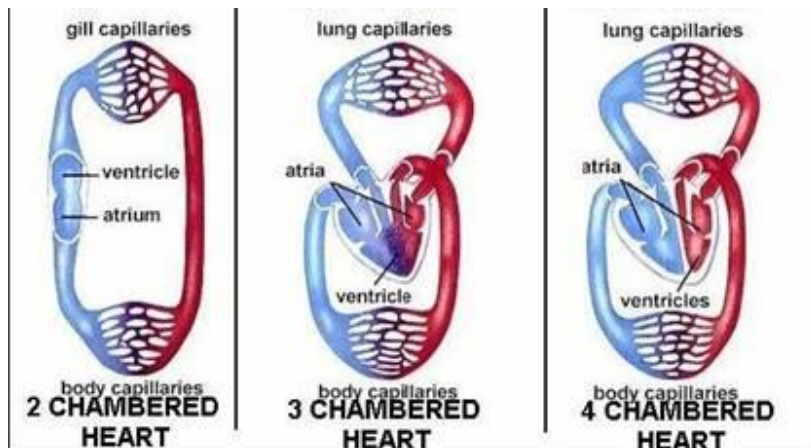
- (i) it contains a respiratory pigment called as Haemoglobin.
- (ii) transportation of oxygen in the body
- (iii) removal of carbon-dioxide from tissues.
- (iv) contains an enzyme carbonic anhydrase which is very important for CO₂ transport.



Q. 6. What is the difference between blood circulation fishes and birds?

Answer: There are major differences in the blood circulation of fishes & birds.

Heart in fishes is 2-chambered while heart in birds is 3-chambered. In fishes the blood enters in the heart only during one whole circulation a single time while in birds it enters twice during one complete circulation. In fishes, both oxygenated & deoxygenated blood gets mixed and then circulated to the whole body, while in birds both oxygenated & deoxygenated remains separated and thus more efficient.



Q. 7. Write a common feature between the following.

- (i) Xylem and phloem
- (ii) Haemoglobin and chlorophyll

Answer: i) Xylem and phloem

Xylem and phloem are the conducting tubes present in the plant which are responsible for the transportation of different materials required by the plant body.

ii) Haemoglobin and chlorophyll

Both of them are the colored pigments just present in different organisms. Haemoglobin is present in animals whereas chlorophyll is present in plants.

Q. 8. Enumerate the difference between translocation and transpiration.

Answer: Translocation: The process of movement of carbohydrates (which act as food) produced by the leaves which is to be distributed to different parts of the plant is known as translocation. The process of translocation takes place in the phloem cells.

Transpiration: The process of movement of water in the plants through xylem and its evaporation through leaves or stem is known as transpiration. It is done through

stomata during the daytime. It is important as it creates a pull which is known as transpirational pull in the xylem.

Q. 9. Blood is a fluid connective tissue. Explain.

Answer: Firstly, blood is mesodermal origin just the way all other connective tissues are. Secondly, blood connects different parts of the body, transporting minerals, nutrients, hormones and collecting waste from different parts. Hence, blood is known as a fluid connective tissue.

Q. 10. Platelets help in clotting of blood at injured side. Draw a flow diagram of this process.

Answer: Platelets help in clotting of blood. There are 13 different factors which affect the clotting mechanism. A clot is a reddish brown scum made up of fibre like structures known as fibrins. The important steps in clotting mechanism can be explained below:-

Step-1:- release of thromboplastin from injured tissues & platelets

Step-2:- This thromboplastin helps in the formation of a complex enzyme thrombokinase.

Step-3:- this thrombokinase converts prothrombin into active thrombin

Step-4:- This thrombin converts soluble fibrinogen into insoluble fibrin.

Step-5:- This fibrin forms a network at the site of injury which traps the blood & form clot.

Q. 11. Blood does not clot in the blood vessels. Give reason.

Answer: The basophils (a type of WBC) and mast cells present in our body (a part of formed elements) secrete an anti-coagulant known as Heparin. This anti-coagulant do not let the blood clot inside the blood vessels.

Q. 12. How is double circulation different from single circulation?

Answer: In the single circulation the deoxygenated blood from the whole body of the animal is pumped into the heart. From the heart it goes to the gills and the oxygenated blood is pumped back into the body. This kind of circulation takes place in fishes. Whereas in double circulation the deoxygenated blood is collected from the body, goes to the lungs for the process of oxygenation and then this oxygenated blood comes back to the heart. The heart pumps back this oxygenated blood into the body tissues. In this type of circulation, as the blood passes through the heart two times, it is known as double circulation. It takes place in birds & mammals like human beings.

Q. 13. Name a circulatory fluid in the human body other than blood. State its functions. How does it differ from blood?

Answer: Another type of circulatory fluid in the human body is the lymph. Lymph is a colorless liquid which is formed out of blood plasma.

Q. 14. Explain how deoxygenated blood travel from body to lung for purification. Draw well-labeled diagram in support of your answer.

Answer: The deoxygenated blood is collected from the body tissues through the veins which further combine to form vena cava. This vena cava pours deoxygenated blood collected from the body tissues into the right auricle of heart. From right auricle it goes to right ventricle and from here the blood is pumped into the pulmonary artery which takes the deoxygenated blood from heart to the lungs. In the alveoli of lungs the blood is oxygenated. This oxygenated blood is pumped into the pulmonary veins which pours the blood into the left auricle. From here the oxygenated blood is poured into the left ventricle. The left ventricle pushes the blood into the aorta which pumps the oxygenated blood into the body tissues and supply oxygen through the tissues for various body functions.

Q. 15. Plants absorb water from the soil. How does this water reach to the top of the tree? Explain in detail.

Answer: i. The soil is the richest source of raw materials for the plant like nitrogen, phosphorous, water and other minerals. Water is essential for all physiological activities of the plant. The absorption of all these substances occurs through a part of the plant called roots.

ii. The plant transport system moves raw materials from roots and energy from leaves. This is done by two independent conducting tubes called xylem which transports water and minerals from the soil and phloem transports the food from leaves to other parts of plants. vessels tracheids of xylem tissue, stem, leaves, and roots form a continuous water conducting channel reaching to all parts of the plant.

iii. The difference of concentration of ions in roots and soil, help water to enter roots from the soil to eliminate this difference (caused by root cells take up ions from soil). This maintains the steady movement of water upwards via roots.

iv. But this pressure is not enough to supply water to heights.

v. Water lost through leaves (or any aerial part of the plant) called transpiration causes a suction which pulls water from xylem cells of roots. Thus, transpiration helps in the absorption and upward movement of water and minerals from soil via roots and reach the top. Also, it helps to regulate the temperature of the plant.

Q. 16.A. How does food prepared by leaves is utilized by roots? Explain.

Answer: The food for plants is prepared by the green leaves by the process of photosynthesis. In this process the plant uses carbon dioxide and produce sugars in the presence of sunlight. Every part of plant body like the roots and stem also require food for its functioning so the food prepared by the leaves must be transported to different parts of the plant. The process of transportation of carbohydrates (sugar) produced by the leaves to other parts of the plant is known as translocation. It is done through Phloem tissues. The movement of carbohydrates in phloem is bidirectional.

Q. 16.B. Water is absorbed by roots and lost through leaves. How does this happen?

Answer: Water is absorbed by the root of the plant but has to be transported to different parts of the plant like leaves and stem. It is done through xylem tissues. The flow of water and minerals in xylem is unidirectional that is from roots to leaves. The process of movement of water in the plants through xylem and its evaporation through leaves or stem is known as transpiration. It is done through stomata during the daytime. It is important as it creates a pull which is known as transpirational pull because of which the water moves from the roots to the leaves.

Q. 17. Amit studied transportation in plants. He wanted to observe the process of transpiration and placed a plant in bright sunlight. He noted down his observations. Next day he asked his teacher few questions about his observations. Read the above passage and answer the following questions.

(i) What is the role of transpiration in plants?

(ii) Explain how the transpiration rate is affected by

(a) decreasing the humidity of the surrounding air.

(b) increasing the temperature of the surrounding

(iii) What values do you observe in Amit?

Answer: **(i)** Transpiration is the process of movement of water in the xylem tissues and its evaporation through the aerial structures of the plant like leaves and stem. It causes a transpirational pull which help in the movement of water from the roots to the leaves.

(ii)(a) When humidity is decreased, transpiration is increased

(b) By increasing the temperature of the surroundings, we tend to increase the rate of evaporation of water droplets through the leaves by the process of transpiration. On increasing temperature, rate of transpiration also increases.

(iii) Amit is very interested in science subject. He believes in applying practical knowledges into real life experience.

Q. 18. Sumay studied about blood circulation in humans. He wanted to observe the flow of blood and was about to cut his finger a bit. He suddenly stopped realizing that this could be fatal. Read the above passage and answer the following questions.

(i) Why is the color of blood red?

(ii) Why does unclotted blood comes out from site of injury when platelets are present in the body?

(iii) Low count of which blood cells can make us vulnerable to infections?

(iv) What values do you think Sumay have?

Answer: (i) The color of the blood is red because of the presence of haemoglobin. Haemoglobin is a pigment which is found in the red blood cells. Even the color of RBCs is because of the presence of haemoglobin in them. It is useful as four molecules of oxygen combine to one molecule of Haemoglobin and thus help in oxygen transport.

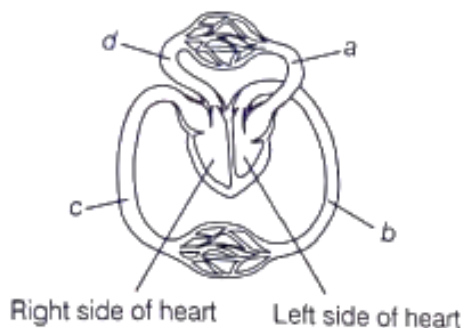
(ii) Blood do not clot in our blood vessels because of the presence of a natural anti coagulant Heparin which is released by the basophils and the mast cells in our body. Hence, unclotted blood comes out from the site of injury even when platelets are present.

(iii) There are three types of blood cells found in human beings. They are: red blood cells, white blood cells and the platelets. Different types of cells have different function. The type of blood cells which protect us from various kinds of infections in our body are the White Blood Cells or the Leucocytes. They are phagocytic in nature and hence, eat up the infection causing agent.

(iv) Sumay must be very serious before doing anything. But at least he realized it before doing anything dangerous.

Challengers

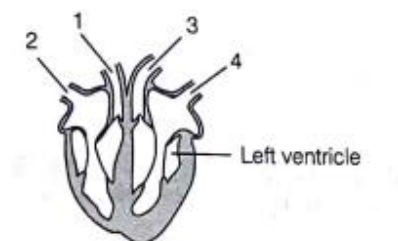
Q. 1. The diagram represents a part of human circulatory system. Where is the blood pressure highest?



- A. (a)
- B. (b)
- C. (c)
- D. (d)

Answer: The part of the diagram labeled as b will have the highest blood pressure in the whole circulatory system. The part labeled as b represents aorta. It is the largest artery which supplies the oxygenated blood from the left ventricle of heart to the body tissues. It has the highest pressure as the left ventricle has to pump the blood to all the body parts.

Q. 2. The diagram shows a vertical section through the heart.



What are the functions of the numbered blood vessels?

	Carries blood to body	Carries blood to lungs	Carries blood from lungs	Carries blood from body
(a)	1	2	3	4
(b)	1	3	4	2
(c)	2	4	3	1
(d)	3	1	4	2

- A. (a)
- B. (b)
- C. (c)
- D. (d)

Answer: 1- pulmonary artery

2- vena cava

3- aorta

4- pulmonary vein

Q. 3. What is the correct route for blood flow in a human?

- A. Left atrium → Left ventricle → Lungs → Right ventricle → Right atrium**
- B. Left atrium → Left ventricle → Right ventricle → Right atrium → Lungs**
- C. Right atrium → Right ventricle → Left ventricle → Left atrium → Lungs**
- D. Right atrium → Right ventricle → Lungs → Left atrium → Left ventricle**

Answer: The deoxygenated blood collected from different body parts is poured into the right auricle. From right auricle it moves to the right ventricle and through the pulmonary artery this deoxygenated blood is pumped into the lungs where it is oxygenated. Then this oxygenated blood is transported to the left Atrium and then moves to the left ventricle from where it is pumped into the whole body.

Q. 4. Which of the following is not a purpose of transpiration?

- A. Supplies water for photosynthesis**
- B. Helps in translocation of sugar in plants**
- C. Cools leaf surface**
- D. Transport minerals from the soil to all the parts of the plant**

Answer: The process of movement of water in the plants through xylem and its evaporation through leaves or stem is known as transpiration. Transpiration supplies water for photosynthesis, cools the leaves surface through evaporation, and the transpirational pull helps in transportation of minerals from the roots to the leaves. But it never helps in the translocation of sugars. Translocation is the process of movement of food from the leaves to the different parts of the plant through phloem.

Q. 5. The table shows the characteristics of blood in one blood vessel of the body.

Oxygen Concentration	Carbon dioxide Concentration	Pressure
High	Low	High

Which blood vessel contains blood with these characteristics?

- A. Aorta**
- B. Pulmonary artery**
- C. Pulmonary vein**
- D. Vena cava**

Answer: Aorta is the only blood vessel which transports the oxygenated blood from the heart to different parts of the body. As the blood is oxygenated and in this blood vessel the oxygen concentration is high, carbon dioxide concentration is low and the blood

pressure is very high so as to supply the oxygenated blood to different parts of the body.

Q. 6. What are the functions of the Xylem?

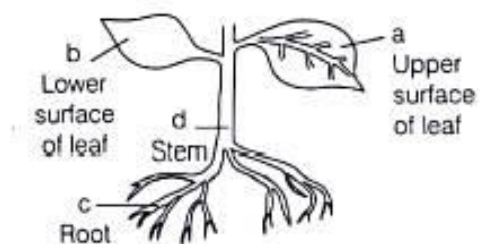
	Carrying Sugars	Carrying Water	Carrying mineral ions	Giving Support
(a)	✓	X	X	✓
(b)	✓	✓	X	X
(c)	X	✓	✓	X
(d)	X	✓	✓	✓

Key ✓ = a function of xylem, X= not a function of xylem.

- A. (a)
- B. (b)
- C. (c)
- D. (d)

Answer: Xylem helps in transportation of water & mineral in the plant body and it also provides support.

Q. 7. The diagram shows part of a flowering plant. Where does the most transpiration take place?



- A. (a)
- B. (b)
- C. (c)
- D. (d)

Answer: Lower surface of leaf has more stomata than upper surface. That is why maximum transpiration occurs.

Q. 8. Which chambers of human heart contain oxygenated blood?

- A. Left atrium and left ventricle**
- B. Left atrium and right ventricle**
- C. Right atrium and left ventricle**
- D. Right atrium and right ventricle**

Answer: The deoxygenated blood is collected from different parts of the body and transported into the right atrium from which it moves to the right ventricle from where it is transported to the lungs for oxygenation. This oxygenated blood now comes to the left atrium and from here it is poured into the left ventricle. Therefore, the left part of the heart that is the left atrium and left ventricle contains the oxygenated blood.

Life Processes (d) Excretion

Check Point 01

Q. 1. How do unicellular organisms perform excretion?

Answer: Excretion refers to the removal of waste matter from the body. The unicellular organisms remove the waste products from their body by the process of simple diffusion which is defined as the movement of a substance from a region of higher concentration to a region of lower concentration through a membrane.

Q. 2. Excretion is different in multi-cellular organisms as compared to unicellular organisms. How?

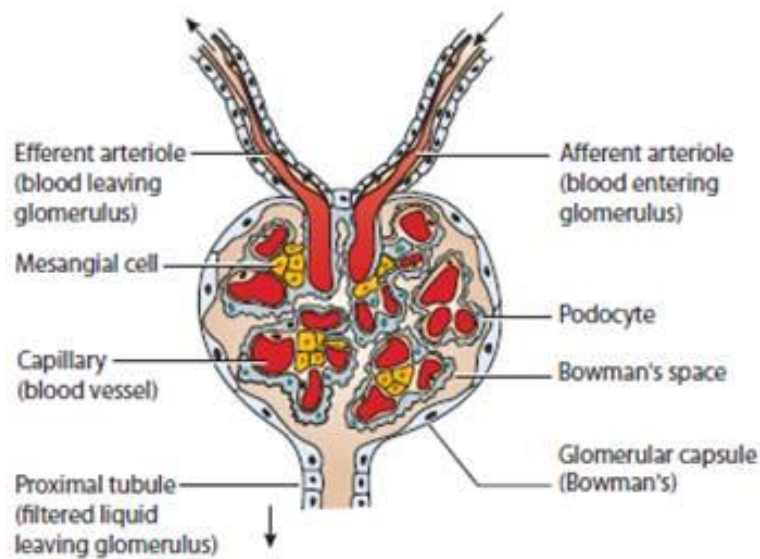
Answer: In unicellular organisms, excretion is performed by a single cell by the process of diffusion through the body surface. Whereas, in multi-cellular organisms, different life processes are performed by different cells and organ-systems (nervous system, excretory system, circulatory system, etc). Multi-cellular organisms use specialised organs such as lungs, kidneys, nephrons, skin, malpighian tubules, etc to eliminate waste products from their body.

Q. 3. Write the location of kidneys in human body.

Answer: Kidneys are bean-shaped organs meant for excretion. In human body, they are located in the upper abdominal area. The two kidneys are present opposite to each other, one on each side of the backbone.

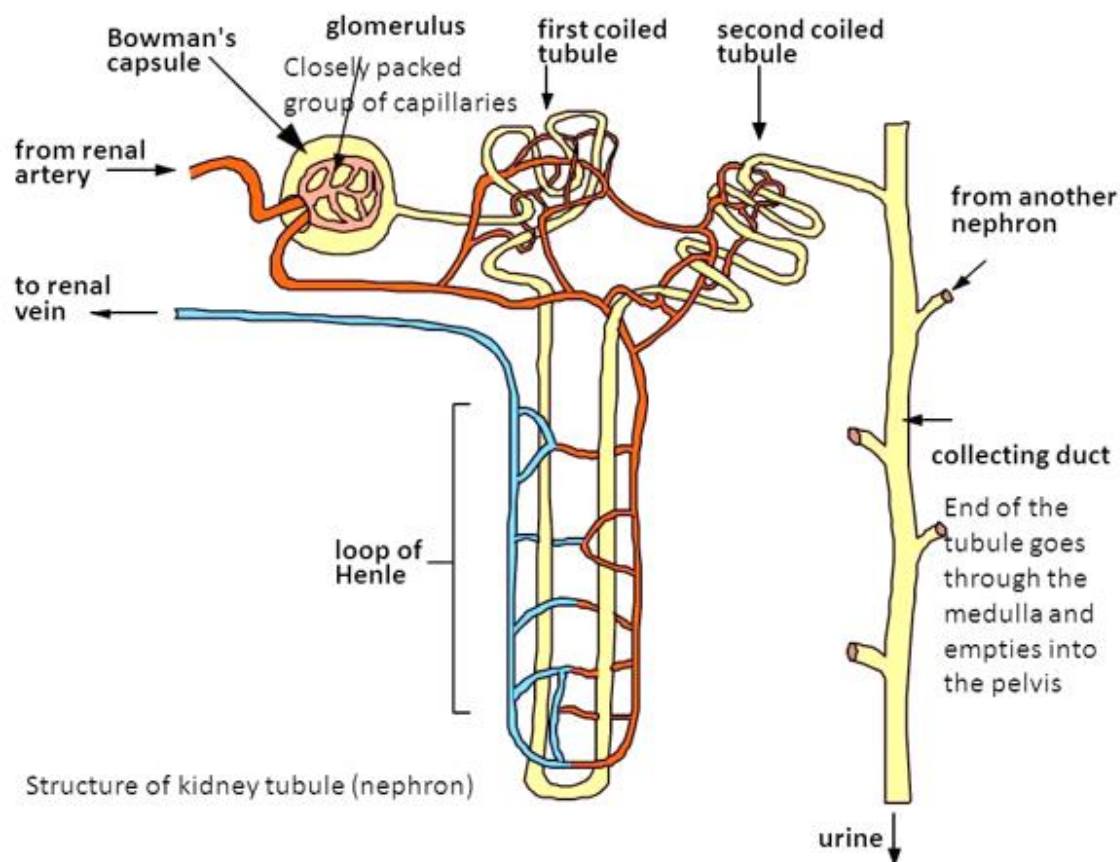
Q. 4. What is glomerulus?

Answer: Glomerulus is a tiny spherical structure present in nephrons (functional unit of a kidney). It is formed by the cluster of very thin-walled blood capillaries that are involved in filtration of blood to form urine. Each of this clustered group of capillaries is associated with a cup-shaped tube that collects the filtered urine.



Q. 5. Name the fundamental unit of kidney. Why is it called so?

Answer: The basic functional and filtration unit of a kidney is called a nephron. It is composed of renal corpuscle (Bowman's capsule + glomerulus) and renal tubules. It is called so because it is actively involved in filtration of blood to produce urine. It removes waste products and excess substances from blood and forms urine.



STRUCTURE OF A NEPHRON

Q. 6. The process of ultra-filtration is essential in urine formation, where does this step occur in nephron?

Answer: In a nephron, ultra-filtration occurs in the renal corpuscle (glomerulus + Bowman's capsule). Glomerular filtration of blood is also known as ultra-filtration. It is a non-selective process and filtration is so fine that every component of plasma (water, glucose, amino acids, urea, etc) except proteins pass into the Bowman's capsule. The epithelium of renal corpuscle has tiny filtration slits (also called slit pores) that help in ultra-filtration. This process ensures that only waste products and excess water are removed from the body and it also helps to concentrate the urine.

Q. 7. Second stage of urine formation is called selective re-absorption. Why?

Answer: The second stage of urine formation, tubular re-absorption, is called selective re-absorption because some substances such as glucose, amino acids, urea, salts and excess water are selectively reabsorbed back into the blood as urine is being filtered along the tubes. All components of plasma are not re-absorbed but only a few of them, hence, selective re-absorption.

Q. 8. 'The urge to urinate can be controlled.' Give reason.

Answer: The urine is stored in urinary bladder, which is a muscular sac composed of smooth muscles that are able to relax and contract. The pressure built inside the expanded bladder due to storage of urine leads to the urge to urinate. As the activity of urinary bladder is under the control of nervous system, the urge to urinate can be controlled.

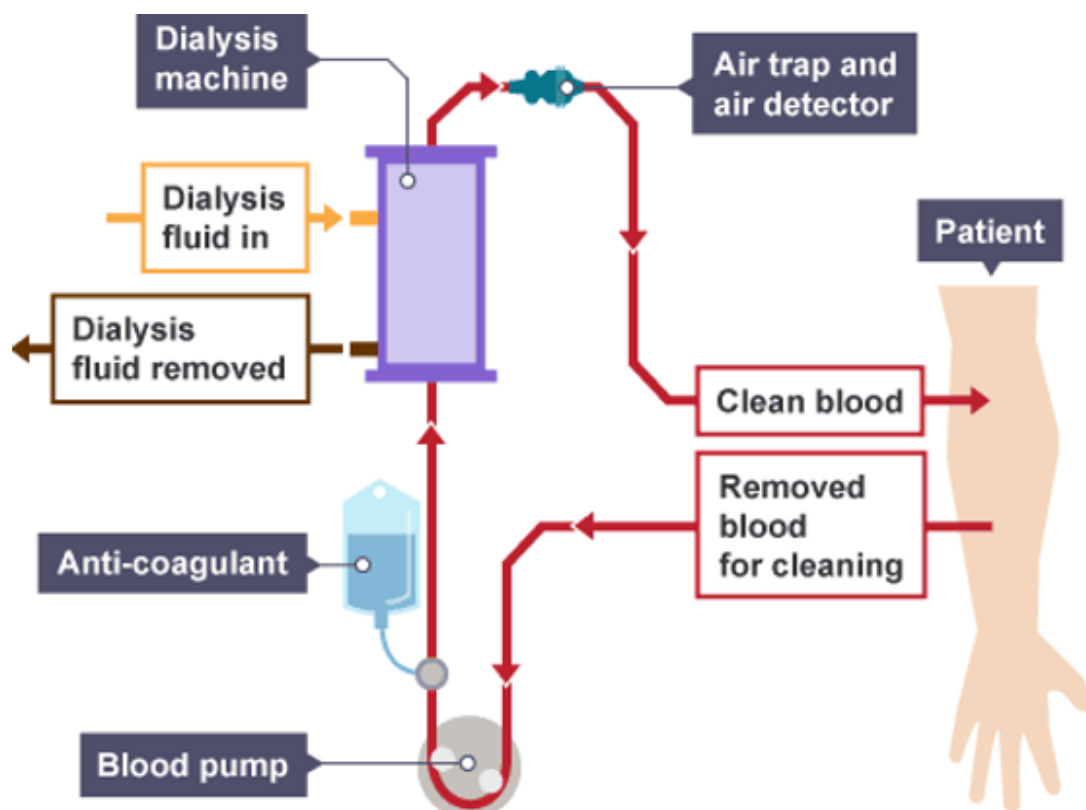
Check Point 02

Q. 1. When do we need artificial kidneys?

Answer. In case of kidney failure, an artificial kidney is needed. The kidneys lose the ability to remove the nitrogenous waste products from the body or their activity is highly reduced. They fail to perform their vital function. There are many reasons for kidney failure such as injury, infection and reduced blood flow that lead to accumulation of wastes in our body. Hence, an artificial kidney can be used.

Q. 2. Explain the term dialysis.

Answer: Dialysis is the process of removing nitrogenous wastes and excess water from the body by using a clinical device, called as artificial kidney and a dialyzing fluid. It serves as a substitute for normal functioning of the kidneys. It is required when the kidneys stop functioning properly or are damaged.



DIALYSIS

Q. 3. State one difference between artificial kidney and natural kidney?

Answer:

Natural kidney	Artificial kidney
Natural kidneys have the capacity of re-absorption to maintain osmotic balance in the body.	Artificial kidneys do not have the capacity of re-absorption to maintain osmotic balance in the body.

Q. 4. In the artificial kidneys, the tubes are all with semi-permeable lining. Why?

Answer: In artificial kidneys, all tubes are semi-permeable and made of cellophane. These tubes are selectively permeable and allow only certain substances to pass through them. The semi-permeable nature allows only the nitrogenous waste products and water to pass through the tubes and does not allow the blood cells and proteins to pass through it.

Check Point 03

Q. 1. Name any two waste products secreted by plants.

Answer: Plants produce many waste products such as gases and water. They eliminate excess water through transpiration. Plants also produce gaseous waste products – oxygen during photosynthesis (yes, oxygen can be considered a waste product for plants) and carbon dioxide during respiration.

Q. 2: Some plants excrete wastes through stomata, others through hydathodes. Name the processes occurring in them.

Answer: When water is lost in the form of vapours through the stomata present on leaves, it is called **transpiration**. Some plants lose excess water in the form of liquid droplets from the margins of leaves, through **hydathodes**. This process is called as **guttation**. Hydathodes are structurally modified pores present on leaf margin.



THE PROCESS OF GUTTATION



Q. 3. How do stems of a plant help in excretion of gases?

Answer: Stems of plants also possess stomata through which diffusion of gases occur. The oxygen from air diffuses into the stem for respiration through stomata and similarly, carbon dioxide diffuses out into the air. The stems of woody plants possess **lenticels** (large raised pores) to facilitate the exchange of gases, thereby help in excretion.



LENTICELS

Q. 4. How does excess of water removed by the plants?

Answer: Plants lose excess water through stomata, lenticels and cuticle. The two processes involved are transpiration and guttation. When water is lost in the form of vapours through the stomata present on the aerial parts of plants, it is called **transpiration**. It occurs by pulling of water. It occurs only in daytime. When excess water is lost in the form of liquid droplets from the margins of leaves, through hydathodes, it is called **guttation**. It occurs by pushing of water towards leaf margins. It occurs only at night. Hydathodes are structurally modified pores present on leaf margin.

Q. 5. In what forms, apart from water, do plants excrete out liquid waste?

Answer: Apart from water, plants excrete out a number of liquid waste products into the soil around them. It includes essential oils, organic acids, aromatic oils, tannins, resins, latex and sap. Resins and gums are stored in old xylem of plants. Most of these wastes are useful to humans.

Q. 6. Name one useful plant waste used to make tyres.

Answer: The latex is exuded as a waste product from plants. The tyres are made from the latex of rubber tree (*Hevea brasiliensis*).

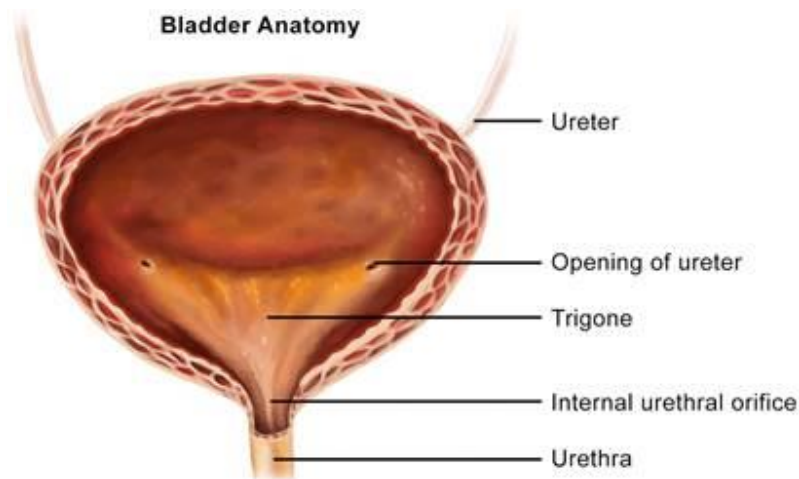
Chapter Exercise

Q. 1. Name the excretory organs in unicellular organisms.

Answer: The unicellular organisms (such as amoeba) have no specialized organs for excretion. They excrete out wastes by simple diffusion through their plasma membrane (general body surface) into their surroundings.

Q. 2. Where is the urine produced by kidneys gets stored?

Answer: The urine is produced by the kidneys and is then passed to the urinary bladder, where it gets stored. The urinary bladder is a pear-shaped hollow muscular sac composed of smooth muscles that are able to expand.



Q. 3. What are the major constituents of urine?

Answer: The urine is made up of a number of constituents. It is an aqueous solution mainly composed of water (95%). It also consists of some organic and inorganic compounds. Other constituents include small amounts of urea, creatinine and some dissolved ions such as sodium, potassium and chloride.

Q. 4. State the process by which chemicals from the blood enter the dialysing fluid?

Answer: The chemicals (toxic waste products) from the blood enter the dialyzing fluid through the process of diffusion when blood is passed along the tubes.

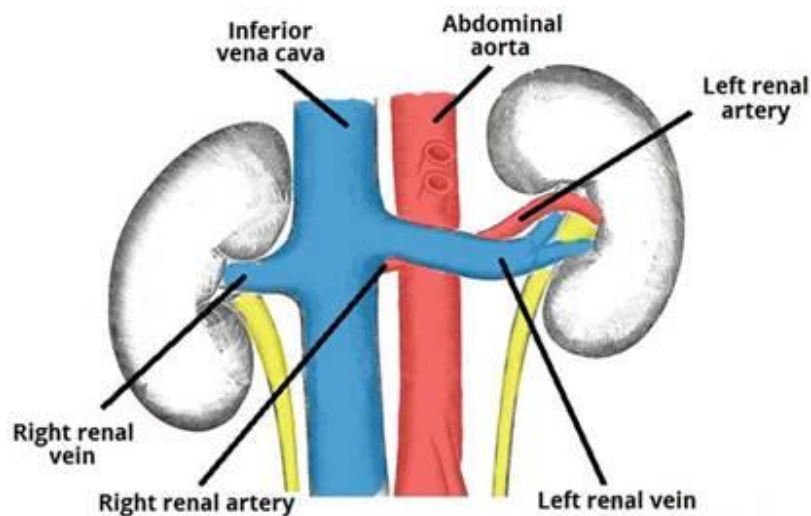
Q. 5. Name the substance which is present in the blood, but not in the urine of a healthy person?

Answer: Normally, glucose is present in the blood, but not in urine of a healthy person. All of the filtered glucose is re-absorbed into the bloodstream by the kidneys through tubular re-absorption. The presence of glucose in urine (**glycosuria**) indicates that the person has diabetes.

Q. 6. Tabulate two differences between renal artery and renal vein.

Answer:

RENAL ARTERY	RENAL VEIN
1. Renal artery is thick, muscular and strong possessing a narrow lumen with no valves.	1. Renal vein is thinner and possess a wide lumen with valves to prevent backflow of blood.
2. It carries oxygenated blood from the heart to the kidneys.	2. It carries de-oxygenated blood from the kidneys back to the heart.
3. Blood flows with high pressure.	3. Blood flows with low pressure.



Q. 7. What is osmoregulation? Name the organs of osmoregulation in:

- (i) Human
- (ii) Amoeba

Answer: Osmoregulation refers to the regulation of water and salt concentration across the membranes within the body fluid to maintain the required osmotic pressure. It serves to maintain the dissolved ions concentration of body fluid.

(i) The main osmoregulatory organs in humans are **kidneys**. They also function to filter blood.

(ii) Amoeba possesses **contractile vacuoles** as osmoregulatory organs. It serves to regulate the water content of the cell. These vacuoles help the amoeba to survive in hypertonic as well as hypotonic environment.

Q. 8. Explain how the blood system carries waste products from liver to the kidneys?

Answer: The circulatory system also serves to remove waste products from the body. Certain wastes such as excess water, urea, uric acid and carbon dioxide are

transported from the liver to the kidneys, where the blood is filtered. The urea is produced in liver and released into the bloodstream. It is then transported to the kidneys by blood to be excreted out in urine. These waste products are exchanged through diffusion as blood is being filtered by kidneys.

Q. 9. Explain the principle of haemodialysis.

Answer: Haemodialysis serves as a substitute for kidney. It works on the principle of **diffusion**. The nitrogenous wastes (urea), creatinine and potassium ions diffuse out into the dialyzing fluid across the semi-permeable membranes along the concentration gradient (from high concentration to low concentration). It corrects electrolyte imbalance and removes waste from the body.

Q. 10. How do plants get rid of their excretory products?

Answer: Plants produce a number of waste products and use different mechanisms to get rid of them. Excess water is eliminated by transpiration and guttation. Oxygen (a by-product of photosynthesis) and carbon dioxide (produced during respiration) moves out through stomata. Some waste products are stored in plant parts like leaves that later fall off. Plants also excrete some waste products into the surrounding soil. Certain wastes are accumulated as resins or gums in old xylem tissue. All these methods help the plants to get rid of their excretory products.

Q. 11. What is the difference between excretion and defecation? Explain the process of excretion in humans.

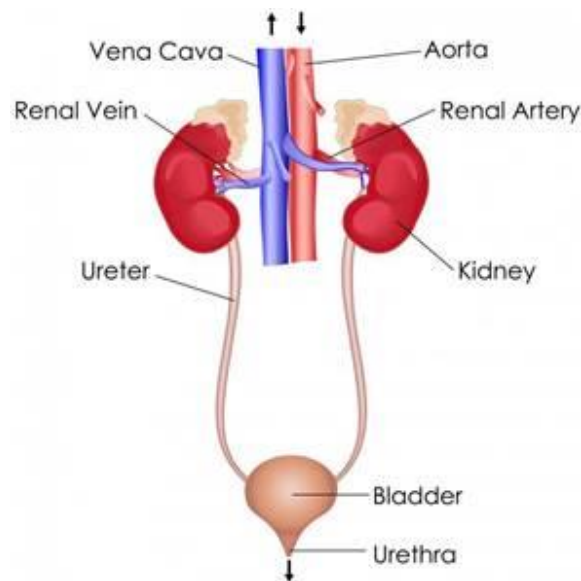
Answer: Excretion is the removal of nitrogenous waste products of metabolism that are formed in the body, such as urine and carbon dioxide through kidneys and lungs. It is a part of excretory system.

Defecation (discharge of faeces) refers to the removal of undigested food and other waste material from the alimentary canal through the anus. It is a part of digestive system. It marks the end of digestion.

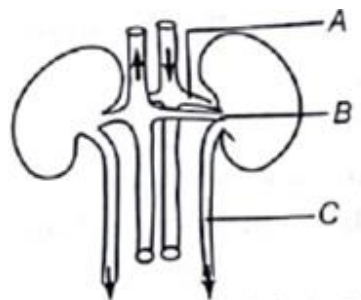
Human excretory system

- It consists of a pair of kidneys, a pair of ureters, a urinary bladder and a urethra.
- Urine is produced in the kidneys and passed to the urinary bladder through the ureters.
- It is then excreted out of the urinary bladder via urethra.
- Each kidney possesses about a million nephrons (basic functional unit) that are responsible to filter out blood and produce urine.

- The three processes involved are filtration, re-absorption and secretion.
- Certain substances such as glucose and amino acids are re-absorbed while other waste products are excreted out in the form of urine, which is carried by ureters from the kidney to the urinary bladder.
- Thus, help to concentrate the urine.



Q. 12. The given diagram shows parts of the urinary system of a mammal.



Identify the structures labelled A, B and C.

Answer: A. Renal artery – It supplies oxygenated blood from the heart to the kidney.

B. Renal vein – It carries deoxygenated blood from the kidney back to the heart.

C. Ureters – Paired tubes connecting kidneys to the urinary bladder. They transport urine from the kidneys to the bladder.

Q. 13. Outline the functioning of kidney dialysis machine?

Answer: • The dialysis machine serves as artificial kidney.

- It is used for patients with damaged or dysfunctional kidneys.
- It filters blood and removes waste products and excess fluid from the body.
- It works on the principle of diffusion.
- It consists of semi-permeable tubes (made of cellophane) and a special dialyzing fluid.
- A small incision is made on the arm and a tube is connected. The blood is passed along the tubes placed in dialyzing fluid that filter waste products from the blood through diffusion.
- The filtered blood is transported back into the body.

Q. 14. Ritu learned that excretion removes harmful metabolic wastes, i.e. nitrogenous wastes from the body. Different processes are employed in varied organisms depending on body's organisation.

Read the passage and answer the following questions.

(i) Why can't diffusion be carried out as excretory process in multicellular organisms?

(ii) Aquatic animals usually excrete ammonia as excretory waste. Give reason.

(iii) List the values observed in Ritu.

Answer: (i) The multi-cellular organisms have a very complex body organization. They possess many different organ-systems to perform the basic life processes, such as respiration, excretion, etc. Also, the cells and tissues of these organisms are not in direct contact with the environment. Moreover, diffusion is quite a slow process. So, excretion cannot be performed through diffusion.

(ii) Ammonia is a toxic nitrogenous waste and is highly soluble in water. The removal of ammonia requires a large amount of water. Aquatic animals are ammonotelic as they need not conserve water. The conversion of ammonia into less toxic metabolite (urea, uric acid) is highly energy intensive. Therefore, aquatic animals prefer not to expend energy in conversion of ammonia.

(iii) Ritu possesses a number of values. She seems to be attentive, vigilant, observant and zealous. She has a curiosity for learning.

Q. 15. Rohan studied excretion in plants. He observed that the oxygen we breathe is actually a waste product of photosynthesis in plants. He wondered about other waste products and their uses. He was also bothered about the increased

deforestation which disturbs the O₂-CO₂ balance of the environment. Read the above passage and answer the questions following.

(i) How do plants release gaseous wastes from their body?

(ii) Apart from oxygen, what other waste products are released by plants? Give two examples along with their use.

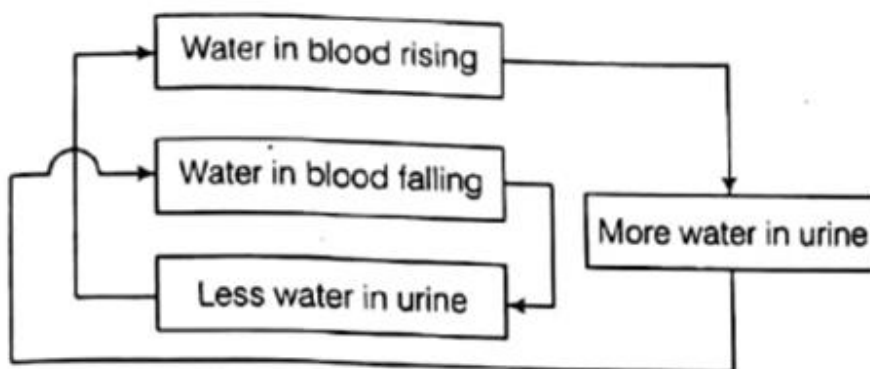
Answer: (i) Plants use different methods to perform excretion. They produce mainly two gaseous waste products, namely oxygen (produced during photosynthesis) and carbon dioxide (produced during respiration). The leaves of plants possess tiny pores called stomata and stems possess lenticels through which O₂ and CO₂ are diffused out of the plant body.

(ii) Apart from oxygen, plants produce a number of waste products such as excess water, essential oils, aromatic oils, tannins, resins, gums, organic acids, latex, etc. Almost all of these products are useful to human.

Gums and resins are used for varnishes and adhesives. Essential oils are used in cosmetics and soap making.

Challengers

Q. 1. Observe the figure given below which represents the control of water concentration in the blood.



This is a negative feedback

A. It decreases the amount of water in the blood.

B. It increases any change occurring in the amount of water in the blood.

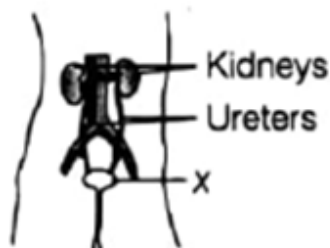
C. It reverses any change occurring in the amount of water in the blood.

D. It increases the amount of water in the blood.

Answer: This is a negative feedback to reverse any change occurring in water concentration in blood. This system regulates and maintains required water amount in

blood by excreting out excess water in the form of urine. If the amount of water in blood is reduced, more concentrated urine is formed to conserve water.

Q. 2. The diagram given below shows the human excretory system.

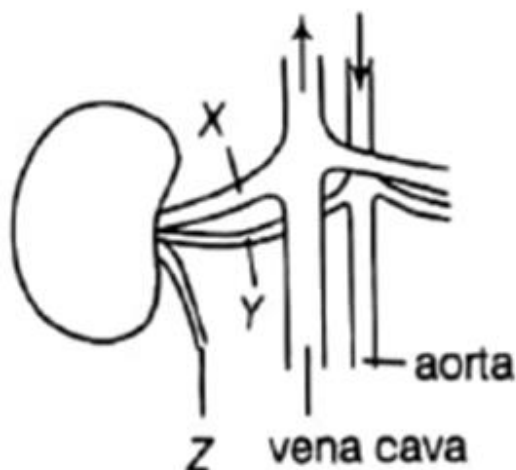


Identify the function of part labelled as x

- A. To excrete urea
- B. To produce urea
- C. To produce urine
- D. To store urine

Answer: The labeled part is the urinary bladder, which is a pear-shaped muscular sac composed of smooth muscle. It is connected to the kidneys via ureters. It is meant for storing urine until it is released out through urethra.

Q. 3. In the figure given below the structures associated with human kidneys are marked (X,Y and Z). The relative concentrations of urea in these structure is



- A. X is sometimes higher than Y
- B. Y is always higher than Z
- C. Y is always lower than Z
- D. Z is sometimes lower than X

Answer: The structures are labeled as:

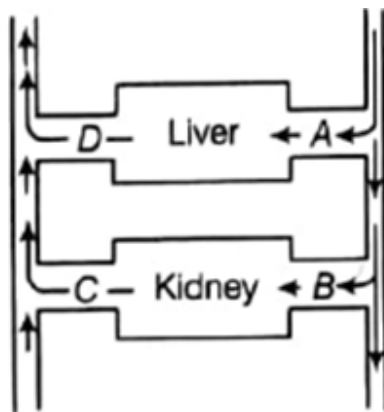
X – Renal vein

Y – Renal artery

Z - Ureter

The renal artery (Y) carries oxygenated blood to the kidneys from the heart. This blood contains negligible amounts of waste products (such as urea). On the other hand, the ureters (Z) transport urine from the kidneys to the urinary bladder. The urine contains comparatively high amounts of urea to be excreted out. Thus, the relative concentration of urea in Y is always lower than that in Z.

Q. 4. The diagram given below represents the liver, kidney and some associated blood vessels. Identify the vessel from the labelled parts A-D in which the blood will contain the lowest concentration of urea?



- A. A
- B. B
- C. C
- D. D

Answer: The urea is formed by the urea-cycle in the liver, and not in the kidneys. The blood vessel coming out from the kidney will contain the lowest concentration of urea (although kidneys contain only a small amount of urea to maintain osmolarity). And the blood vessel coming out from the liver will contain the highest concentration of urea.

Q. 5. A healthy woman consumes a litre of water at once.

- (i) How will be the internal environment of her body affected by this?
- (ii) A corrective measure to bring the arising condition to normal state is?

Select the correct option for (i) and (ii) from those given below

(i)	(ii)
(a) Plasma becomes diluted	Concentration of the urine formed
(b) Osmotic pressure of the plasma decreases	Increase in the volume of urine formed.
(c) The body cells undergoes shrinkage	Less water is reabsorbed by the kidneys
(d) Osmotic pressure of the plasma increases	Formation of dilute urine occurs.

- A. (a)
- B. (b)
- C. (c)
- D. (d)

Answer: Consuming high amount of water leads to increased water concentration in blood. As a result, osmotic pressure of the plasma decreases because excess water must be eliminated to maintain normal functioning of the body. Decreased osmotic pressure of the plasma tends to push out excess water from the circulatory system.

Consequently, more volume of urine is produced and the person has frequent urination.

Q. 6. Which substances will be present in the glomerular filtrate from the kidneys of a mammal?

	<i>Glucose</i>	<i>Protein</i>	<i>Salts</i>
(a)	✓	✓	×
(b)	×	✓	✓
(c)	✓	×	✓
(d)	×	×	✓

Key ✓ = present, × = absent

- A. (a)
- B. (b)
- C. (c)
- D. (d)

Answer: The process of glomerular filtration, also called ultra-filtration occurs in the renal corpuscle (glomerulus + Bowman's capsule) through numerous tiny filtration slits present in the basement membrane of renal corpuscle. This filtration is so fine that every component of plasma, except proteins (as they are large in size) pass into the

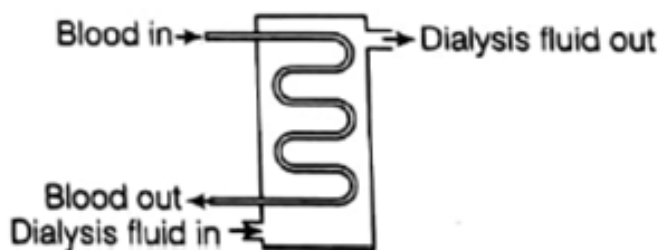
Bowman's capsule. Therefore, the filtrate from the kidneys of a mammal contains glucose and salts, but not proteins.

Q. 7. Most often during a kidney disorder, the colour of urine changes from yellow to others. A patient is secreting dark coloured urine which turns to blue or black later. This is due to the presence of which of the following?

- A. Homogentisic acid**
- B. Methaemoglobin**
- C. Corpoporphyrin**
- D. Both A and B**

Answer: The accumulation of Homogentisic acid (phenolic acid) causes alkaptonuria (a rare inherited disease that causes the urine to turn black when comes in contact with air). This accumulated acid is excreted out in urine giving it a dark colored appearance. Alkaptonuria is caused by the deficiency of an enzyme (homogentisic dioxygenase).

Q. 8. The figure given below is representing the dialysis machine for removing nitrogenous wastes in patient with a kidney failure.



Which substances out of the following in the dialysis fluid should be at a lower concentration than in the blood of patient?

- A. Glucose and urea**
- B. Glucose and amino acids**
- C. Salts and urea**
- D. Glucose and salts**

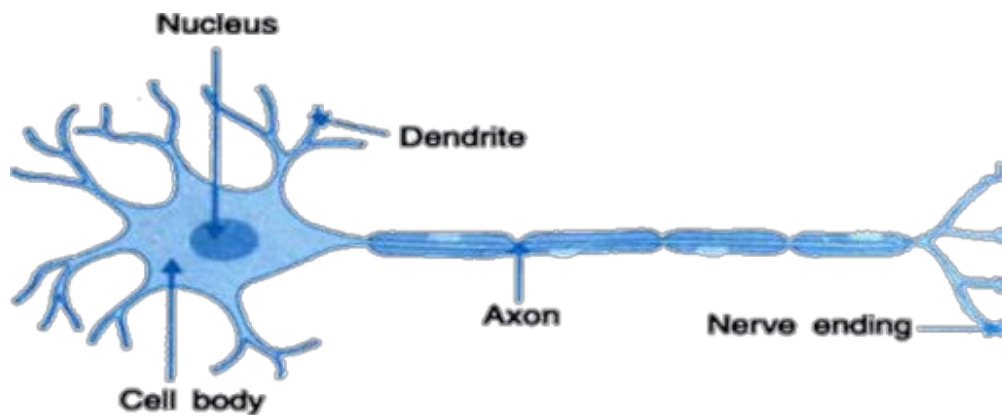
Answer: The kidney is dysfunctional in the patient; nitrogenous wastes will not be excreted out from his body. As a result, salts and urea will get accumulated in the blood. The dialysis fluid is meant for filtering the blood, so it contains no nitrogenous wastes. As compared to blood, urea and salts should be at a lower concentration in the dialysis fluid.

Control And Coordination

Check Point 01

Q. 1. Name the structural and functional unit of nervous system.

Answer: Neurons are the structural and functional unit of human nervous system. Parts of neuron are dendrite, nucleus, cell body, axon and nerve ending. All the information is received from dendrites and through nerve ending is passed to the next neuron.



Q. 2. What is detected by gustatory receptors?

Answer: Gustatory receptors detect the taste. They are distributed over the surface of the tongue in individual organs called taste buds. Like olfactory receptors will detect smell.

Q. 3. At which point information is acquired in the neuron?

Answer: At the end of the dendritic tip information is acquired. After the information is acquired, chemical reaction is set off at the dendritic tip and an electrical impulse is generated. This impulse is passed through axon to its end. At axon end, impulse is set off and again some chemicals are released, which crosses the gap between the two nerve cells and again starts the same procedure in the second nerve cell.

Q. 4. Define reflex action.

Answer: A reflex action or also known as reflex is the sudden action given in response to any activity. These are the involuntary movement. Reflex action does not involve the conscious part of the brain. The path of impulses in reflex action is known as reflex arc. For example when we touch the hot pan by mistake we suddenly pull-off our hands. This response to the stimuli is known as reflex action.

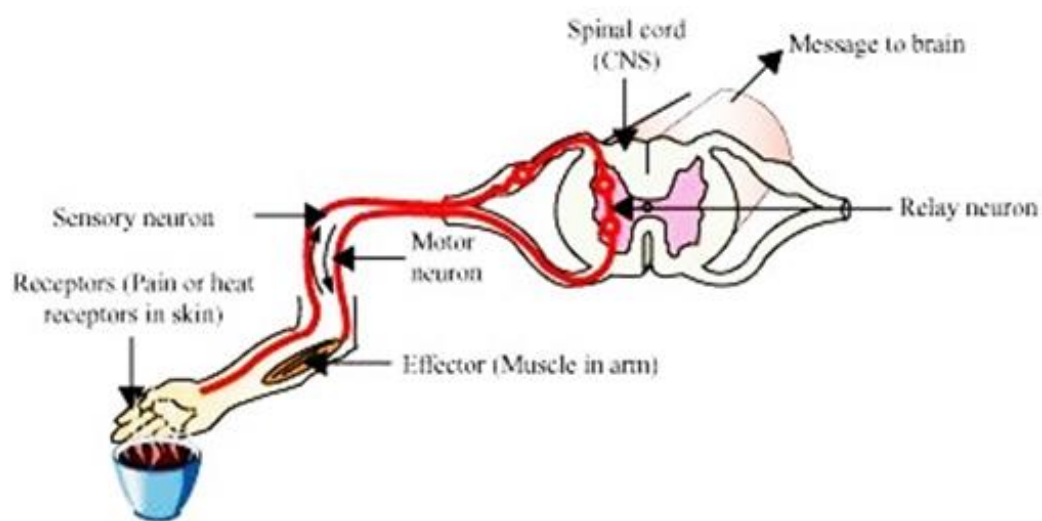
Q. 5. Give two examples of reflexes.

Answer: Examples: - 1. On touching a hot pan we pull-off our hand.

2. Contraction of pupil when there is bright light.

Q. 6. What is the role of sensory neuron in a reflex arc?

Answer: Components of reflex arc are receptors, sensory neuron, spinal cord (CNS), relay neuron, motor neuron and effector. The basic function of sensory neuron is to carry the impulse from sensory organ to the central nervous system. For example when we touch a hot pan the from the receptors present on our hands the stimulus is passed to spinal cord or central nervous system through the sensory neuron.



Check Point 02

Q. 1. What constitutes Central Nervous System (CNS)?

Answer: Spinal cord and brain together make the central nervous system. All the sensory and motor impulses are sent to and from the brain through the spinal cord and also spinal cord is centre for all the reflex actions. Brain the major centre of co-ordination in the body.

Q. 2. What is the role of the Peripheral Nervous System (PNS)?

Answer: Peripheral Nervous System consists of cranial nerves from the brain and spinal nerves from the spinal cord. All these nerves lie outside the spinal cord and brain. The main function of PNS is to build a communication channel between central nervous system and the other parts of the body is facilitated by peripheral nervous system.

Q. 3. Mention the part of the brain involved in thinking. State one more function of this part.

Answer: The Human brain has three parts- fore-brain, mid-brain, and hind-brain. Fore-brain is the main part which is involved in thinking. It has all the sensory receptors so it receives all the sensory impulses. Different parts of fore-brain are responsible for hearing, seeing etc.

Q. 4. Which part of the brain helps us to focus on the objects?

Answer: Fore-brain helps us to focus on the objects. In fore-brain occipital lobe is responsible for processing the sight.

Q. 5. Blood pressure and heart rate will be regulated by which part of the brain?

Answer: Hind part Medulla oblongata is responsible for the control of involuntary activities such as breathing, blood pressure (BP) etc.

Q. 6. Name the structure that helps in the protection of the spinal cord.

Answer: Spinal cord is protected by the vertebral column, also known as the backbone. It is a hard and bumpy structure which protects the spinal cord.

Q. 7. Why do muscles change their shape in response to a nerve impulse?

Answer: In order to cause the movement of muscles, muscles change their shapes and arrangement in cell in response to nervous impulse. The new arrangement of proteins thereby, give the muscle cells a shorter form and move in direction according to the mind.

Check Point 03

Q. 1. Plants do not have any nervous or muscle tissue, still, they have the ability to sense touch. How?

Answer: In plants also electrical-chemical means is used to convey the information of touch from the cells to cells. By changing the amount of water they change the shape of the plant cell and hence information about touch is transferred. This movement is known as growth independent movement and this is seen in the touch-me-not plant.

Q. 2. Plants show tropism in response to stimuli'. Comment.

Answer: Tropism means movement of the part of the plant either in the direction of the stimuli or away from the stimuli. Stimuli can be light, gravity, water or chemicals. For example, in case of phototropism means movement of part of the plant in the presence of light, in this two type of movement is seen shoots moves or grows in the direction of

light whereas in case of roots, it grows in the direction opposite to the light. So, with different stimulus plants show different tropism or directional movement.

Q. 3. What is common in plants like pea, pumpkin, and cucumber?

Answer: They all show the growth of tendrils which are sensitive to touch. When tendrils come in contact with the support, the part which is not in contact with the support tends to grow fast and tendrils circle around the object or the support and clings over the object.

Q. 4. Identify the stimulus in the following movements:

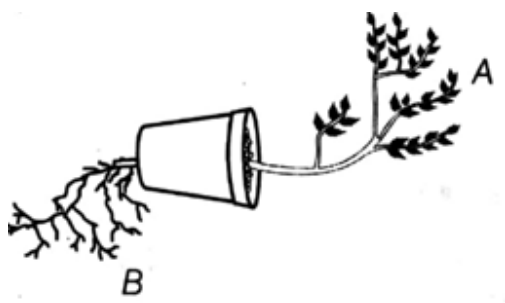
- (i) Phototropism
- (ii) Geotropism
- (iii) Chemotropism

Answer: (i) 'Photo' means light so, in phototropism light acts as the stimulus.

(ii) 'Geo' means earth or gravity so, in geotropism earth or gravity acts as the stimulus.

(iii) 'Chemo' means chemicals so, in chemotropism chemicals acts as the stimulus.

Q. 5. Observe the given figure. Identify A and B types of tropism shown by the plant.



Answer: In the given diagram, the plant is showing geotropism that is a movement of the part of the plant either in the direction of gravity or away from gravity. A shows negative geotropism or shoots are negatively geotropic as it grows away from the earth or in the opposite direction of the gravity. B shows positive geotropism or roots are positively geotropic as it grows in the direction of gravity or the earth.

Q. 6. Give an example of chemotropic movement.

Answer: Chemotropic movement means movement in the direction of the chemicals. For example, growth of pollen tube towards the ovule during fertilisation.

Check Point 04

Q. 1. Why is there a need for chemical communication in organisms?

Answer: In an organism cells cannot continuously create and transmit electrical impulses. Thus most multicellular organism use another means of communication between different cells, called the chemical communication.

In this A chemical compound is released, which would diffuse all over around the original cells. Other, cell around will detect the compound using special molecules. They can recognize and transmit the information carried by it. These compounds are called hormones.

Q. 2. How auxin helps in the bending of shoots towards a light source?

Answer: In the presence of light auxin is released or is synthesized at the tip of the shoot which helps the cells to grow. When the light comes from one side, auxin diffuse towards the shady part of the shoot. This concentration of auxin elongates the cells of the shady part of the shoot and hence it appears that the plant is bending towards the light.

Q. 3. The highest concentration of cytokinin is found in which area?

Answer: Cytokinin are the hormones which promote cell division.

Highest concentration of cytokinin is found in the areas of rapid cell division like fruits and seeds.

Q. 4. Which plant hormone is a growth inhibitor?

Answer: Absciscic acid is the growth inhibitor hormone that is it stops the growth of the plant. Because of this hormone wilting of leaves is seen.

Q. 5. How does adrenaline prepare us for the stress situations?

Answer: In stress situations adrenaline is released into the blood by adrenal glands. Its target organ is heart which as results heart rates increases so as to increase the supply of the oxygen to the muscles, blood to digestive system and skin is reduced and breathing rate increases. All these responses together prepare the body to face any stressful situation.

Q. 6. What will happen if the intake of iodine in our diet is low?

Answer: If there is iodine deficiency then production of thyroxine stops and as a result, the neck swells and this condition is known as goitre. Iodine is very important for the production of thyroxine hormone.

Q. 7. What is the significance of the feedback mechanism in the control of hormonal secretions?

Answer: Feedback mechanism makes sure that the desired amount of hormones is released. Also, it makes sure that the timing and amount of the hormones are correct. For example in the sugar level increases in the blood, insulin is secreted which decreases the amount of sugar in the blood. As the amount of sugar falls, insulin also gets reduced.

Chapter Exercise

Q. 1. Is reflex action the only function of the spinal cord. Support your answer with a single statement.

Answer: No reflex action is not only function of spinal cord; it is function of central nervous system which consists of spinal cord and brain.

Q. 2. The sensation of feeling fear of hunger is associated with which part of the brain?

Answer: Fore-brain is associated with the feeling of hunger. In fore-brain hypothalamus is responsible for this feeling.

Q. 3. Give the exact location and function of the cerebellum.

Answer: Cerebellum is located in hind-brain and is responsible for maintaining the balance and posture of the body.

Q. 4. How is geotropism necessary for the plant?

Answer: Geotropism is necessary for proper growth and orientation of a plant. It is because of geotropism that root and shoot growth in their respective directions.

Q. 5. Write one function of each

- A. Auxin**
- B. Gibberellins**

Answer: A. Auxin is a growth hormone and is responsible for cell elongation.

B. Gibberellins help in stem growth, seed germination and flowering.

Q. 6. Name the source and target organ of adrenaline.

Answer: Adrenaline is secreted by adrenal glands directly into the blood.

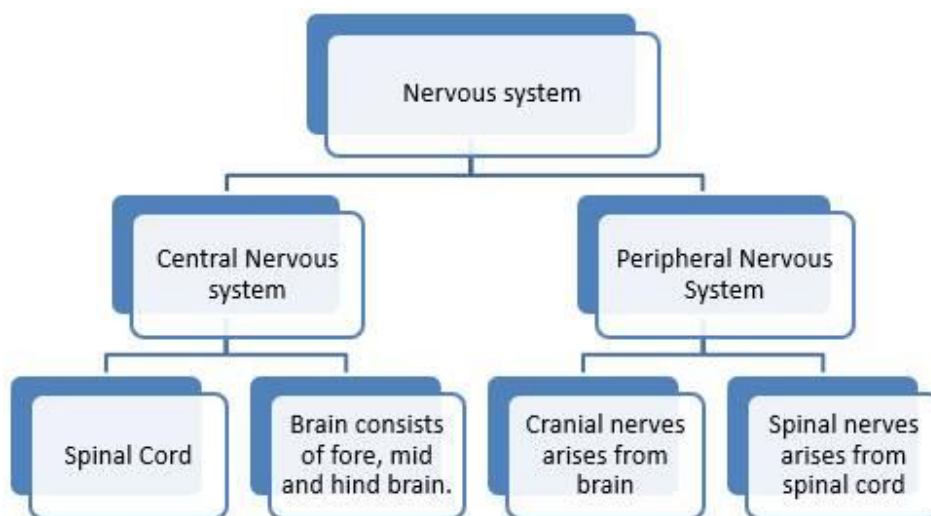
The target organ is Heart.

Q. 7. Neuron is the longest cell but does not undergo cell division. Why is it so?

Answer: Centriole is responsible for carrying out cell division but in neurons, centrioles are absent so they do not divide. Another reason why neurons don't divide is that they are linked with a brain so each time it will become difficult for the brain to reset the memory. That is why neurons do not divide.

Q. 8. Give the flow chart of the nervous system of the human beings.

Answer:



Q. 9. If the effectors are missing in the reflex arc, what will happen?

Answer: Effectors are nothing but the muscles itself. If it is absent then the movement of the hand after receiving the signal won't be possible since there is no organ to act upon the electric impulse. For example, in case we touch hot pan then in the absence of effectors, we won't be able to pull back our hand.

Q. 10. Draw a neat and well-labelled diagram of the neuromuscular junction.

OR

Draw a schematic diagram of transmission of a nerve impulse at neuromuscular junction.

Answer:

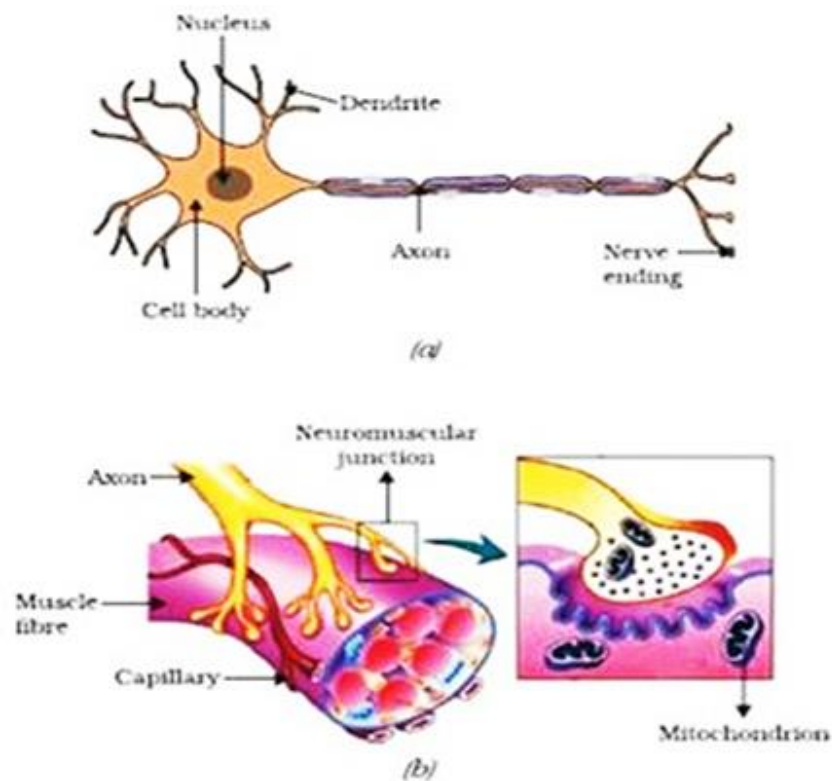
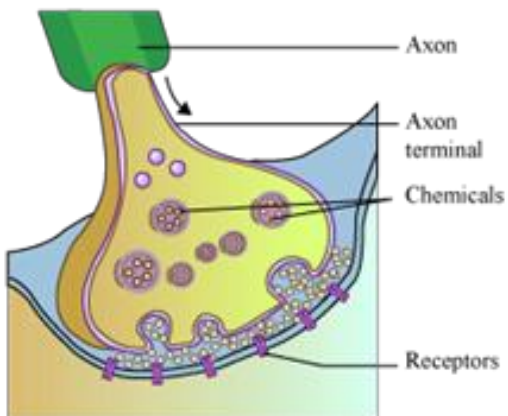


Figure 7.1 (a) Structure of neuron. (b) Neuromuscular junction

OR



Q. 11. How are the occipital lobe and the olfactory lobe of the forebrain differ from each other?

Answer: Occipital lobe of the fore-brain is for sight whereas olfactory lobe is for sense of smell.

Q. 12. Midbrain connects the forebrain and hindbrain. Write its role in CNS.

Answer: Midbrain connects forebrain to the hindbrain. It controls the movement of the head, neck and trunk to locate sounds and visual reflexes that are involved in focusing on the objects.

It controls reflex that are involved in movement of eye muscles, pupil size etc.

Q. 13. Write the type of response that occurs when an organism eats food.

Answer: When we put food in our mouth that response is a voluntary response and after that, the process of digestion and excretion comes under the involuntary response.

Q. 14. 'Tropism is directional whereas nastic movement is non-directional'. Justify this statement.

Answer: Tropism is the movement in the presence of any stimulus. If the movement is towards the stimulus then it called positive tropism and if the movement is away from the stimulus then it is called negative tropism.

In nastic movement, there is not directional movement in the presence of stimuli. These movement always occur in the particular direction irrespective of the type of stimuli.

Q. 15. Do organisms have hormones, who control their directional growth? Justify.

Answer: Plants have auxin which is synthesized at the tip of the shoot and it is responsible for the directional growth of the shoot towards the light. In the presence of light auxin is released or is synthesized at the tip of the shoot which helps the cells to grow. When the light comes from one side, auxin diffuse towards the shady part of the shoot. This concentration of auxin elongates the cells of the shady part of the shoot and hence it appears that the plant is bending towards the light.

Q. 16. 'Pancreas' is the overall controller of the blood glucose level. Give your views.

Answer: Pancreas produce insulin which helps in maintaining the blood glucose level in the body. When glucose level increases pancreas produced insulin which makes sure that cells take up glucose from the blood. Soon blood glucose level starts to drop and as it decreases the production of insulin also decreases.

Q. 17. 'There is a close coordination between nerves and hormones'. Explain in brief.

Answer: Hypothalamus is part of hind-brain. So it becomes the part of CNS and is responsible for maintaining the homeostasis of the body. Also, it is responsible for secreting the hormones in the human body. So because of the hypothalamus there is close coordination between nerves and hormones. Also when adrenaline is released

into the blood supply of oxygen increases to the muscle which helps to run and is made of nerves. So nerves and hormones together work in case of stress.

Q. 18. What are receptors with reference to the nervous system? List three types of receptors and mention their functions. How do receptors pass the information to the brain?

Answer: Receptors are tissues which are capable of receiving any stimuli and start the impulse which is passed to the CNS.

Three types of receptors are: -

1. Olfactory receptor: - They detect the smell
2. Gustatory receptor: - They detect the taste
3. Thermoreceptor: - they detect the temperature of the outer world.

Receptor through sensory-motor passes the information to the spinal cord which then sends the information to the brain.

Q. 19. Following are the two examples of plant movement.



(i) Which stimulus is common for movement in both the cases?

(ii) Does the movement take place towards the point where the stimulus is received? Mention separately for both plants.

(iii) Give one reason for the movement in each case.

Answer: (i) In both the cases stimulus of touch is same.

(ii) In the mimosa plant, the movements of leaves are in the opposite direction to the touch. On touching the leaves, they curl up towards the stem.

This is because plant cells change their shape by changing the amount of water in them. This happens due to swelling or shrinking of cells.

In case of the pea plant, tendrils cling over the object or the support so the movement takes place in the direction of the stimulus.

(iii) In mimosa plant, this movement is seen because of the change in concentration of water in the leaves.

In pea plant, this movement is seen because of the rapid growth of that part of a tendril which is away from the stimulus or the support.

Q. 20. A plant in the laboratory is given an increased dose of a hormone, which promotes the development of seedless fruits. Identify the hormone and write its other two functions.

Answer: Auxin is given in an increased dose which promotes the development of seedless fruits. Other functions of auxin are: it is responsible for elongation of cells at the shoot tip and also is responsible for showing positive phototropism.

Q. 21. A boy runs on seeing a stray dog. His breathing rate becomes very fast and blood pressure also increases.

(i) Name the hormone found to be high in his blood and the gland which produces it.

(ii) What other effects are caused by this hormone?

Answer: (i) In this case adrenaline hormone will be highest in the blood. It is produced by the adrenal gland.

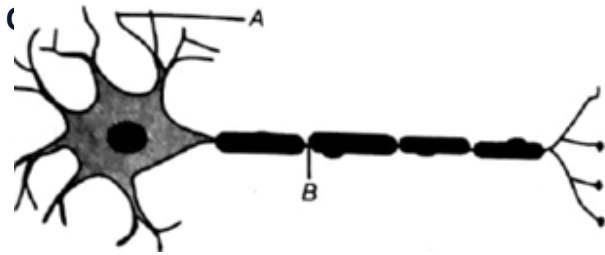
(ii) Supply of blood to digestive system and skin is reduced, supply of oxygen increased towards the muscles and also the blood supply to the heart is increased.

Q. 22. Adrenal glands are located on top of each kidney. What will happen if these glands do not secrete adrenaline?

Answer: If these glands do not secrete adrenaline then our body won't get prepared for stressful situations. Also, there are many disorders like Addison's disorder which a person might have to face such disorders.

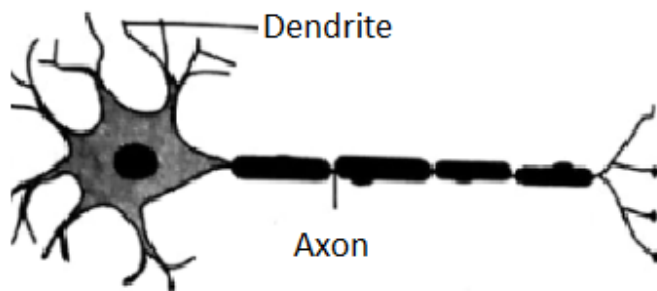
Q. 23. The feedback mechanism is an important aspect of hormonal coordination. Explain.

Answer: Yes feedback mechanism is a very important aspect of hormonal co-ordination as it is responsible for making sure that the desired amount of hormones is released. Also, it makes sure that the timing and amount of the hormones are correct. For example in the sugar level increases in the blood, insulin is secreted which decreases the amount of sugar in the blood. As the amount of sugar falls, insulin also gets reduced.



- (i) Name the parts labelled as A and B in the diagram given above.
- (ii) Which part acquires the information in the neuron?
- (iii) Through which part does the information travel?
- (iv) In what form does the information travel?
- (v) Where is the impulse converted into a chemical signal for onward transmission?

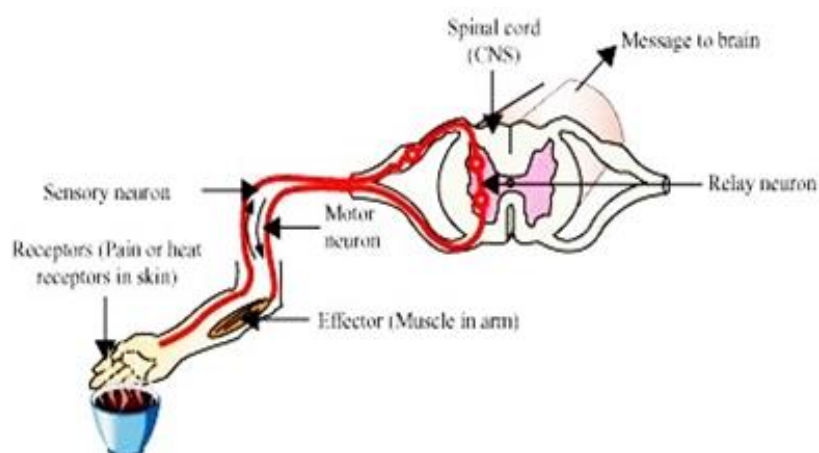
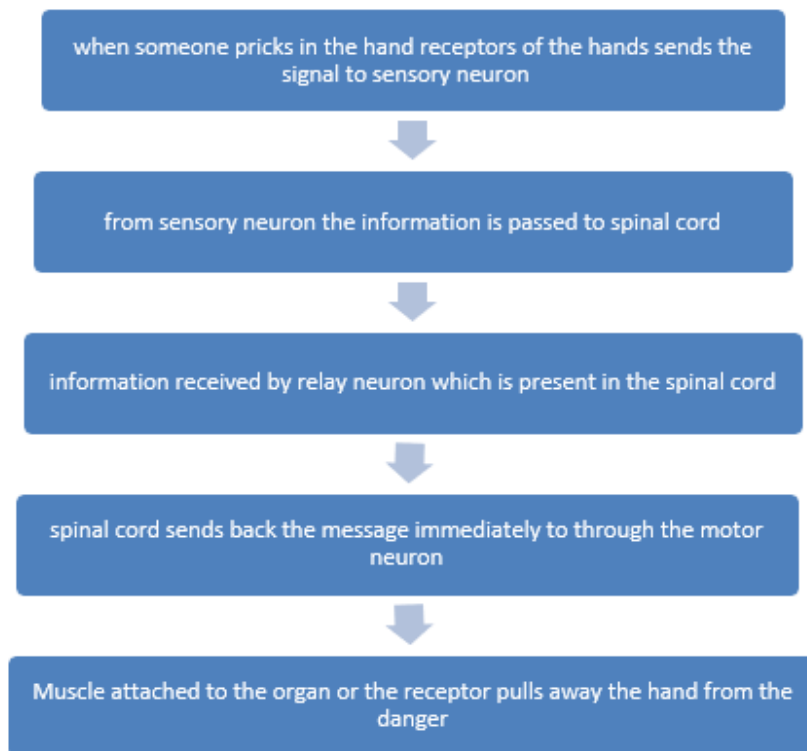
Answer:



- (i) A is dendrite and B is axon.
- (ii) Part A that is dendrite acquires the information in the neuron.
- (iii) Through part B that is axon the information travels.
- (iv) The information travels in the electrical impulse.
- (v) At the nerve ending the impulse is converted into a chemical signal.

Q. 25. With the help of a labelled diagram, illustrate the pathway of response when someone pricks in your hand with a pin.

Answer:

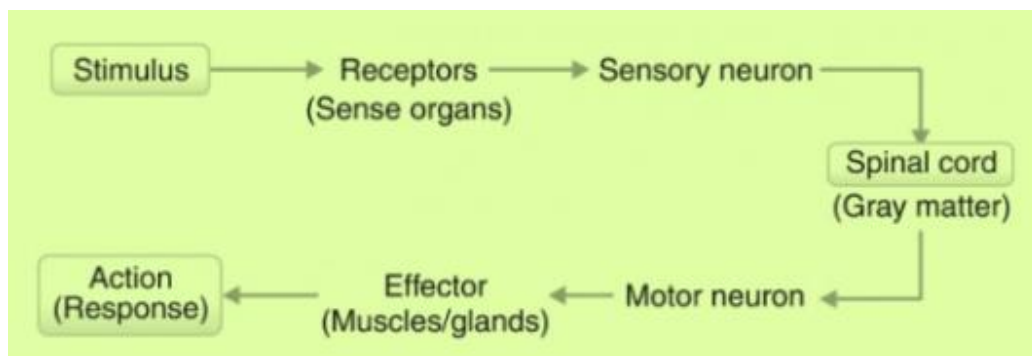


Q. 26. (i) A nerve input signal travelled only up to the spinal cord and gave output signal for a response. What type of action did the body show-voluntary or involuntary?

(ii) Draw a nerve pathway for the above action and suggest specific terms for input nerve and output nerve.

Answer: (i) When a nerve input signal travelled only up to the spinal cord and gave output signal for a response, then such type of action is called an involuntary action. An involuntary action occurs without the conscience of the organism.

(ii) The nerve pathway is shown below:



Q. 27. Nerves and hormones both are used to control processes within the body. Using examples, show how nervous control and hormonal control.

- (i) resemble and
(ii) differ from one another.

Answer: (i) Hypothalamus is part of hind-brain. So it becomes the part of CNS and is responsible for maintaining the homeostasis of the body. Also, it is responsible for secreting the hormones in the human body. So because of the hypothalamus there is close coordination between nerves and hormones. Also when adrenaline is released into the blood supply of oxygen increases to the muscle which helps to run and is made of nerves. So nerves and hormones together work in case of stress.

(ii) Differences: -

Nervous control	Hormonal control
• Mode of communication is electrical	• Mode of communication is chemical.
• Fast	• Slow
• Can reach cells on those which are connected by nerves	• Can travel in the full body and reach all the parts of the body.

Q. 28. (i) Suggest an explanation for the fact that the chemicals produced by endocrine glands are usually in the form of small molecules.

(ii) Write any three endocrine glands and chemically produced by them.

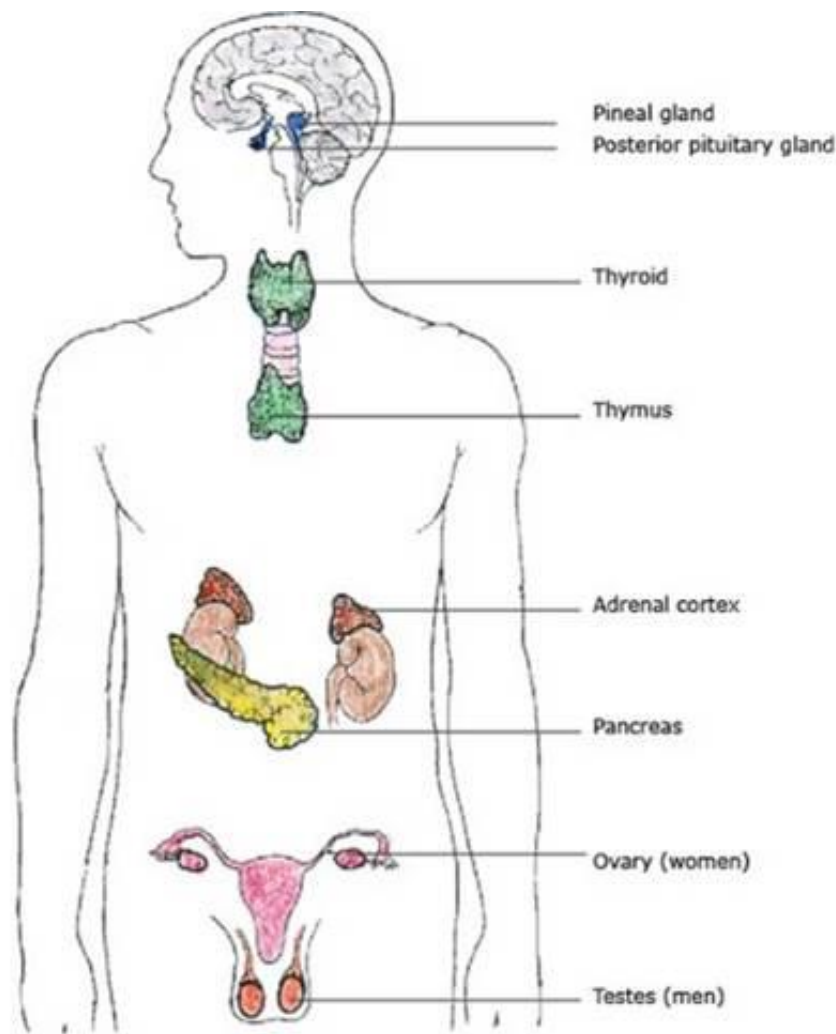
Answer: (i) The endocrine system is a control system of ductless glands that secrete hormones directly through blood. Thus, a smaller size helps in easy diffusion through the blood. Moreover, the endocrine molecules are basically responsible for chemical

communication in an organism. These glands secrete special small molecules which need to be diffused with cells of target organs to detect them with special molecules. Thus, to make the process of diffusion faster in the target organ cells. Hence these hormones consist of small molecules.

(ii) The three endocrine glands and the chemicals they produce are:

1. Pineal gland - It produces melatonin. It is the hormone that affects the sleeping patterns.
2. Thyroid – This gland produces hormones which regulate the heart rate, the rate of metabolism and affect the growth.
3. Pituitary gland – The most important gland, that produces more than 9 hormones – example - thyroid stimulating hormone (TSH).

The organs of endocrine glands are shown here:



Organs of the Endocrine System

Q. 29. An endocrine gland P is located below the stomach in the human body. The gland P secretes a hormone H. The deficiency of hormone H in the body leads to a rise in blood sugar, due to which a disease D is caused.

Answer: P is pancreas. H is insulin. D is diabetes or high blood sugar level.

Q. 30. Ramesh a class X student, goes with his mother to bring milk from a nearby dairy farm. On a number of occasions, he had seen the dairy owner giving an injection to the buffalo before milking. Ramesh being concerned discussed with the dairy owner, about the harmful effects of such practice. Read the above passage and answer the following questions.

(i) Which chemical was being injected by dairy owner in buffalo before milking it and why?

(ii) What other major functions this chemical performs in buffalo or adult human

females? Also, list two common terms used for the chemical based on its functions.

(iii) Why should such practice be discouraged? Comment.

(iv) What values were shown by Ramesh?

Answer: (i) Progesterone was being injected in buffalo to increase the milk production.

(ii) Progesterone is responsible maintain the menstrual cycle in the women. Milk-producing and sex hormone.

(iii) This practice should be discouraged as it may affect the buffalo as well as the quality of milk which can have an adverse effect on us.

(iv) Responsible, good knowledge skills and aware.

Q. 31. Recently. The science teacher discussed with students 'Control and Coordination in Animals'. He told children that two systems, i.e. the nervous system and endocrine system help to regulate all body functions. He also told becoming addict to alcohol drinking and how alcohol is affecting their body.

Read the above passage and answer the following questions.

(i) Which hormones are responsible for the onset of adolescence

(ii) How does alcohol drinking affect the nervous system?

(iii) What role the government should play to check alcohol drinking especially by adolescents? Give at least two suggestions.

(iv) What values were shown by the teacher?

Answer: (i) Hormones like testosterone and estrogen are responsible for the onset of adolescence.

(ii) Alcohol acts as a depressant and it slows down the working of the nerves cell and also the activity of CNS.

(iii) A. The government should make sure that all the liquor shops should not give drinks without checking the id card.

B. Should run awareness campaigns.

(iv) Responsible, knowledgeable and concerned.

Q. 32. In order for quick harvest, a farmer added product A in the field. Later, the effects of another product were observed, i.e. wilting of leaves and dormancy in seeds. Read the above passage and answer the following questions.

- (i) What is the name of product A? List its two functions.
- (ii) Can you guess what was applied instead of product A? What is its mode of action?
- (iii) Can you suggest two naturally occurring plant hormones and their actions?
- (iv) What values should be present in agricultural practitioners?

Answer: (i) Absciscic acid is product A. Its functions are cell division (in fruits and seeds) and breaking of seed dormancy.

(ii) Absciscic acid. It inhibits the growth.

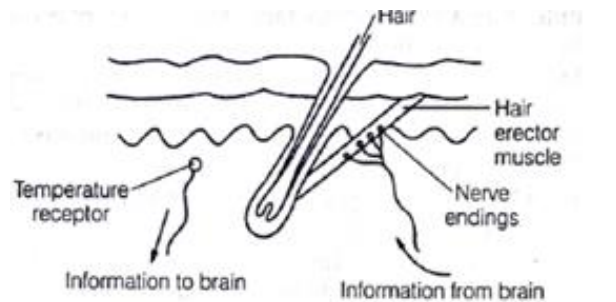
(iii) Auxin – elongation of cells and promotes the growth of seedless fruits.

Gibberellins – stem growth, seed germination and flowering.

(iv) Values like honesty and responsibility should be present in agricultural practitioners.

Challengers

Q. 1. The given diagrams shown some of the features of human skin.

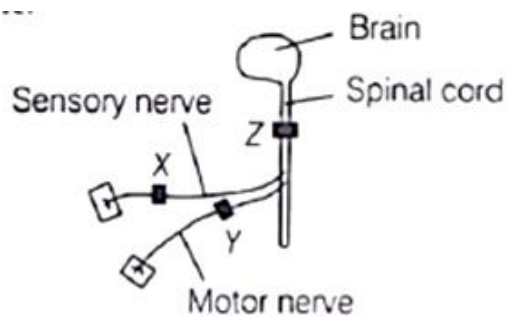


Which part of the brain coordinates the information labeled in the diagram?

- A. Medulla
- B. Hypothalamus
- C. Cerebrum
- D. Cerebellum

Answer: In this both nerves and hormonal function is involved so the only part which handles the both is hypothalamus.

Q. 2. The diagram shows the central nervous system, which has been blocked in three different places by a drug used as an anaesthetic.

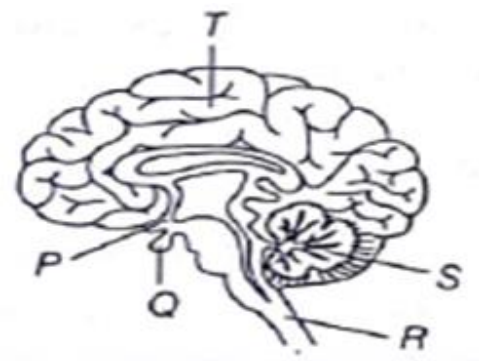


Three men had one unaesthetic block at X,Y or A. One of the men can move his leg in response to a pinprick, but does not feel it. Where is the anesthetic block in this man?

- A. At x
- B. At y
- C. At Z
- D. No block

Answer: At Z because the message does not reached the brain cells and as a result the man cannot feel it.

Q. 3. Observe the figure given below. In the figure, some parts are labeled as P,Q,R,S and T. Given below are functions associated with these parts.



Parts of brain	Functions
P	Master hormone producers
Q	Controls body temperature
R	Controls unconscious activities
S	Helps to control balance
T	In conscious behaviour

Which part of the brain is matched with incorrect function?

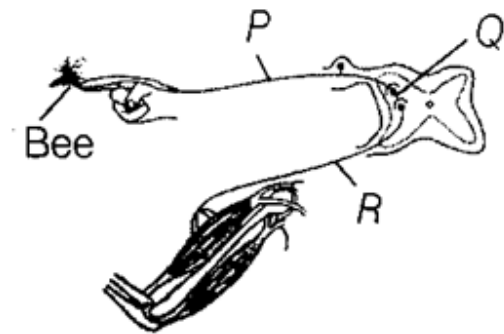
- A. p and S
- B. P, Q and T
- C. R and T
- D. P, R and T

Answer: Function of P – Master hormone

Function of Q – Q is pituitary gland and it is responsible for secreting hormones.

Function of T – Centre of conscious behavior

Q. 4. The diagram shows a reflex arc in which a bee sting causes the arm to be moved quickly?



If the relay neuron is damaged, how will the transmission of nerve impulses in the reflex are be affected?

- A. Impulses cannot pass from p- Q
- B. Impulses cannot pass from p- R
- C. Impulses cannot pass from Q- P
- D. Impulses cannot pass from R- Q

Answer: If relay neuron is damaged, the impulse cannot pass from R-Q

Q. 5. Adrenaline hormone is secreted in the body during emergency situations. What would be the effects of increased concentration of adrenaline on body?

	<i>Concentration of glycogen in the liver</i>	<i>Concentration of glucose in the blood</i>
(a)	Decrease	Increase
(b)	Increase	Increase
(c)	No effect	Decrease
(d)	Increase	No effect

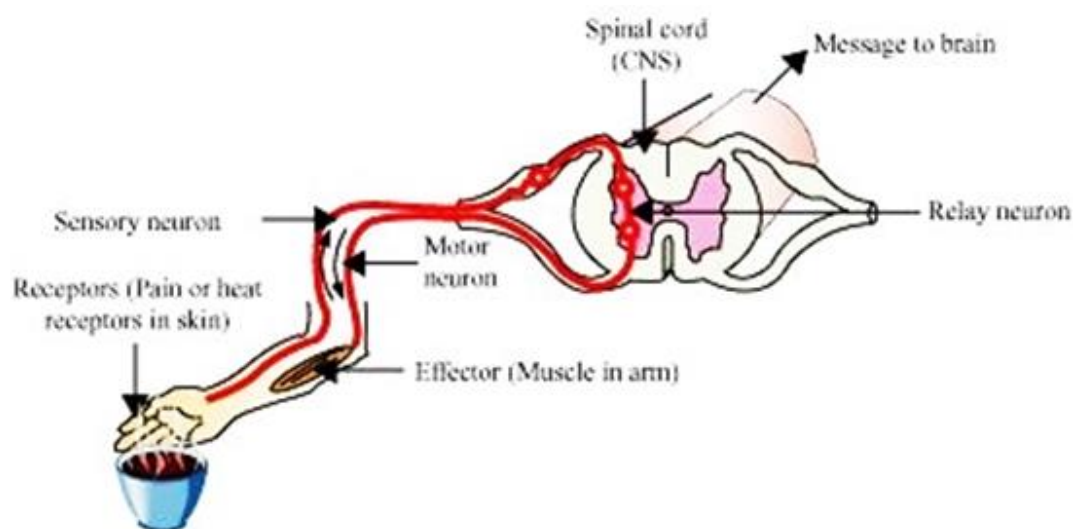
- A. (a)
- B. (b)
- C. (c)
- D. (d)

Answer: Because when adrenaline is secreted the blood supply to digestive system decreases and so concentration in liver decreases and whereas blood flow increases so the all undigested food concentration of glucose in blood increases.

Q. 6. A child is frightened by a loud noise and shouts for help. In which order the different types of neurons in neurons involved will act?

- A. Motor neurone → relay neurone → sensory neurone
- B. Motor neurone → sensory neurone → relay neurone
- C. Sensory neurone → motor neurone → relay neurone
- D. Sensory neurone → relay neurone → motor neurone

Answer: From the receptor the information passes from sensory neuron to relay neuron and then to motor neuron.



Q. 7. Following are certain reflex actions occurring in our body.

- I. Moving to the side of road when a speeding car approaches.
ii. Closing of eyes in response to a sudden bright light.
iii. Shouting when we are suddenly disturbed or get scared
iv. Withdrawing hands on touching a hot surface. The reflex is given below, will be occurring for,



- A. I and II
B. I,II and III
C. I,II,III and Iv
D. Only II and IV

Answer: Because all are the examples of reflex action. In all the examples a sudden response is given to stimuli.

How do Organisms Reproduce?

Check Point 01

Q. 1. Name the blueprint responsible for making all basic body designs.

Answer: DNA (Deoxyribonucleic acid) is considered as the blueprint for making all basic design of an organism.

The DNA is present in the nucleus of a cell in the form of a condensed structure called chromosome.

Q. 2. Incorrect DNA copying can alter the reproduction process. List the effect of such a case.

Answer: When DNA replication occurs, due to some natural or artificial conditions wrong nucleotide base pairs could get attached and this may lead to “mutations.”

Now, these mutations could be non-harmful or harmful depending upon the sequence of DNA in which it occurred. One such example is “Down syndrome” in which there exists an extra copy of chromosome number 21 leading to several abnormalities.

Q. 3. What is the significance of body design in determining the habitat of an organism?

Answer: Body design/ morphology of an organism defines the way how much he is fitted or suitable for a specific habitat. E.g.- a bacteria doesn't need big houses or area to survive and also it's nutritional requirements are very less but humans, on the other hand, need much larger space and have complex nutrition system. A fish can survive under water because of gills but a bird or human cannot.

Q. 4. An existing population of birds was suddenly wiped out from an area. Give a suitable reason for the same.

Answer: There could be numerous causes for this,

a) There was some natural calamity like tornado or storm that caused it.

b) - There was no food left for those birds in that area.

c) - Due to human intervention environment in that area, survival became unsuitable for them.

d) The population of their predator might have grown huge which ate all birds.

But taking into consideration, it was a mass extinction which occurs mostly due to environmental factors.

Q. 5. How does the reproduction process can be classified on the basis of germ cells involved?

Answer: On the basis of germ cells involved reproduction is of 2 Types,

a) Asexual reproduction: A single parent organism reproduces by the fragmentation of the cell of the parent organism to form daughter organism, thus includes processes like fission, budding, fragmentation, regeneration. E.g.:- Hydra, Yeast reproduce by the mode of asexual reproduction.

b) Sexual reproduction: - It involves the fusion of gametes from 2 sexually opposite parents one of them is called male, and other is female. E.g.: - mammals, plants reproduce by the mode of sexual reproduction.

Q. 6. Give one advantage of the asexual mode of reproduction.

Answer: Asexual mode of reproduction occurs very fast as it include processes like budding, fission, etc. While the sexual mode is very slow. Clones can be produced by asexual mode of reproduction but sexual mode cannot produce clones since there is a step called crossing over during cell division in sexual reproduction that leads to variations.

Q. 7. Give one difference between sexual and asexual reproduction.

Answer: Asexual reproduction does not involve fusion of male and female gametes thus zygote formation doesn't take place, and it is a quick method of reproduction while in sexual reproduction fusion of male and female gametes occur, and then zygote is formed, and these processes take a lot of time.

Check Point 02

Q. 1. Name the mode of reproduction occurring in Amoeba.

Answer: "Binary fission"

In this, the cytoplasm and nucleus of parent cell divide equally into two daughter cells, and no mitosis occur.

Q. 2. "Multicellular organisms can also reproduce asexually." Give an example to support the above statement.

Answer: Yes, basically asexual mode of reproduction involves only 1 parent and processes like meiosis, gamete production, fertilization, parthenogenesis, and transfer of gametes between two individuals does not occur,

In fungi and algae spores like zoospores, conidia, etc, are formed asexually.

Also in plants, vegetative reproduction in which a specific plant part, e.g. - eyes in potato, bulbils tubers, etc. can form a complete plant and is another example of asexual reproduction in multicellular organisms.

Q. 3. A student noticed that an organism by mistake was cut into parts. After some time, both developed into new individuals.

(i) Name the mode of reproduction followed by the organism.

(ii) Give an example of organism which multiply by this process.

Answer: i) Mode of reproduction followed here is Regeneration.

In some organisms, each body cell possesses the ability to proliferate and form a complete body.

ii) e.g.- Planaria, Hydra

Q. 4. A plant that has lost the capacity to produce seed. Name a process using which it can reproduce?

Answer: "Vegetative reproduction"

Plant body parts like roots, tubers, bulbils, stem, leaves, buds possess the ability to proliferate into parent plant if grown under correct conditions and the property is called "Totipotency".

Q. 5. Name the kind of organisms that reproduce by spore formation.

Answer: Mostly lower organisms like algae, fungi, and bacteria lead to spore formation.

E.g.- Albugo, Phytophthora.

Q. 6. What are the advantages of vegetative propagation?

Answer: a) Maintain genetic stability. The plants produced are generically similar to the parent plant and have all its characteristics.

b) Plants raised by vegetative propagation can bear flowers and fruit earlier than those produced seeds.

c) It also makes possible the propagation of plants such as banana, orange, rose and jasmine, which have less capacity to produce seeds.

Q. 7. Name two plants which are grown by the technique of tissue culture.

Answer: Tissue culture is a technique in which a plant tissue can be used to generate a complete plant under lab conditions.

E.g.:- Orchids, Nepenthes

Q. 8. Why do spores remain viable during unfavorable conditions?

Answer: Sporulation occurs under an unfavorable environment like high temperature, pH., etc. Where a normal cell cannot survive. So bacteria and fungi can convert their cells into a spore. These spores have all the nutrition required for growth but have very less water content which makes it hard and unreactive to the harsh environment. Also, some spores have an extra protective covering of lipids, polysaccharides or some proteinaceous substance that makes it withstand the harsh environment.

Check Point 03

Q. 1. What is Zygote?

Answer: Zygote is the product when male and female gametes fuse under sexual reproduction. This zygote is diploid mostly and develops into a whole new organism.

Q. 2. Give one difference between bisexual and unisexual flowers.

Answer: Most plants have both male and female reproductive organs in the same flower and are known as bisexual flowers, E.g lily, rose, Hibiscus, mustard, etc. While others have either male or female reproductive parts in a flower known as unisexual flowers, E.g papaya, watermelon, etc.

Q. 3. What constitutes a female reproductive part in a flower?

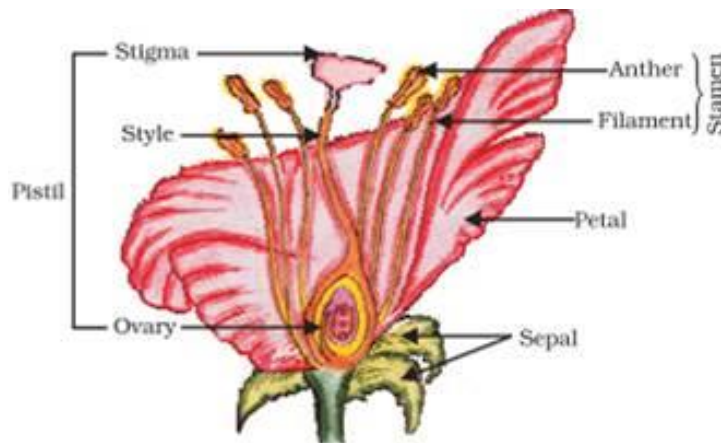
Answer: Carpel is the female reproductive part in plants.

This Gynoecium consists of three parts,

- **Stigma:** It is the terminal part of carpel which may be sticky. It helps in receiving the pollen grains.

- **Style:** It is the middle elongated part of carpel. It helps in the attachment of stigma to the ovary.
- **Ovary:** It is the swollen bottom part of carpel. It contains ovule having an egg cell.

The diagram is shown below:



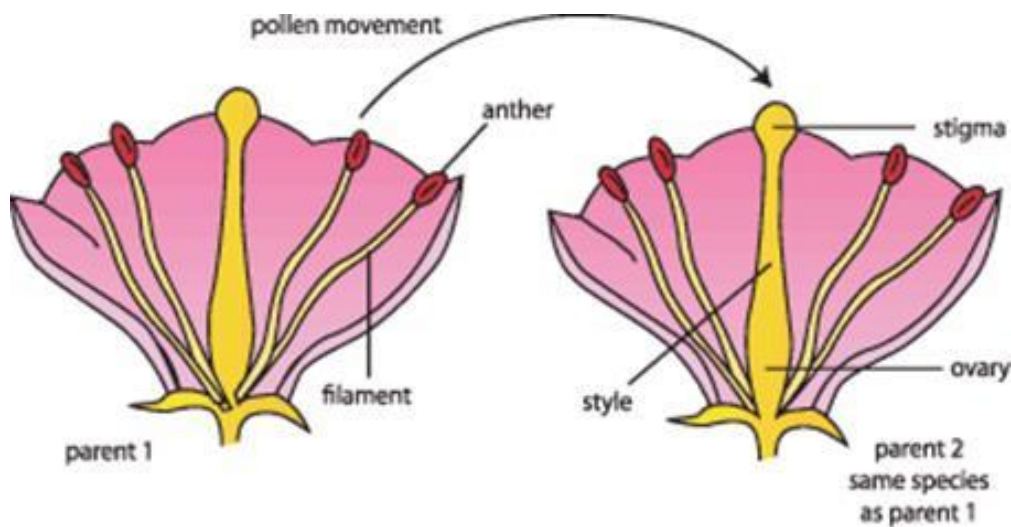
Q. 4. What are various agents of pollination?

Answer: Pollinators could be,

- Biotic pollinators:** - These include living organisms such as animals, insects, and humans.
- Abiotic pollinators:** - These include non-living vectors or natural carriers such as wind, water, gravity, fire etc.

Q. 5. State one reason why cross-pollination is preferred over self-pollination.

Answer: Cross-pollination is the transfer of pollen from the flower of one plant to the stigma of the flower of another plant, as shown below:



Due to this, cross-pollination brings about recombination, variations, helps in the production of new varieties and disease resistant plants.

Q. 6

Where can zygote be found in flower after fertilization?

Answer

After the fertilization process is done, i.e. male nucleus from pollen fused with a female nucleus in the egg cell inside ovary of a flower, this newly fertilized egg develops into zygote inside the ovary.

Q. 7. 'The seed contains the future plant.' Why is it said so?

Answer: After fertilization, ovules develop into seeds. These seeds could be monocot (with one cotyledon) or dicot (with two cotyledons) depending upon the plant variety. These seeds contain the embryo, plumule, and radicle. Plumule develops in to shoot while Radicle develops into roots.

Q. 8. The fruit is developed from which floral part?

Answer: Ovary of the flower develops into fruit after fertilization.

Check Point 04

Q. 1. What changes take place in boys during the reproductive phase?

Answer: In boys puberty starts near 14-15 years of age.

During this phase,

- Body is larger, more muscular, and stronger.
- Beard, moustache and chest hairs start appearing.
- Shoulders become broad.
- Voice becomes low pitched.
- Behavior becomes a little aggressive because of a spike in testosterone levels.
- Development of Adam's apple is there.

Q. 2. What is responsible for attainment of sexual maturity in both males and females?

Answer: Sexual maturity is attained due to the secretions of sex organs “testis” and “ovaries” in males and females respectively.

These secretions are Testosterone (male sex hormone) and Progesterone and Estrogen (female sex hormones) at puberty.

Q. 3. Sperms are produced in testis, how do they reach the urethra for further passage into the female reproductive tract?

Answer: Testis are connected to the urethra with the help of a 40 cm long tube-like structure called "Vasa Deferentia". It is slightly coiled at first near testis but then becomes straight as it enters the abdominal cavity where it passes over urinary bladder and joins to the urethra.

Q. 4. What is the function of testosterone in males?

Answer: Testosterone is the male sex hormone called “Androgen”. Testosterone's secretions are at peak during male puberty and it is responsible for bringing about all the reproductive changes like beard, muscular body, penis enlargement, pubic hairs, etc.

Q. 5. Name the organ responsible for secreting seminal fluid.

Answer: Seminal fluid is the combination of secretions from accessory sex glands and mucus gland to the sperms i.e. sperms together with secretions from seminal vesicles, prostate gland, preputial gland and Cowper's gland form a seminal fluid.

Q. 6. What is the function of the Fallopian tube in the female reproductive system?

Answer: Fallopian tube or oviducts is about 10 to 12 cm long muscular tube. It has a funnel shaped opening near the ovary.

It carries ova or egg from ovary to the uterus and is the site of fertilization.

Q. 7. What is placenta? Discuss its role in the human body.

Answer: Placenta is a reddish brown disc that attaches to the wall of the uterus and the umbilical cord arises from it. Placenta form finger like projection called the villi toward embryo. This creates large surface for the exchange of glucose and oxygen between mother and the embryo.

Q. 8. What happens when fertilization does not occur in a female body?

Answer: In female, ovaries release ovum or egg once every 28 days from the age of puberty. The uterus prepares itself every month to receive a fertilized egg. Thus, its lining becomes thick and spongy. If the egg is not fertilized it lives for about one day. Afterwards this lining of uterus is no longer required and menstruation occurs.

Menstrual is the time of uterine bleeding in which an unfertilized egg and the thick uterine lining. It occurs through the vagina as blood and mucus.

Chapter Exercise

Q. 1. Name the individual units of floral whorls.

Answer: "Sepal" is the individual leaf segment of the calyx.

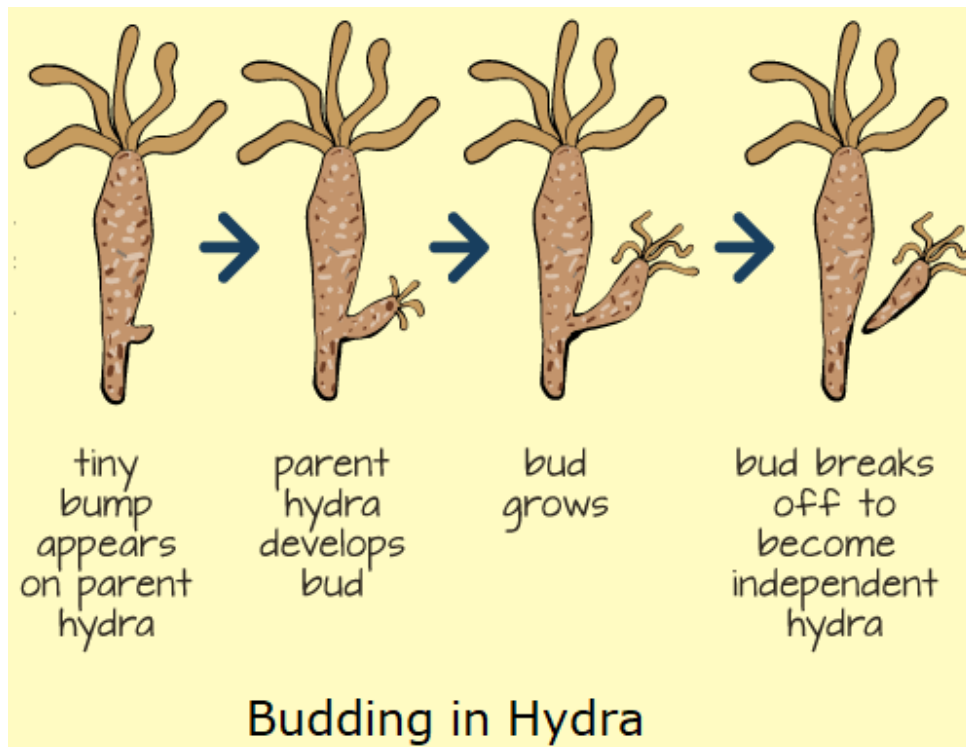
Q. 2. What type of cell division occurs in Plasmodium during reproduction?

Answer: Multiple fission occur in which parent cell is divides into multiple identical daughter organism at the same time.

Q. 3. What will happen if Hydra is cut into many pieces?

Answer: Hydra reproduce by the mode of "Budding" which is a type of asexual reproduction.

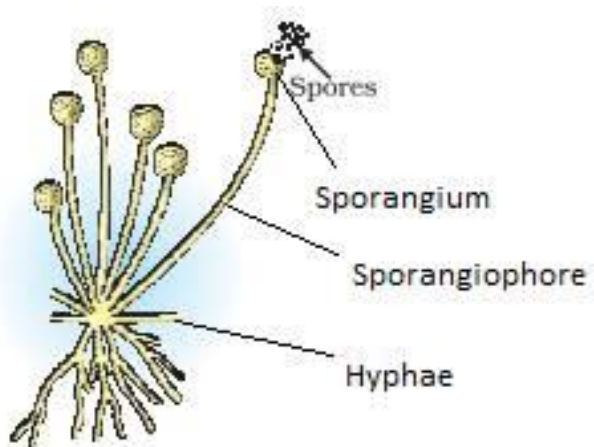
When Hydra is divided into pieces, each part acts as a bud. Each bud grows and gradually assumes the form and size of the parent.



Q. 4. Some of the fungal hyphae are aerial and bear black blobs. What are these bulb-like structures on sticks called in Rhizopus?

Answer: These structures are called "Sporangiospores".

A sporangium is an outside covering containing these spores, these are non-motile and are dispersed by wind. When germinated form new mycelium.



Q. 5. Write the dual purposes served by urethra in males.

Answer: Human penis conducts urine as well as semen, but the two cannot pass at the same time.

The urethra acts as a common passage for both the sperm and urine.

Q. 6. Delivery of sperms from where they are produced to the urethra is facilitated by which part?

Answer: Sperms are produced in the "Testis".

From the testis, they reach urethra via vasa differentia, epididymis and then vasa deferens which is a 40 cm long tube, joins and release the secretions in the urethra.

Q. 7. Which one is one STD among the following? AIDS, diarrhea, genital warts, syphilis.

Answer: AIDS

STD is "sexually transmitted disease". Out of all only AIDS is transmitted via. Sexual contact between an HIV positive and normal person.

Q. 8. Is variation more beneficial for the species or for the population? How?

Answer: Variations is more beneficial for the species than for the population. During reproduction, copying of DNA takes place which is not 100% accurate, thereby causing variations are favourable they help the individuals to survive and pass there, variations to their progeny. Depending upon the nature of variations, different individuals have different upon the nature of variations, different individual have different advantages, which promotes their survival like bacteria which can withstand heat will survive better in heat wave.

Q. 9. What is the part played by stamens and carpels in sexual reproduction?

Answer: "Stamens" and "Carpels" are male and female reproductive parts of a flower respectively. Stamens lead to the formation of pollen grains while carpels include three parts which are stigma style and ovary. During sexual reproduction, it is the process of fusion of male germ cell with the female gametes. It gives rise to zygote. The pollen lands on suitable stigma, it reaches the female ferm cells in ovary. The pollen tube grows out of the pollen grain, travels through the style and finally reaches the ovary.

Q. 10. Why is cross-pollination considered to be superior to self-pollination?

Answer: Cross-pollination is superior to self-pollination in ways mentioned below,

- It brings about genetic recombination and production of new varieties.

- Cross-pollination results in healthy and stronger offspring.
- Variations are caused due to this.
- It leads to the production of seed in self-sterile plants.

Q. 11. Differentiate between an ovum and a zygote.

Answer: The following table gives the difference between ovum and zygote:

Ovum	Zygote
The female gamete is called ovum. Also called as an egg.	It is the product formed by the fusion of male and female gametes
During fertilization the ovum and sperm fuse to form zygote.	After fertilization zygote divides many times and embryo is formed within ovule.
Ovum is present in an immature form in all the female	Zygote is fertilized egg or ovum

Q. 12. Explain some changes seen in boys during puberty.

Answer: In boys puberty starts near 14-15 years of age. During this phase testosterone level spikes and is responsible for all the changes which are,

- Body is larger, more muscular, and stronger.
- Beard, moustache and chest hairs start appearing.
- Shoulders become broad.
- Voice becomes low pitched.
- Behavior becomes a little aggressive because of a spike in testosterone levels.
- Development of Adam's apple is there.
- Enlargement of the penis and appearance of pubic hairs.

Q. 13. Give an example of IUCD for females? What is its mechanism of action?

Answer: “Copper-T” is an example of IUCD for female.

These devices are placed in the uterus of the female by a doctor. The copper-T shaped device made of copper inserted into the uterine cavity by a doctor or nurse and left there for certain period for the contraception purpose. It works by stopping the egg and the sperm surviving in the fallopian tubes can also prevent the fertilized egg implanting in the womb.

The copper in copper-T act as a spermicides within uterus also.

Q. 14. Name one STD caused by a bacterial infection and one by a viral infection. How can these be prevented?

Answer: Gonorrhea and syphilis are caused by bacterial infection while HIV and Genital warts is a viral STD.

In order to prevent STD'S,

- One must avoid having copulation with an unknown person or an infected person
- Always use protection
- Avoid any instances that include the transfusion of blood.
- Do not share infected needles or surgical instruments with an infected person

Q. 15. The normal body growth slows down, and reproductive tissues begin to mature during puberty? Give reason.

Answer: Normal growth is controlled initially by growth hormones and thyroid but during puberty, a third factor comes into the consideration which is sex hormones. In males, between the age of 10 to 13 puberty begins and lasts till 16 to 18 years of age while in girls puberty starts at around 11 to Twelve years of age and lasts till 16 to 17.

During this period of puberty, the growth of body is controlled by the sex hormones and the normal body growth becomes very slow because the sex hormones tend to emphasize more on reproductive tissues than rest of body.

Q. 16. Give a few characteristics of asexual reproduction.

Answer: Production of offspring by a single parent without the formation and fusion of gametes are called asexual reproduction.

Characteristics of asexual reproduction.

1. It is a rapid mode of multiplication.
2. Cell division takes place either mitotically or asexually.

3. The new individuals produced after cell division are always genetically identical or clone to their parents.

4. A single parent is involved, i.e opposite sexes are not involved.

5. It does not involve the fusion of gametes.

Q. 17. When is vegetative propagation used? Name any three methods of vegetative propagation.

Answer: Vegetative propagation is a form of asexual reproduction that occurs in plants.

There are certain parts of plants that possess the ability to get developed into a complete parent plant when they are grown under correct nutrition.

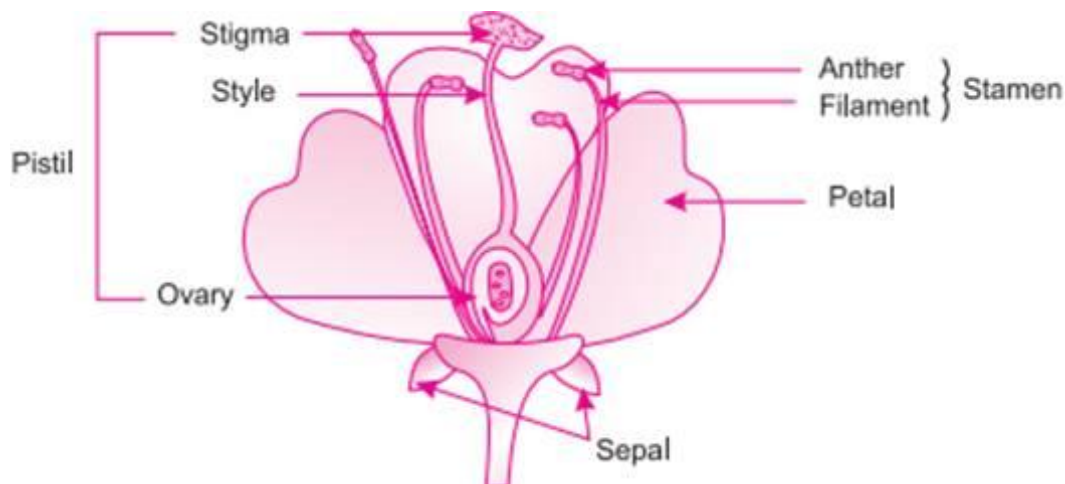
Plant parts such as roots, stem, leaves, buds flowers, anthers and ovary possesses the ability to get developed into a complete parent plant tassels possesses a special property called as “totipotency” which is responsible for this phenomenon.

Now there are certain methods of vegetative propagation which includes

- Grafting
- Cuttings
- Mound layering
- Side grafting
- Wedge grafting
- Propagation by plant tissue culture or also called as micro propagation.

Q. 18. Draw a neat and labeled diagram showing longitudinal section of a bisexual flower.

Answer: The answer is given below:



Stamen and carpels are the reproductive parts of a flower.

Stamen: It is the male reproductive part of the flower.

Anther: It is bilobed structure containing two pollen sacs present at tips of stamen. These produces pollen grains that are yellowish in colour.

Carpel: It is the female reproductive part, which is present in the flower center.

Stigma: it is terminal part of carpel which may be sticky. It helps in receiving the pollen grains during pollination.

Style: it is the middle elongated part of the carpel. It helps in the attachment of stigma to the ovary.

Ovary: It is the swollen bottom part of carpel. It contain ovules having an egg cell.

Q. 19. What is implantation? Where does it take place? Mention the structure involved and its function.

Answer: The embryo sinks down and reaches into soft and thick lining of the uterus. The embedding of the embryo in the thick lining of uterus is called implantation.

The implantation occurs in the uterus.

The placenta is a grows into a disc like structure between uterine wall and the embryo. Placenta forms finger like projection called villi towards embryo. This creates large surface area for the exchange of glucose and gasses between mother and embryo.

Q. 20. Name the organ where ova are formed inside the body. Trace their pathway from formation to Fertilization.

Answer: Female reproductive gametes are “ova” or “egg.”

The ova are produced inside the ovary when a girl reaches its stage of puberty, this egg or ova produced is carried from ovary through the fallopian tube to the womb or we can say to the uterus.

In the uterus, the male reproductive gamete or sperms arrives, it fertilizes the egg, and then zygote is formed which on development leads to the formation of foetus.

Q. 21. What does HIV stand for? Is AIDS as an infectious disease? List any four modes of spreading AIDS.

Answer: HIV is a human immunodeficiency virus.

This causes a disease, or we should say a collection of diseases called AIDS.

AIDS is a viral disease which could spread through any activity that includes blood transfusion or direct sexual contact.

AIDS is an STD how it spreads could include,

- Unprotected copulation
- Sharing of infectious needles
- Transfusion of blood between a normal and infected person
- It can also be transmitted from an infected mother to the fetus.

Q. 22. Explain

(i) Population control

(ii) Advantage of using contraceptives.

Answer: i) Human population has increased drastically over the years.

According to the data, the human population is doubling every 35 years so we need a way or a method that could provide full stop solution or that could prevent this explosion of population. The Methods that could help in controlling the overpopulation or the population explosion are considered as population control. Population control doesn't mean that we need to kill people or remove population already present on the earth It is a way in which the population or we should say the coming population is planned or it is a planned control of population.

ii) Contraceptives are the most used and the safest methods of birth control. Contraceptive includes the use of condoms, IUD and other surgical methods that could provide a method to avoid unwanted pregnancy.

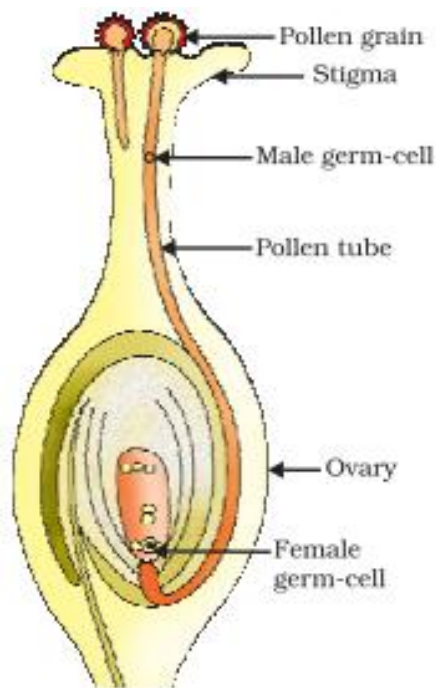
Using contraceptives reduces the risk of STD.

Pregnancy at an early stage of a woman could adversely affect her body and her mind so to prevent that contraceptives are used. To control the exploiting population contraceptives play a major role.

Q. 23. Draw a neat diagram of fate of pollen after landing on stigma. Also, label the following parts.

- (i) Female germ cell
- (ii) Pollen tube
- (iii) Pollen grain
- (iv) Male germ cell

Answer: The diagram is given below:



The above diagram shows the process of germination of pollen on stigma.

Q. 24. What is the function of anther? How does fusion of male and female gametes take place in plants?

Answer: Anthers are male reproductive parts of plants. They are bi-lobed and are connected with a long tube like structures called filament.

Anther is responsible for the formation of pollen grains. Pollen grains, when formed, are stored inside the anther when pollen matures they exert pressure on the inside wall of anther causing it to burst and release the pollen outside. Now these pollens reaches the stigma of the female flower by pollinators.

Once pollen lands on the stigma, certain interactions occur and pollen absorbs water and swells leading to the formation of the pollen tube. This pollen tube is a hollow tube which enters stigma, travels through style and penetrates inside ovary. Through this pollen tube, male nuclei reach the egg and fertilization takes place.

Q. 25. (i) State any three characteristics of sexual reproduction.

(ii) Explain, what happens to the egg once it gets fertilized in a human female?

Answer: i) • Sexual reproduction includes crossing over of chromosomes which leads to variations.

- These variations are responsible for making the existing species better and healthier and then ultimately to evolution.

- Sexual reproduction could also lead to speciation which is the formation of new species from the pre-existing one.

- Since it involves 2 parents so, the offspring receive characteristics from both the parents. Also, it is a time-consuming process so it somehow controls the population explosion which could have been there due to asexual reproduction.

ii) After the 14th day of menstruation cycle, the egg is taken to the uterus where it waits for the sperm to reach and fertilize it.

Female receives sperms after sexual intercourse, sperms travel through the vagina and reaches the egg in the uterus and fertilize it. After fertilization zygote is formed. zygote divides and forms an 8 celled structure called blastocyst. This blastocyst attaches itself to the uterine wall by a process called implantation. From here it further divides and develops into a fetus and then ultimately into a baby.

Q. 26. Give reasons why a woman should avoid frequent pregnancies. Explain the following methods of contraception giving one example of each.

(i) Barrier method

(ii) Chemical method

Answer: Pregnancy is a very complex process. It includes a the very long period of around 9-10 months. A woman has to suffer a lot of hormonal changes during this period and also her inner body needs recovery after one pregnancy because it has undergone a lot of wear and tear during fetal development and mostly during labor.

According to doctors, there should be a gap of 3 years between subsequent pregnancies.

In order to prevent unwanted pregnancy, Contraceptives should be used.

i) Barrier method includes preventing the entry of sperms inside the vagina, so that it cannot fertilize the egg. This includes the use of condoms which are available for both males and females. cervical caps, IUD'S are some examples of barrier method.

ii) Chemical methods involve using chemicals in order to either kill the sperms or making the surroundings inhospitable for them. These mostly contain acids or some salts such as lactic acid, or potassium permanganate. E.g. - Tablets (unwanted 72), jellies, creams and pastes.

Q. 27. 'DNA copies generated will be similar, but may not be completely identical to the original.' Explain the statement concerning asexually reproducing organisms.

Answer: In asexual reproduction there is involvement of only one parent, hence the offspring receives DNA from a single parent only. Now, this DNA divides or duplicates during the process of replication and cell division. During this division mostly what happens is there is the creation of clones because the similar DNA is being passed on to both daughter cells. However, DNA transferred is not identical because during replication there could be certain environmental factor or any other factors that caused certain changes in the DNA sequences of both.

Q. 28. Explain tissue culture technique. In which area this technique is finding its application?

Answer: Tissue culture is basically a technique that includes the propagation of plants by culturing cells or tissues.

Plant parts like buds, flowers, anthers, stems, leaves and meristematic tissues possess a property. Due to this property plant cells retain the ability to get developed into any plant part when grown under exact nutritional requirements. Thus various nutrient media are there which contain different compositions of vitamins, minerals, ions etc.

Initially, the culturing of cells led to an undifferentiated mass of callus called as "callus" and then this callus is manipulated under the influence of various factors such as hormones, vitamins, minerals, light, water etc. this callus develops into plantlet which is then transferred to separate pots.

Applications of this technique are,

- By this technique virus or disease-free plants can be generated.
- Various homozygous diploids that are commercially important can be produced by this.
- Plants that cannot produce seed or produce unviable seeds e.g. banana, seedless grapes etc. can be grown by this technique.
- It is widely used for research purposes in order to study plant behavior under variable conditions.
- Original plant lines or pure lines can be preserved by this technique.

Q. 29. (i) Give the possibilities for a flower to reproduce by self-pollination.

(ii) What events take place in a flower after fertilization has taken place?

Answer: i) Self-pollination is the transfer of pollen from the anther of flower to the stigma of the same flower of the same plant or a genetically similar flower. Self-pollination is responsible for producing pure lines and to prevent any kind of genetic recombination. Mostly self-pollinating flowers have certain characteristics, like anthers cover the stigma densely so that when pollen is shed they fall directly on stigma also a group of flowers is clustered together to increase the possibility of self-pollination. Flowers do not need to waste their energy in creating attractive morphologies like order, bright and showy petals for attracting pollinators also self-pollination increases the chances of pollination.

ii) Soon as the egg nuclei fuses with male nuclei, and in some cases, after double fertilization is over the flower begins to lose its shine. Petals, stamens, and style either fall or wither away. Calyx may remain persistent in some cases such as Tomato, Brinjal. Major events are,

- The triploid primary endosperm nuclei formed develops into endosperm.
- The zygote develops into an embryo.
- Seeds are formed from ovules.
- Fruit is developed from the ovary

Q. 30. We hear and read about female feticide, which is really a wrong practice. In some families, be it rural or urban, females are tortured for giving birth to a girl child.

- (i) Female feticide leads to which major problem in the country?**
(ii) In your opinion, the approach of the society towards mother in this regard is correct Not? Explain with a scientific reason.
(iii) What value will the learners infer from this passage?

Answer: i) Female feticide is killing the girl child when it is in the mother's womb. This leads to a major problem of decreased girl population in the country leading to disturbed sex ratio i.e. a number of males per female. The sex ratio lies at around 880 females per 1000 males which is very low and is of a moral concern.

ii) Scientifically speaking, sex of the baby cannot be changed or influenced. Genetically male possess 1 copy of X chromosome and 1 copy of Y chromosome while female possess both copies of X chromosomes.

Thus males produce 50% X chromosome sperms and 50% Y chromosome sperms while female bears only X chromosome egg. Now which sperm is going to fertilize the egg is not in anyone's control. Hence, it is worthless to blame women for giving birth to a female child because she cannot control it.

iii) From this passage first of all, learner will learn about the problem persisting in our society. Secondly, he/she will get the genetic and scientific knowledge regarding the birth and sex control of baby. Third, a learner will now know that it is worthless to blame anyone especially women for giving birth to a female child and he/she will get awareness regarding this which he/she will pass on.

Q. 31. You must have seen your mother adding a paste of yeast cells to the idli paste she has prepared. Similarly, the brewing industry uses yeast in the manufacture of alcohol.

- (i) How does such a small amount of yeast add help to produce thousands of liters of alcohol?**
(ii) Explain how yeast multiplies so fast.
(iii) What are the values shown by your mother?

Answer: i) Yeast (*Saccharomyces cerevisiae*) is a eukaryotic fungus. Yeast is a unicellular organism that multiplies asexually by the process of budding which is a very fast process. Yeast converts carbohydrates into carbon-di-oxide and alcohol and due to this property only it is highly exploited in the brewery industry. Yeast doubles its population every 80-90 minute, thus when a small amount of yeast is added it multiplies and increases its population to 1000 folds within 24 hours.

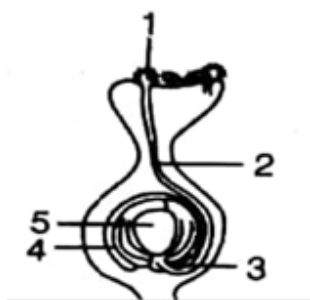
ii) Yeast multiplies by the process of budding which is a mode asexual reproduction. From the existing parent cell, a bud arises genetic material duplicates and then get divided into half between the 2 cells. However, newly formed yeast cells mostly do not separate from the parent cell and form long chains of cells.

iii) Mother is the owner of kitchen, and she knows the importance of yeast that means she is aware of yeast's fermentation properties.

This thing shows that science has influenced our household and our eating habits greatly.

Challengers

Q. 1. The diagram shows the cross-section through the carpel of a flower just before fertilization.



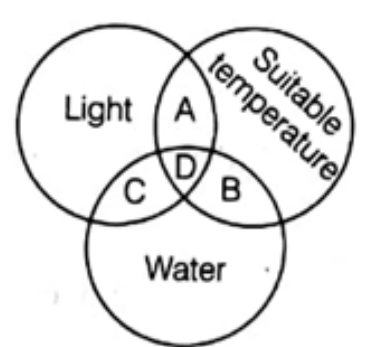
Where will the male and female gametes be just before fertilization?

	Male gamete	Female gamete
(a)	1	5
(b)	1	4
(c)	2	4
(d)	3	5

- A. (a)
- B. (b)
- C. (c)
- D. (d)

Answer: Male gamete travels inside the pollen tube while female gamete is inside the ovule. Pollen tubes penetrate the ovule to release the male nuclei inside it, that why just before fertilization male gamete is at the end of pollen tube while gamete is inside the ovule.

Q. 2. Which conditions are necessary to activate enzymes when a seed germinates?



- A. C
- B. A
- C. D
- D. B

Answer: When the seed is shed it contains very less moisture content, hence when it receives appropriate temperature before germination, seed first absorbs water which activates the enzyme inside it, now these activated enzymes and hormones start the digestion of food stored in endosperm mostly in the form of starch. Once starch is mobilized, root and shoot start appearing and light is needed when chloroplast is developed in leaves. Because till that time seed has used all its stored food and now it will prepare food using sunlight.

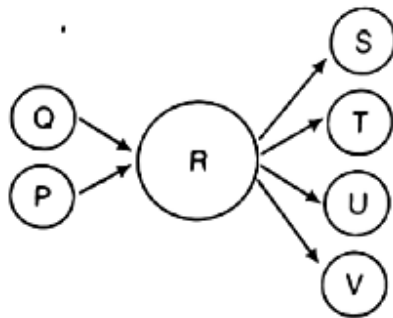
Q. 3. Given below are certain adaptations in the fruit of certain plants. On the basis of information given below, identify the agent of pollination in both situations.

- i. small, dry and light seeds with a parachute of fine hair.
- ii. Brightly colored, sweet and juicy but hard seeds.

- A. I-insects, II-animals
- B. I-water, II-insects
- C. I-wind, II-animals
- D. I-birds, II-insects

Answer: When seeds are light in weight and contain hairs they can be easily blown away by the wind to a greater distance. Since plants tend to disperse their population to a far extent. While, brightly colored, sweet and juicy fruit contain hard seeds which cannot be dispersed by wind thus it needs human/animals as dispersal agents since we eat the fruits and throw away the seeds.

Q. 4. The diagram represents gametes P and Q fusing to give cell R. This cell then produces gametes S.T.U and V.



Which statement about the numbers of chromosomes in the cells and gametes is corrected.

- A. The numbers of chromosomes in P and Q are different.**
- B. The numbers of chromosomes in P and Q are the same.**
- C. The numbers of chromosomes in S is one-quarter of chromosomes in Q**
- D. The numbers of chromosomes in T is half the member of chromosomes in Q**

Answer: All the cell types have 23 pairs of chromosomes or 46 total.

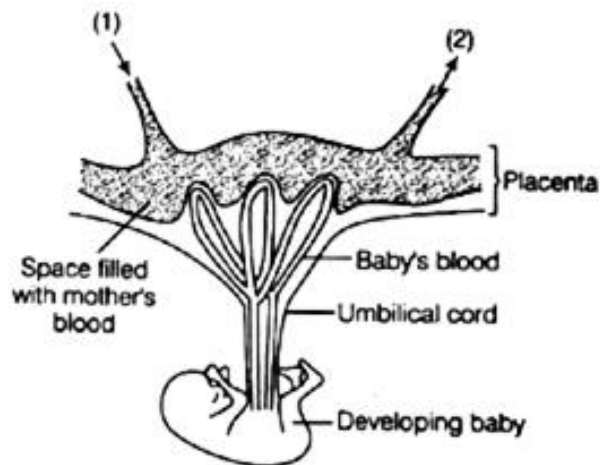
During Meiosis, a cell undergoes two rounds of cell division during which the chromosome pairs are separated and the resulting gametes each have only one copy from each set of chromosomes.

Q. 5. Among all the methods of contraception, which one can prevent the implantation of the fertilized egg?

- A. Coil (mechanical)**
- B. condom (mechanical)**
- C. Spermicide (chemical)**
- D. Vasectomy (Surgical)**

Answer: It is because condoms are a barrier method of protection which doesn't even allow sperms to enter the vagina. On the other hand, spermicides kill the sperms as soon as they enter vagina hence prevent fertilization. Vasectomy is a surgical method that cuts vasa deferentia thus doesn't even allow the sperms to get ejaculated in the urethra. Thus, only coil mechanism prevent implantation.

Q. 6. The diagram shows the arrangement of blood vessels in the uterus wall and placenta of pregnant women.

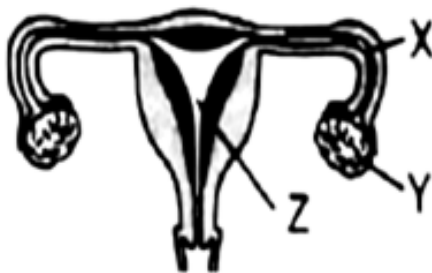


Which of the following will increase in concentration in the blood as it flows from 1 and 2?

- A. Amino acids
- B. Carbon dioxide
- C. Glucose
- D. oxygen

Answer: Placenta functions as a carrier of nutrients from mother to baby. Thus all of amino acids, glucose, and oxygen will decrease in the concentration at 2 since all of them are transferred to the baby at 1 because it has a low concentration of all. However, due to metabolic processes and lack of excretory mechanism baby's blood has a high concentration of carbon dioxide, which will be transferred to mother's blood because her blood has low CO_2 concentration. Thus at 2 blood is coming at high CO_2 concentration.

Q. 7. The diagram shows a section through the female reproductive system.



During pregnancy. Where does mitosis occur in the cells of the embryo?

	X	Y	Z
(a)	✓	✓	✓
(b)	✓	✓	x
(c)	✓	x	✓
(d)	x	x	✓

key : ✓ = takes place, x = does not take place

- A. (a)
- B. (b)
- C. (c)
- D. (d)

Answer: This is because mitosis begins just after fertilization i.e. after formation of zygote. So mitosis is occurring at X and Z location but at Y the only ova are being prepared thus no mitosis while meiosis (reduction division) is there.

Check Point 05

Q. 1. Define the reproductive health.

Answer: Reproductive health can be defined as the state of physical, mental and social fitness to lead a healthy reproductive life.

Q. 2. Give a reason for the declining balance in sex ratio.

Answer: The major reason for the decline in balance of sex ratio is due to reckless female foeticide, sex ratio is declining rapidly in some section of our society.

Q. 3. Why expanding population is a matter of concern.

Answer: Expanding population is a matter of major concern because an expanding population makes it difficult to improve the standard of living.

Q. 4. Which is the most commonly used method of birth control.

Answer: The commonly use method for birth control is barrier method in which a barrier is created which does not allow sperm to fertilise egg in the women in uterus.

The various method include in Barrier method are:

1. Condom: Rubber sheath is worn over the penis to stop sperm entering the vagina.

2. Diaphragm: Rubber cup that is placed in the vagina over cervix.

3. Intra-Uterine Contraceptive Device (IUCD): Copper-T is placed in uterus by doctor which prevent pregnancy.

Q. 5. Name a method which acts as birth control and also protects from STDs.

Answer: The barriers method is acts as birth control and also protects from STDs.

Q. 6. In what ways, oral contraceptive measure help in birth control.

Answer: Oral contraceptive is an example of hormonal contraceptive method in which oral medicines containing hormones, which prevent releases of ovum, so that the fertilization cannot occur. These disturb the hormonal balance of the body.

Q. 7. Name two STDs caused by bacteria.

Answer: Two STDs caused by bacteria are:

1. **Gonorrhoea:** it is caused by *Neisseria gonorrhoeae*.

Symptoms:

- a. Discharge of pus from penis and vagina
- b. Burning sensation on urinating

2. **Syphilis:** It is caused by bacteria *Treponema pallidum*.

Symptoms of syphilis:

- a. Appearance of sore on body parts
- b. Fever, ulcer, bone pain, liver disease and anaemia.

Heredit And Evolution

Check Point 01

Q. 1. State the unit of hereditary material found in all living organisms.

Answer: The unit of hereditary material found in all living organisms is gene. Genes are the proteinaceous part present on the DNA (deoxyribonucleic acid - genetic material) and codes for all the characters expressed in any living organism.

Q. 2. What is meant by variations found in a population?

Answer: Genetic variations are the differences which are found in a population of sexually reproducing organisms. The degree by which the progeny differs from its parents generation is known as variation. These differences are caused when two sets of chromosome combined together to form a new set.

Q. 3. Name the plant Mendel selected for his experiments on genetics.

Answer: The plant selected by Mendel for his experiments on Genetics was **Pisum sativum**. The common name for this plant is sweet pea.

Q. 4. What is meant by pair of contrasting characters?

Answer: The pea plant studied by the Mendel has two contrasting traits of each and every character. Tall and dwarf are two contrasting traits of the character plant size similarly purple and white colour of the flower are the contrasting traits of the character flower colour. There were total 7 pairs of contrasting traits given by Mendel in Pisum sativum.

Q. 5. Where are genes located in an organism?

Answer: Genes are the smallest unit of inheritance. They contain the information which is required to express a particular trait. They are present on the chromosomes inside the nucleus of the cell.

Q. 6. How is variation brought in the progeny in the sexually reproducing organisms?

Answer: Progenies which are formed in sexually reproducing organisms by fertilisation of male & female gamete. As these gametes contains genetic information of two distinct individual organisms (one male & one female), their fertilisation will produce progenies with varied genome. This is how variations are produced in sexually reproducing organisms.

Check Point 02

Q. 1. What is the parameter which decides inheritance?

Answer: The process by which different characters are passed on from the parent to the progeny is known as inheritance.

The rule of inheritance of such traits in human being are related to the fact that both father and the mother contribute practically equal amounts of genetic material to the child. This means that each trait can be influenced by both paternal and maternal DNA. Thus, for each trait there will be two versions in each child

Q. 2. Name two human traits which show variation?

Answer: As humans are sexually reproducing organisms all the traits show variation.

1. Different colour of eyes.



2. Free and attached earlobes are two variants found in human populations.



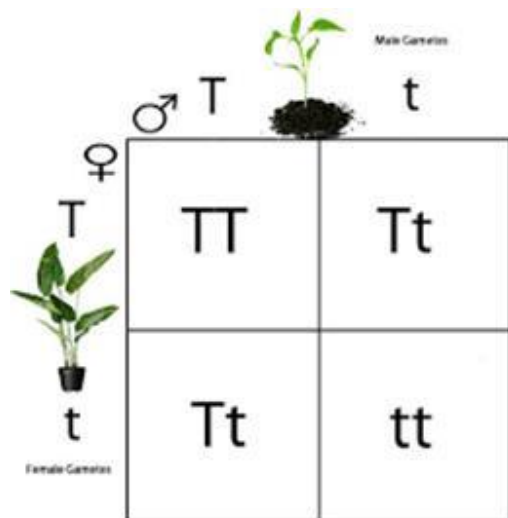
Q. 3. Who is considered as the father of genetics?

Answer: Gregor Mendel is considered as the father of genetics as he gave various laws and explained the concept of inheritance and variation.

Q. 4. What is a monohybrid cross?

Answer: When a cross is conducted between dominant and recessive traits of only one character, then it is known as a monohybrid cross.

Example: The cross conducted between Dominant trait tall (TT) and recessive trait (tt), it resulted into all four heterozygous tall (Tt) in the F1 generation.



Q. 5. Parent pea plants were crossed for contrasting traits, i.e. round and wrinkled seeds. The progeny obtained in F1 generation is Rr, RR, Rr and rr. Which of these are dominant and recessive traits?

Answer: Tall plant (RR): dominant trait

Wrinkled seed (rr): recessive trait

From the above given progeny obtained in the F1 generation:

1 RR: dominant

2 Rr: dominant

1 rr: recessive

The ratio would be - 1:2:1

Q. 6. How are traits expressed?

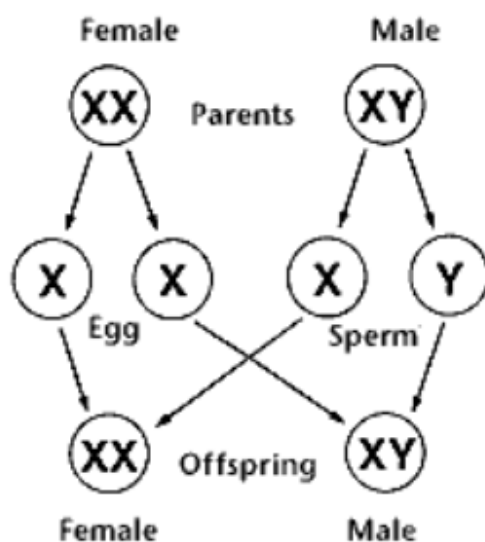
Answer: The traits are present on a single long thread of DNA, but as separate independent pieces, each called as chromosome. Thus each cell has two copies of each chromosome, one from male and female parent. It was observed that when two pairs of traits or characters were considered, each trait expressed itself independent of the other. Thus, Mendel was able to propose the law of independent assortment which says about independent inheritance of traits.

Q. 7. Why do mice whose tails were surgically removed just after birth for generations, continue to produce mice with tails?

Answer: The mice even after the removal of the tail after the birth is an acquired trait but the tail in the mouse is an example of inherited trait which means that even after cutting the tail inherited trait cannot be removed thus the mice continue to produce mice with tails.

Q. 8. Write the sex of the baby that inherits Y-chromosome from the father.

Answer:



The mother can only contribute one X chromosome to the sex of the baby while the father may contribute either an X or Y chromosome.

When the father contributes Y chromosome, the offspring has the chromosome set of XY which means the baby born is a boy.

Check Point 03

Q. 1. Give the difference between acquired and inherited traits with an example. How will you explain organic evolution?

Answer:

Acquired Trait	Inherited trait
Acquired traits are the characters or traits which we acquire over our lifetime	inherited traits are the one we get from our parents.
Acquired traits can be altered.	Inherited traits are lifetime traits which cannot be changed (as it depends on our genome),

Example: If we cut the tail of the mice after the birth the trait acquired by the mice is the acquired trait but if the mouse is allowed to reproduce the offspring of the no tail mice will still have tail is an example of inherited trait.

Q. 2. Evolution indicates the forever evolving life on the Earth. Give a statement supporting the above claim.

Answer: Evolution is the process in all forms of life over generations and evolutionary occurs. Biological populations develop through genetic changes that correspond to changes in the organism observable traits.

Evolution indicates the forever evolving life on earth. Evolution assures the continuity of various species & organisms on earth.

The accumulation of variations over a period of time is evolution.

Example: In a field there are red and green beetle. The crows are flying over the field found red beetles in the field to be eaten which give green beetle an advantage over red beetles and more the proportions of green beetles in the population would be in the population will eventually results in evolution of species to fit the environment better.

Thus, Evolution indicates the forever evolving life on the earth

Q. 3. How variation in a population leads to a survival advantage?

Answer: Variation refers to the difference in the characteristic or traits among the individuals of a species.

Variation is beneficial to the species because:

1. It enables the organism to adapt themselves in changing environment.
2. It forms the basis of heredity.

3. It forms the raw materials for evolution and development of new species.

Thus accumulation of variations in a population led to population to adapt to the changes and the new needs. This provide survival advantage to the species

Q. 4. Explain the term genetic drift.

Answer: Genetic drift is a phenomenon more common in the small population which may lead to the accumulation of different changes which lead to the formation of different species.

The accidental survival of the beetles of one colour that changed the common characteristics of the resultant population So accidental change in the small population can change the frequency of some gene in the population example accidental red beetles get crushed by elephant while green survived led to genetic drift which change the colour of the population to green.

Q. 5. Out of the following the traits like eye colour, height and physical strength which are genetically acquired.

Answer: Genetically acquired traits are the ones which we inherit from our previous generation. They depend upon the genetic material. Of the given traits in the question **eye color and height are the genetically inherited traits** whereas **physical strength is the acquired trait**, the one acquired over a course of time.

Q. 6. If your mother has pierced ears, will you inherit the trait? If not, why?

Answer: In India almost all the girls have their ears pierced still we never see any girl born with her ears pierced already. It happens because the piercing is done on the body of the organism and no effect is caused on the genetic material. The traits we inherit depends solely on the genetic material of the parents and not on the physical features. Piercing is an acquired trait, not inherited one.

Q. 7. What are the two causes of speciation between two population?

Answer: The two causes of speciation are-

(i) Genetic drift -: If the DNA changes are severe enough, such as a change in the number of chromosomes, eventually the germ cells of the two groups cannot fuse with each other.

(ii) Natural selections:-If a new variation emerges in which females are only able to mate with few males due to their specific trait. This allow natural selection.

Check Point 04

Q. 1. Define evolution.

Answer: Evolution is the process by which newer types of organism are developed from the pre-existing ones through modification in them due to certain factors like environmental change.

Example: Humans evolved from the great apes.

Q. 2. State the basis of classification of the organisms.

Answer: Classification of organism is the arrangement of organisms into a series of group based on physiological, biochemical, anatomical or other relationships.

The more closely two species are related, the more characteristics they will have in common. And the more closely they are related the more recently they will have had their common ancestors.

There are various categories of classification. These are:-

kingdom, phylum/division, class, order, genus, species.

Q. 3. Describe the phenomenon of homology.

Answer: According to Darwin, more closely related species have evolved from a common ancestor. The characteristics and fundamentally similar structures suggest the possibility of a common ancestor.

Such a phenomenon of similarity of structures due to common ancestry is known as homology. Example the forelimbs of vertebrates.

Q. 4. Describe the phenomenon of homology.

Answer: The homologous organs are the two organs which have the same origin but perform a different function and the phenomenon is known as homology.

Characteristics of Homologous organs are given below:

1. Similar in basic structure and have the same developmental origin.
2. Have different functions in different organisms.
3. Their similarity is due to common ancestry.

Examples of homologous organs are the arm of a human, the wing of a bird or a bat, the leg of a dog and the flipper of a dolphin or whale. They all have the same origin but perform a different function.

Q. 5. Give examples of analogous organs.

Answer: Analogous organs are the organs which have a different origin but perform the same function.

Examples of analogous organs are wings of insects and the wings of birds. Both originate from different parts but perform the same function i.e. flying.

Check Point 05

Q. 1. How are evolutionary relations between organisms traced?

Answer: The evolutionary relationship can be traced by observing the following things:-

(i) Homologous organs:- homologous organs are the one which have same structure performing different functions. It shows the same ancestral history.

(ii) Analogous organs:- organs which have different structures performing the same function. It shows convergent evolution

(iii) Fossils:- fossils are dead remnants of plants & animals living on earth far back. Fossils provide us with a way to peep into the window of history and to learn a lot about them. Fossils play a major role in tracing evolutionary relationships.

Q. 2. In terms of evolution, what is the significance of homology between a human hand and a wing of a bird?

Answer: Homologous organs are the organs which have the same origin but different function.

Hand of a human being and the wing of a bird originate from the same part of the body but perform a different function. The human hand is used for various functions like holding, writing, etc while the wing of a bird is used for flying.

Q. 3. 'Older fossils are found closer to the surface of deep in the Earth strata?

Answer: Fossils are formed when dead organisms get buried inside the earth crust or in deep sea levels. During this long course of time, a great number of layers will be formed over them. So the organisms who died earlier will be buried deeper than the newer ones.

Q. 4. Evolution of cauliflower, broccoli, cabbage, red cabbage has occurred from wild cabbage. Is this an example of natural selection or artificial selection?

Answer: Evolution of cauliflower, broccoli, cabbage red cabbage has occurred from wild cabbage. It is an example of artificial selection.

It is so because the evolution of all these varieties from wild cauliflower was largely dependent on the choice of a farmer who was growing it. If a farmer wants to grow short leaf plant, he opted cabbage. If they wanted to grow a flower shaped plant, they opted broccoli or cauliflower.

Q. 5. What is molecular phylogeny?

Answer: Phylogeny is a branch of biology that deals with the study of evolutionary relationships of various organisms.

MOLECULAR PHYLOGENY is that sub-branch of phylogeny that deals with the study & detailed analyzation of molecular composition of organisms (the study of various DNA sequences) i.e. their genetic material to trace evolutionary relationships.

Q. 6. To where can the earliest members of the human species be traced to?

Answer: Homo erectus was considered as the first human type species which has an origination in Africa.

Q. 7. Which tools can be used for tracing the evolutionary relationships of human evolution?

Answer: Evolutionary relationships of humans can be traced by observing the following things:-

(i) Homologous organs:- homologous organs are the one which has the same structure performing different functions. It shows the same ancestral history.

(ii) Analogous organs:- organs which have different structures performing the same function. It shows convergent evolution

(iii) Fossils:- fossils are dead remnants of plants & animals living on earth far back. Fossils provide us with a way to peep into the window of history and to learn a lot about them. Fossils play a major role in tracing evolutionary relationships.

(iv) Molecular structure:- by studying the molecular structure of organism i.e. its DNA sequences one can trace its relationships with other organisms. This is known as molecular phylogeny.

Q. 8. Write the scientific name imparted to the human species.

Answer: The scientific name given to human species is Homo sapiens.

Chapter Exercise

Q. 1. Variations are the basis of heredity. Explain.

Answer: Variation is the basis of heredity.

When an organism reproduce through sexual reproduction copying of DNA take place which is not accurate, thereby causing variations. If these variations are favourable they help individuals to survive and pass these variations to their progeny. Variation acquires any trait in its genome, during a large course of time, it gets transmitted to its progeny. This forms heredity.

Q. 2. Write the scientific term for 'Science of heredity and variation.'

Answer: Evolution is the scientific term used for 'Science of heredity and variation.'

Q. 3. Name two human traits which show variation.

Answer: Almost all the human traits show variation. Variations occur in the generations of sexually reproducing organisms. The two human traits that show variation are as follows:

i) Ear lobes: free and attached earlobes, is closely attached to the side of the head in some of us and not in others. Free and attached are two variants found in human being.

ii) Eye color: from black to brown to blue to hazel brown, there are so many shades of eye colours found in the human population.

Q. 4. Give the scientific name of the plant used by Mendel in his genetical experiments.

Answer: The plant used by Gregor Mendel for his experiments on genetic was a sweet pea. The scientific name of the plant is **Pisum sativum**.

Q. 5. When is a recessive trait able to show up?

Answer: When di-Hybrid cross is conducted between two heterozygous parents with contrasting traits then it produces offspring which are 3 dominant and 1 recessive.

$Tt \times Tt = TT, Tt, Tt, tt$

The ratio would be - 1:2:1

Q. 6. What is the human being with XY pair of chromosomes called?

Answer: The human being with XY pair of chromosomes is called a male. The sex of the human offspring is determined by the set of chromosomes inherited from father.

Q. 7. Which among the males and females are homogametic?

Answer: XX: female

XY: male

Human females have two X chromosomes whereas the human male has one X and one Y chromosome.

Thus females are homogametic

Q. 8. Define the term 'Natural Selection' given by Charles Darwin.

Answer: Natural selection is a nature's phenomenon in which the species which inherits variations and has better chances of survival are allowed to reproduce and produce a large number of offsprings. The term was given by Charles Darwin.

Q. 9. According to the evolutionary theory, what leads to the formation of a new species?

Answer: According to the evolutionary theory, the new species are formed as a result of variation.

Variation is a process in which a progeny differs from its parent generations. The ability to adapt to the external environment come because of variation and also help in the formation of new species.

Q. 10. Choose the one term from the following which differs from the other three.

Broccoli, wild cabbage, Cauliflower, and Kale.

Answer: Wild cabbage is the odd term of the given four terms.

Wild cabbage is the ancestral plant from which after artificial selection gives broccoli, cauliflower, and kale.

Q. 11. Which organs in two animals indicate that they are derived from a common ancestor?

Answer: When different animals which have organs originated from the same part of the body but function differently then they are known as homologous organs.

Example: wings of a bat, wings of birds, dolphin, flipper and human arm are the homologous organs. They all are derived from the same set of bones which are humerus, radius, ulna, carpals, metacarpals, and phalanges. But all of them function differently.

Q. 12. In which animals, the feathers do not fulfill the purpose of flying?

Answer: Penguin. In penguin, the feathers present are mainly for the purpose of keeping the body of the animal warm. They can jump with the help of their feathers but cannot fly.

Q. 13. Give a paleontological evidence of evolution.

Answer: Paleontology is the study of fossils. Fossils can be anything from teeth, bones, shells to even the footprints of animals or outline marks of leaves.

Q. 14. (i) Name the carrier of heredity.

(ii) Mention the practical utility of genetics.

Answer: i) Gene is the carrier of heredity. Genes are present on the chromosomes which code for different characters. Genes play a very important role in passing the information from one generation to another.

ii) Genetics is used for sex determination in humans. E.g.- It is important in finding the parent of the child as the child will have one set of similar genes as that of parents.

Q. 15. Genes and chromosomes have similar behaviour. Justify.

Answer: Genes and chromosomes function similarly as genes are a part of the chromosomes. Chromosomes are the coiled DNA (deoxyribonucleic acid) and are proteinaceous in nature. Gene is the smallest unit of inheritance.

Q. 16. Among all the chromosomes, what is different about a sex chromosome?

Answer: The 22 pair of chromosomes except for the pair of sex chromosomes are known as autosomal chromosomes or autosomes.

They are passed on to the progeny and determine various characters such as height, eye colour, complexion, bone structure etc where as the sex chromosomes help to determine the sex of the baby. In humans, the XX chromosome codes for a baby girl where as the XY chromosome codes for a baby boy. All other chromosomes are identical in a human but sex chromosomes are different from one another.

Q. 17. Write down the four ways in which an individual with a particular trait may increase in a population?

Answer: A population accepts those traits which are helpful for the survival of that specific population. Whenever a new trait gets introduced in a population which can help them increase their number, they try to adapt to that particular trait.

There are four ways in which this can do. These are:-

(i) Natural selection: Natural selection may work differently in different location. Due to this, variations may occur which lead to the formation of a new species.

(ii) Geographical isolation: is the isolation of population by physical barriers such as stretches of water, mountain, etc.

(iii) Dna changes: variations during DNA copying often leads to the formation of a new species

(iv) genetic drift: Over generations, genetic drift may lead to the accumulation of different changes which leads to the formation of a new species.

Q. 18. Define variation in relation to a species.

Answer: Variation is the degree by which offspring differs from its parent generations.

Q. 19. How does environment determine the sex of a newborn in some organisms?

Answer: In almost all the organisms like humans, birds, lizards etc the sex of the newborn depends upon the chromosomes inherited from the parents. But in few species of reptiles like turtles and crocodiles, the sex of the new born depends upon the environment just after fertilization has taken place. In these organisms, the temperature at which the eggs are incubated determines the sex of the offspring. Low temperature after fertilization produces one sex and slightly high-temperature results in another.

Q. 20. Give the role of genes in evolution.

Answer: Evolution is a result of a change in the genetic material from generation to generation. These changes can occur in many ways, one of which can be a mutation.

Mutations are the random changes in the genetic codes of an organism. No genes mean no mutations and no mutations means no evolution. Hence, genes are very important in the process of evolution.

Q. 21. Give reasons, why the hybrids are generally found to be superior to their parents.

Answer: During hybridization, the two parents taken are of the superior class i.e. they are healthy, physically as well as genetically, we have the best genes so that the hybrid produced has the best characters of the two parents of different species.

Q. 22. (i) A gene can express more than one trait. What gives rise to different expressions?

(ii) When a true breeding pea plant which has yellow seeds is pollinated by a plant that has green seeds, all the F₁ plants have yellow seeds. What might have been the allele for yellow seeds (tell whether it was dominant or recessive / heterozygous or homozygous)?

Answer: i) A gene codes for a character which has two or more contrasting traits. If we see in the sweet pea plant taken by Mendel for his experiments on genetics, a single gene codes for the height of the pea plant. It has two different traits governed by two different alleles T and t. The combination of these two alleles codes for the different type of height of the pea plant. TT or Tt codes for tall plant whereas tt codes for the dwarf plant.

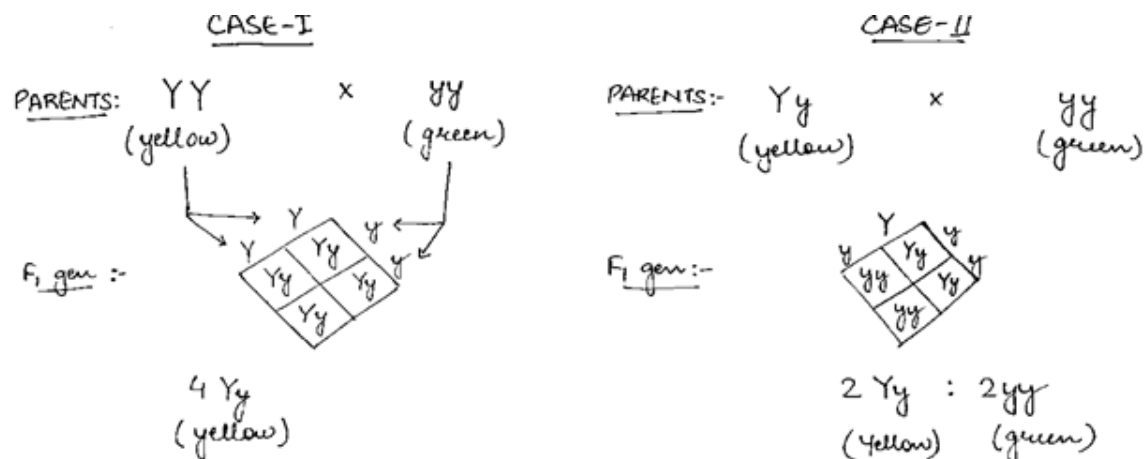
ii) To determine the alleles of the yellow seed. To show whether it is homozygous or heterozygous, dominant or recessive.

YY/Yy codes for yellow seeds of the true breeding pea plant

yy codes for green seeds of another pea plant

When a cross is conducted between true breeding pea plant which has yellow seeds and another pea plant which has green seeds and the first generation produced has yellow seeds. The test conducted to determine the allele of the parent plant is known is known as test cross.

Below given are the crosses to check the two possibilities.



By seeing the cases we can say that the yellow colour of the seed of the pea plant is homozygously dominant i. e. YY.

Q. 23. What do you understand about the independent inheritance of traits?

Answer: It is explained by Mendel in the form of Law of Independent Assortment. This law states that when two pairs of traits are combined in a hybrid, segregation of one pair

of characters is independent of the other pair of characters. It was based upon the observation in the dihybrid cross.

Q. 24. An animal (guinea pig) having black colour is crossed with guinea pig having the same colour. They produced 100 offsprings, of which 75 were black and 25 were white.

Find out

(i) What is the possible genotype?

(ii) Which trait is dominant and which is recessive?

Answer: Let BB/ Bb be the dominant color (black) of guinea pig and bb be the recessive trait which codes for white color of guinea pig.

i) The possible genotype of the parent pigs is Bb i.e. the animals are heterozygously dominant as they produced offspring in the ratio of **3: 1**. The 25 of the black pigs have the gene BB whereas the rest 50 of the black pigs have genes Bb and the white pigs have bb.

ii) The trait coding for black color is dominant while the one coding for white is recessive.

Q. 25. A cross was made between pure-breeding pea plants one with round and green seeds and the other with wrinkled and yellow seeds.

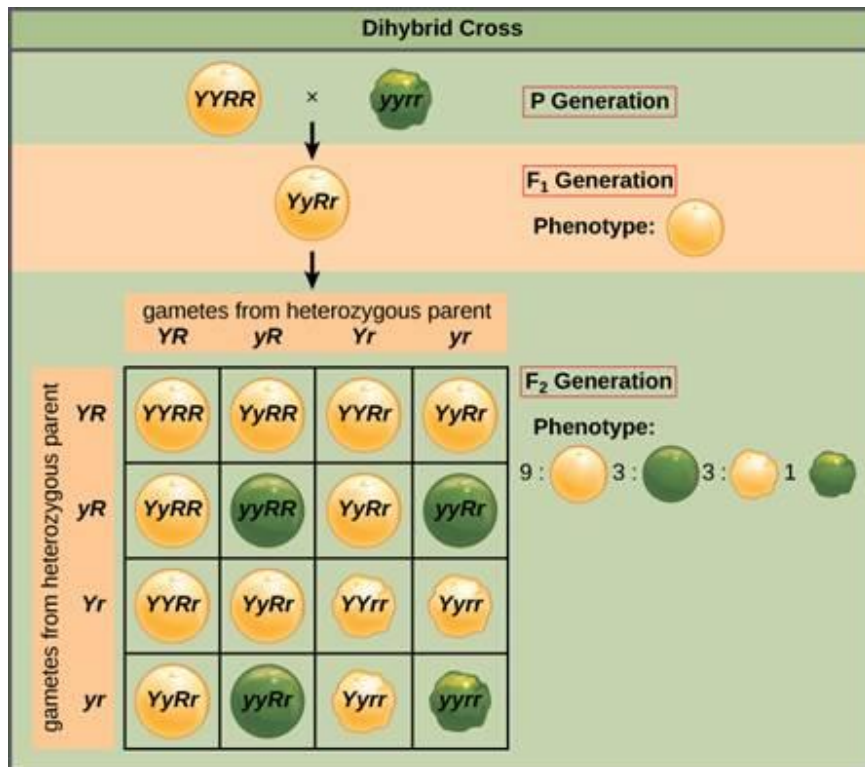
(i) Write the phenotype of F 1 progeny. Give a reason for your answer.

(ii) Write the different types of F 2 progeny obtained along with their ratio when F 1 progeny was selfed.

Answer: i) On crossing pure-breeding pea plants one having round and green seeds and the other having wrinkled and yellow seeds we observe that all the F1 generation plants have round and yellow seeds with the genotype RrYy.

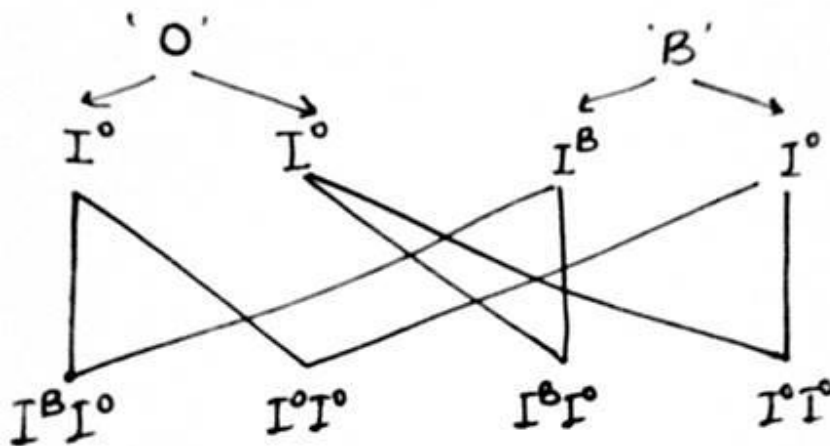
ii) On selfing the plants obtained on the F1 generation i.e. the plant with the genotype RrYy we obtain 16 type of offsprings in the F2 generation. Their phenotypic ratio is as follows:

9:3:3:1 (round yellow 9: round green 3: wrinkled yellow 3: wrinkled green 1)



Q. 26. A man having blood group 'o' ($I^o I^o$) marries a woman with blood group 'B' ($I^B I^o$). What will be the blood group of their children?

Answer: When a man having blood group A marries a woman having blood group B, two types of blood groups can be observed in their children. The possible blood group options are B and O in the ratio 1:1



Q. 27. How are contributions of Darwin different from that of Mendel?

Answer: Mendel learned about genetics. He figured out how traits carried by a parent would be passed onto their offspring. He didn't figure out that all organisms come from a single source through evolution and the formation of new species.

Darwin learned that where certain traits are passed from the parents to offspring. This results in variations in individuals that are passed onto the succeeding generations.

Q. 28. Explain the development/origin of the theory of the chemical origin of life.

Answer: Miller & Urey has performed an experiment to the proof chemical origin of life. They postulated that first organic cell would have been produced from inorganic (chemicals) substances.

They took a glass jar and tried to create an internal environment same as that of earth's environment billions of trillions year ago.

In a sterile jar they insert methane (CH_4), hydrogen (H_2), water (H_2O) & ammonia (NH_3). They heat the jar to increase its temperature to match up the earth's temperature million years back & also increases the pressure. They even provided some electric current to that jar. After some days, the solution starts turning pink because of the formation of some organic compounds.

Q. 29. (i) How do we get an idea about the extinct or previously existing organisms?

(ii) What are connecting links? Give one example.

Answer: i) To know about the extinct or previously existing animals we can look at the fossils. Fossils are not just the buried teeth, skull and bones but can also be the footprints of any animal or the outlines of the fallen leaves or plants which under the pressure of the layers of soil become preserved as fossils. The study of fossils is known as paleontology.

ii) Connecting links are the organisms which behave as a link or connection to two different classes or species.

Example: One very common example is of Archaeopteryx. It is a connecting link between

Aves (birds) and reptiles. It has common features of both the classes. Some features of birds include that they can fly but they also have teeth and tail like the ones present in the reptiles.

Archaeopteryx

Reptiles & Birds



Q. 30. How do homologous organs help in determining the evolutionary trend?

Answer: Homologous organs are the organs present in different organisms which have the same origin but perform different functions. Examples of Homologous organs include wings of bat, wings of birds, dolphin, flipper and human arm. By observing them we can conclude that they all have the same origin and during the course of evolution they started performing different functions as per their needs and requirements. They all are derived from the same set of bones which are humerus, radius, ulna, carpals, metacarpals and phalanges but now all of them function differently.

Q. 31. (i) Give an example which shown that organs of features may be adapted to new functions during the course of evolution.

(ii) What is the essence of the idea of evolution?

Answer: (i) A. Organs or features can be adopted to new functions during evolution
Example-Feathers were developed from providing insulation in cold Weather (in Dinosaurs) but in birds they were adopted for flight.

B. “Older body design are not efficient”. Example-simplest form like Bacteria, which inhabits most inhospitable habitat like, hot springs, deep sea, thermal vents and ice in antarctica.

(ii) The study of classification of various organisms gives us an idea about the evolutionary history of the organisms, which have certain similar characteristics are placed in one group. It can be thus concluded that the organisms placed in one group may have evolved from common ancestors and may have a common evolutionary history.

Q. 32. How do variations occur in offspring? Explain.

Answer: The variation are produced when the new generation reproduces, The second generation produced will have variations that they inherit from the first generation.

The organism can reproduce through two mode of reproduction

(i) Asexual reproduction.

(ii) Sexual reproduction.

In Asexual reproduction is found by the division of parent organism into daughter nuclei. In case of bacteria, bacteria get divided into two individuals, each of them will divide again and give rise to two other organism. The four individual bacteria generated would be very similar with minor difference that occurred due to small inaccuracies in copying of DNA.

In Sexual reproduction involves the fusion of gametes. The offsprings show variations from their parents due to crossing over and exchange of gene segments. They are not exact copies of their parents, due to environmental factors certain favourable variations are also produced. Due to production of variations, sexually reproducing animals show very quick evolution.

Q. 33. How do genes control the traits? Explain in detail.

Answer: Gene is that active part of DNA which can express itself by forming proteins. All the traits found in any organism is because of the proteins produced by genes. Thus genes are very important in controlling the traits of an organism. The total appearance of an organism is controlled by its genes. A gene is the one which decides whether the organism will be tall or short, what is going to be its skin color or eye color, presence or absence of body hairs is also decided by the genes only.

Q. 34. Explain how the variations get accumulated.

Answer: The accumulation is the variations of gradual changes which takes places in primitive organisms over millions of years and new organisms are formed.

There are four ways in which this can do. These are:-

(i) Natural selection: Natural selection may work differently in different location. Due to this, variations may occur which lead to the formation of a new species.

(ii) Geographical isolation: is the isolation of population by physical barriers such as stretches of water, mountain, etc.

(iii) Dna changes: variations during DNA copying often leads to the formation of a new species

(iv) Genetic drift: Over generations, genetic drift may lead to the accumulation of different changes which leads to the formation of a new species.

Q. 35. Give an account of the experiment performed Miller and Urey in 1953.

Answer: Miller & Urey has performed an experiment to proof chemical origin of life. They postulated that first organic cell would have been produced from inorganic (chemicals) substances.

They took a glass jar and tried to create an internal environment same as that of earth's environment billions of trillions year ago.

In a sterile jar they insert methane (CH_4), hydrogen (H_2), water (H_2O) & ammonia (NH_3). They heat the jar to increase its temperature to match up the earth's temperature million years back & also increases the pressure. They even provided some electric current to that jar. After some days, the solution starts turning pink because of the formation of some organic compounds.

This experiment gave some evidences of formation of life from some inorganic/chemical sources.

Q. 36. Is it true that evolutionary relationship is linked to classification? Explain with an example.

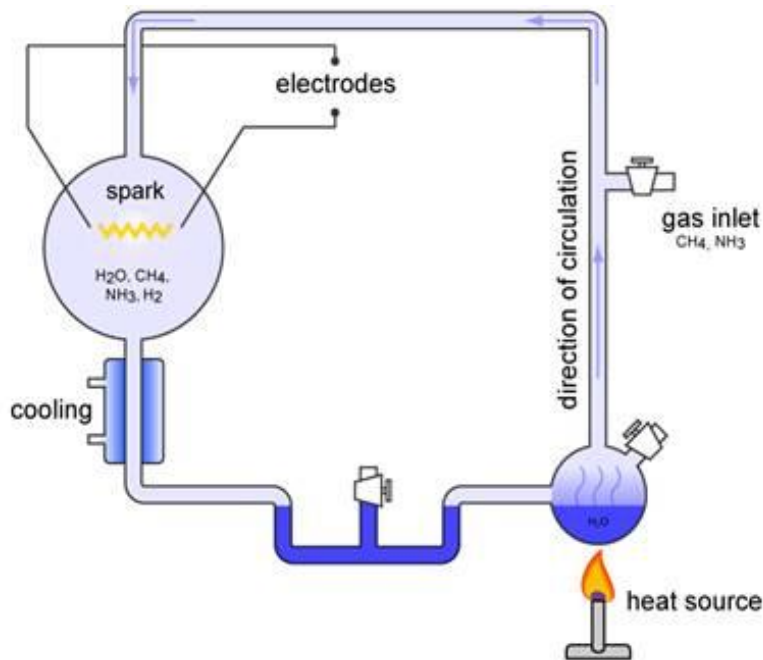
Answer: Yes, evolutionary relationship is linked with classification. Organisms which are more closely related i.e., they have some ancestral history are placed comparatively more closer than species which are not related.

For e.g.- humans & apes are placed in the same family-

Hominidae during classification.

Similarly, lion, cat & tigers are also placed in the same family- Felidae.

It is so because humans & apes and cat; lion & Tigers have common ancestral histories. They all are inter-related. But there is no relation between humans, apes & cat, lion & tigers that is why they are placed in different families.



Q. 37. Give a brief idea of the formation of the fossil.

Answer: Fossils are remaining parts of organisms found in deep Earth's crust who died million years ago.

Formation of the fossil is a very complicated yet interesting process. When an organism dies due to any reason (may be some calamity like earthquake or tsunami or flood or even natural death), its body gets buried inside the earth's crust or even deep sea level. The soft tissues of that organism get decomposed by various bacteria or other organisms but its hard tissues like bones/teeth etc remained un-degraded. Moreover, due to the high pressure inside the crust, they become more hard and tough. Over a long period of time, a lot of layers will get formed over them and they will get deeper & deeper. During paleological researches when these layers are deep drugged, these remnants were discovered in the form of fossils.

So this is how fossils are formed.



Q. 38. How does comparing DNA of different species help in tracing evolutionary relationship?

Answer: Tracing evolutionary relationships between organisms is called as phylogeny while studying structures of various DNAs to establish evolutionary relationships between them is called as, while studying structures of various DNAs to establish evolutionary relationships between them is called as molecular phylogeny.

The sequence of base pairs in a DNA molecule decides the characteristics of an organism. A slight change in this sequence can bring very large changes in certain organisms.

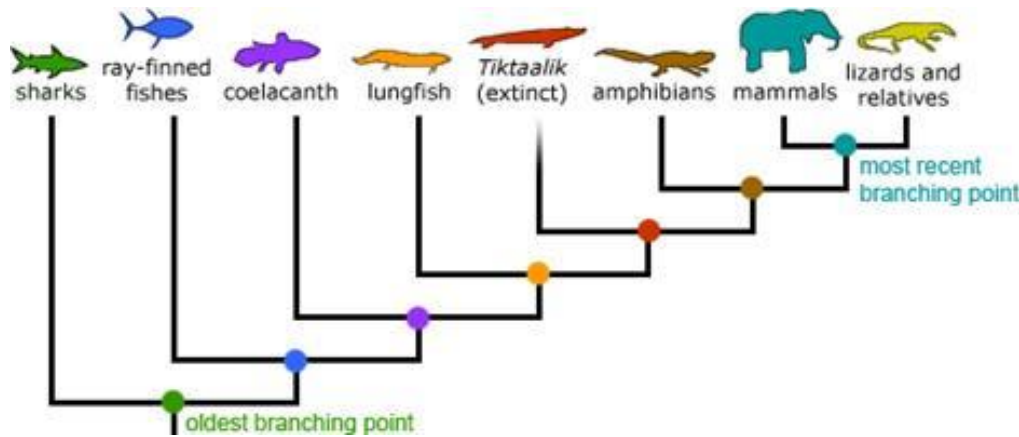
For e.g. - DNA of Homo sapiens (i.e. humans) are 99.9% same. That is, only a 0.1 % difference in humans' DNA can create so many variations. Similarly, population of different unrelated species is very different in their molecular organization too.

DNA of humans has some similarity with DNA of apes, and due to this reason, it is assumed that they might have some common ancestors.

Q. 39. 'There is no real progress occurring in the concept of evolution. 'Explain.

Answer: Evolution is shaping of various diversities into its best form. It should not be equated with progression. Evolution is a different concept from progression. Let us take an example of a big tree with lots of branches in it. Each branch has a sub-branch. Similarly, diversity is like that tree, which has a lot of organisms in it. All these are inter-related because one is evolved from other and will further evolve to form a new species. But just like in that tree, as all the branches are special & equal, all these species or organisms are special and unique in its own way.

It is not like that if species B gets evolved from species A, organisms of species A will become extinct or they weren't good enough. It's just that species A was unique in its own way & organisms of species B are good in its own way.



All these species are totally different & all of them are evolved in different time courses. But all of them are considered equal & are placed on same level irrespective of their evolutionary time.

Thus we can say that evolution & progression are two unrelated terms.

Q. 40. During a science lecture on evolution and inheritance, Amit got confused and went to clear his doubts. He asked, if characters can be passed to the future generation, then why does not he have the tattoo that his mother has on her arm. The teacher smiled and told him about inherited and acquired characters.

- (i) What are inherited and acquired characters?
- (ii) The tattoo on the arm of Amit's mother was not present on Amit's arm. Give a scientific reason.
- (iii) What values are shown by Amit?

Answer: (i) INHERITED TRAITS:- characters which an organism get through its parents in his genome. They are lifetime traits & cannot be altered.

ACQUIRED TRAITS:- traits which we acquire or generates in our whole life time. They are inheritable because they are not related to our genome.

(ii) the tattoo is an acquired trait which Amit's mother has done in during her lifetime. This trait hasn't affected her genome & thus is inheritable. Due to this reason, Amit doesn't have that tattoo which her mother had.

(iii) Amit is a curious child, who doesn't hesitate in asking his doubts. It is a very good quality of Amit which will help him in taking decisions without any doubt or unclarity.

Moreover, he used to be a keen observer who has noticed the presence to tattoo on his mother's arm and absence of that tattoo on his arm.

Q. 41. After attending a class lecture on evolution, Katy came home and gathered photographs of all her possible relatives and grandparents. Afterward she made a family tree using those photographs in which she was surprised to see her resemblance to most of her relatives and grandparents.

(i) Why was there resemblance seen by Katy to most of her relatives?

(ii) What are the laws of inheritance? Name them.

(iii) What values are shown by Katy?

Answer: (i) There is a resemblance in most of the photos of her relatives because they had inherited the same genes with slight variations from their parents.

(ii) Gregor Mendel has given laws of inheritance which explains the passing of characters from parents to their progenies.

There are 3 laws of inheritance. These are:-

a) The **law** of dominance

b) The **law** of segregation

c) The **law** of independent assortment

(iii) Katy is a practical girl. She believes more on practical approaches that is why, after studying evolution & inheritance, she tried to find out its reality by observing it in her own family.

Challengers

Q. 1. According to the evolutionary theory, the formation of a new species is generally due to

A. Sudden creation by nature

B. Accumulation variations over several generations

C. Clones formed during asexual reproduction

D. movement of individuals from one habitat to another

Answer: Charles Darwin has given a theory of Natural selection & survival of the fittest which states that evolution is a slow process in which organisms get adapted to the present day environmental conditions.

Q. 2. What determines the sex of a child?

- A. Chromosome content of the ovum
- B. Chromosome content of the sperm
- C. Number of days between ovulation and fertilization
- D. Number of days between fertilization and implantation

Answer: XX: mother

XY: father

The mother always contributes one X chromosome to the sex of the baby while the father may contribute either an X or Y chromosome. When the father contributes Y chromosome, the baby born is a boy as the set of chromosome he will have would be XY and, if the father contributes X chromosome, the progeny will be a baby girl.

Q. 3. When a breed of cattle with red coats is crossed with the same breed with coats, the offspring all have coats with a mixture of red and white hairs, a condition called roan. If roan cows were crossed with a red- coated bull, the theoretical ratio of the offspring would be

- A. all red
- B. all roan
- C. 1-red: 1 roan
- D. 3 red: 1 roan

Answer: Let red coat be RR (dominant) & white coat be rr (recessive).

In F₁ generation: - RR × rr = Rr (roan)

In F₂ generation: - when roan (Rr) is mated with red (RR)

Rr × RR

RR	RR
Rr	Rr

Therefore the ratio will be - RR: Rr (Red: roan) = 1:1

Q. 5. Which statement about the genotypes of organisms is correct?

- A. Dominant alleles are only found in homozygotes
- B. One recessive allele always causes a recessive phenotype.
- C. Recessive phenotypes must be homozygous
- D. The dominant phenotype must be heterozygous

Answer: Allele which can express themselves in heterozygous conditions are dominant alleles while which does not are recessive allele.

Due to this reason, recessive allele is able to express themselves in a homozygous condition only.

TT has a phenotype of tall height & Tt also has a phenotype of tall height but tt is for short height.

Q. 6. A farmer saves the seeds from his best maize crop plants to sow for next year's crop.

This is an example of

- A. artificial selection**
- B. genetic engineering**
- C. natural selection**
- D. variation**

Answer: In this situation, the farmer has chosen the best crop seeds on its own and because of this next year a greater production will be of those seeds. So it is an example of artificial selection.

Q. 7. What is a result of natural selection?

- A. Dogs that are friendly to humans**
- B. Grapes that contain no seeds**
- C. Mosquitoes that are resistant to insecticides**
- D. Onion crops that have a pleasant taste**

Answer: It is a general observation that when we start using insecticides against mosquitoes, initially their population diminishes but later on they become resistant to it and there is no effect of those chemicals on them. It is because of Natural selection in which the resistant mosquitoes are selected by nature & thus are able to produce more progenies.

Q. 8. Which statement describes an example of artificial selection?

- A. It has been found that some strains of bacteria produce antibiotics**
- B. It is common practice to mate bulls with cows that produce the most milk**
- C. It is possible to control caterpillars on food crops by releasing small wasps which lay their eggs on caterpillars and kill them**
- D. Mosquitoes have developed strains that are resistant to insecticides**

Answer: Options A, C & D are an example of natural selection, where the organisms have adapted themselves to the changing environmental condition.

While option B is an example of artificial selection where good milk producing progenies are developed after human interference.

Q. 9. A recessive homozygote is crossed with a heterozygote of the same gene. What will be the phenotype of the F₁ -generation?

- A. All dominant**
- B. 75% dominant, 25% recessive**
- C. 50% dominant, 50% recessive**
- D. 25% dominant, 50% heterozygous, 25% recessive**

Answer: Let us take tt as homozygous recessive & Tt as heterozygous dominant. So the cross will be Tt*tt.

The progenies in F₁ generation are –

Tt	tt
Tt	tt

So Tt (dominant phenotype): tt (recessive phenotype) = 1:1

Therefore, 50% dominant & 50% recessive.

Q. 10. The genotype of the height of an organism is written as Tt. What conclusion may be drawn?

- A. The allele for height has at least two different genes**
- B. There are at least two different alleles for the gene for height**
- C. There are two different genes for height, each having a single allele**
- D. There is one allele for height with two different forms**

Answer: Allele are different forms of same gene. If genotype is showing Tt, it means that there are at least 2 allele for the gene of height.

'T 'for tall height & 't ' for short height.

Light: Reflection & Refraction

Check Point 01

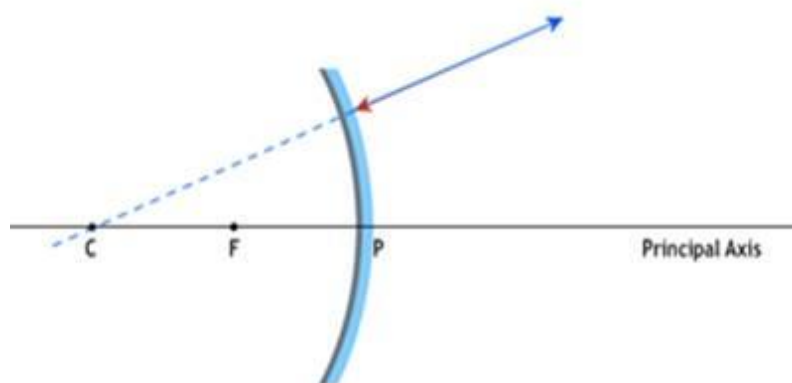
Q. 1. Why does a ray of light passing through the centre of curvature of a concave mirror gets reflected along same path after reflection?

Answer: When ray of light passes through the center of curvature of the concave mirror it strikes along the normal that means it is incident on mirror at 90° .

Thus by the law of reflection which states that the angle of incidence is always equal to the angle of reflection i.e. 90° .

Hence the incident ray coincides with the normal and retraces its path after reflection from the spherical mirror.

The figure below illustrates the above situation.



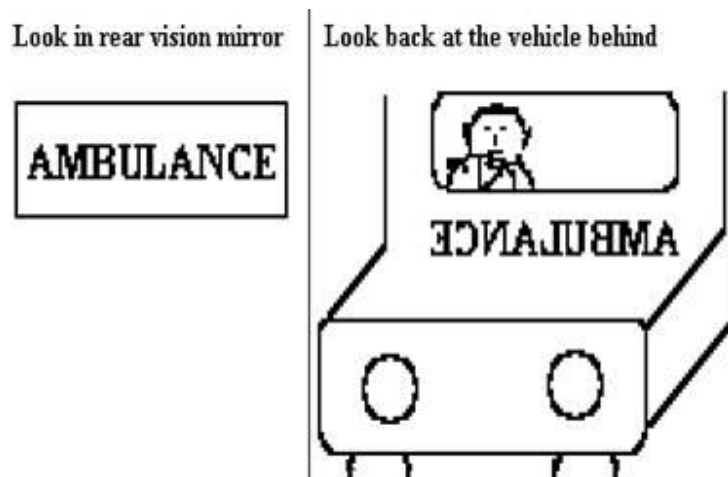
Q. 2. What kind of image is formed on a cinema screen?

Answer: Image formed is real and erect because real image is formed on the screen, and it is not inverted because the object inside the projector is inverted already, therefore its image will come as erect image, hence we are able to produce the image on screen as well as keep it erect.

Q. 3. What do you mean by laterally inverted?

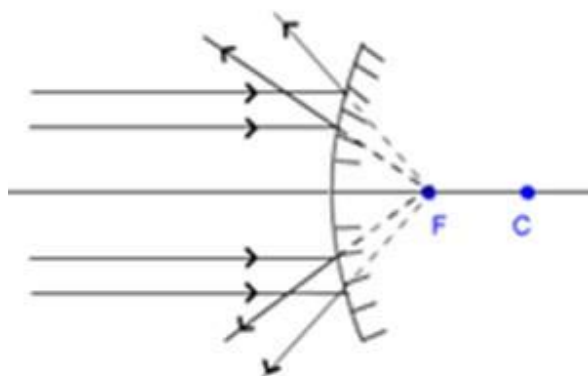
Answer: A mirror forms an image such that its left side is object's right side and its right side is object's left side. This phenomenon of change in object and image sides is known as lateral inversion.

For example, the word AMBULANCE is painted left-right inverted on the ambulance so that when the driver of a vehicle in front looks into his rear-view mirror, he can make out the word AMBULANCE quickly and give way. As shown in the figure below.



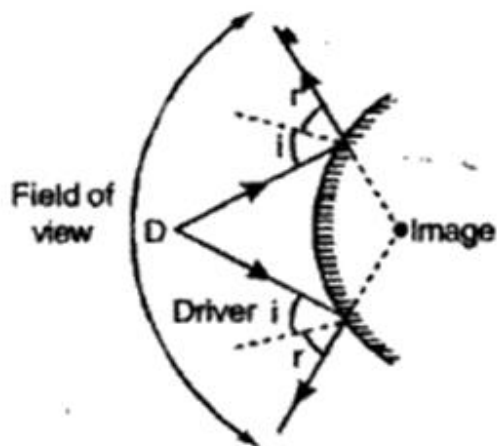
Q. 4. The image formed by a convex mirror is observed to be virtual, erect and extremely diminished than the object, what should be the position of the object?

Answer: Convex mirror always forms virtual, erect and diminished image of an object but when the object is kept at infinity the image is formed at focus and is extremely diminished. As shown in the figure below.



Q. 5. Which type of spherical mirror has a larger field of view?

Answer: Convex mirror has a larger field of view because it is diverging in nature. The light rays incident on it get diverged following the laws of reflection, the reflected rays form the wider path as shown in the figure below.

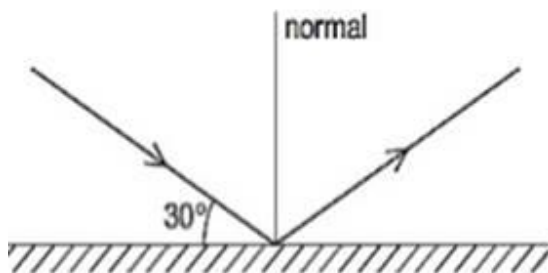


Due to large field of view convex mirrors are used in headlights of vehicles.

Q. 6. If a ray of light is incident on a plane mirror such that it makes an angle of 30° with the mirror, then will be the angle of reflection?

Answer: Ray of light strikes the mirror at an angle of 30° .

$\Rightarrow$ It will make an angle of 60° ($90^\circ - 30^\circ$) with the normal. As shown in the figure below.



$\therefore$ Angle of incidence = 60° .

Now, By laws of reflection;

Angle of Incidence = Angle of reflection;

$\Rightarrow$ Angle of reflection = 60° .

Hence Angle of reflection is 60° .

Check Point 02

Q. 1. A spherical mirror has focal length -10 cm. What type of mirror is it likely to be?

Answer: The mirror is likely to be the concave mirror because the focal length of the concave mirror is negative because the focus is on the left-hand side of the mirror which is taken to be negative according to sign convention.

Thus the required spherical mirror is a concave mirror of focal length 10 cm.

Q. 2. If the magnification of an image formed by a mirror is positive, what does it mean?

Answer: Positive magnification means that both the object and the image formed by a spherical mirror (concave or convex) are erect (upright). An erect image is always virtual. Thus, positive magnification indicates that the image formed by a spherical mirror is virtual, erect.

Q. 3. What is the magnification produced by a rear view mirror fitted in vehicles?

Answer: Convex mirrors are used in vehicles for rear view due to their wide field of view. And the convex mirror forms a virtual, erect and diminished image of the object. Therefore, magnification (m) produced by a rear view mirror fitted in vehicles is less than one i.e., $m < +1$ because

$$\text{Magnification (m)} = \frac{\text{Image height}}{\text{object height}}$$

And image size is less than the object size.

Q. 4. Rays from the sun converge at a point 15 cm in front of a concave mirror. Where an object should be placed, so that its image formed is equal to the size of the object?

Answer: The rays from sun coming from infinity are parallel to principal axis after reflection they converge at a point, known as focus. Therefore, focal length (F) of concave mirror is 15 cm.

And we know that same size, real and inverted image is formed by concave mirror when object is placed at centre of curvature = $2 \times \text{Focal length (F)}$. So to form same size image object will be placed at $15 \times 2 = 30\text{cm}$.

Q. 5. An object is placed at a distance of 8 cm from a convex mirror of focal length 12 cm. Find the position of the image formed?

Answer: According to the question;

Focal length (f) = 12cm;

Object distance (u) = -8cm;

By mirror formula;

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$

$$\Rightarrow \frac{1}{v} + \frac{1}{-8} = \frac{1}{12}$$

$$\Rightarrow \frac{1}{v} = \frac{1}{8} + \frac{1}{12}$$

$$\frac{1}{v} = \frac{3+2}{24}$$

$$\Rightarrow \frac{1}{v} = \frac{5}{24}$$

$$\Rightarrow v = \frac{24}{5} = 4.8\text{cm.}$$

Since $v = 4.8\text{cm}$ which is positive hence image is behind the mirror.

The image is formed at the distance of 4.8 cm behind the mirror and is virtual and erect.

Q. 6. If the object distance for a concave mirror is 24 cm and image distance is 12 cm in front of a mirror. Then, find the magnification of the mirror.

Answer: Given that;

Object distance (u) = -24cm;

Image distance (v) = -12cm (image is in front of mirror hence v is negative).

Now;

$$\text{Magnification} = -\frac{v}{u}$$

$$\Rightarrow \text{Magnification} = -\frac{-12}{-24} = -\frac{1}{2}$$

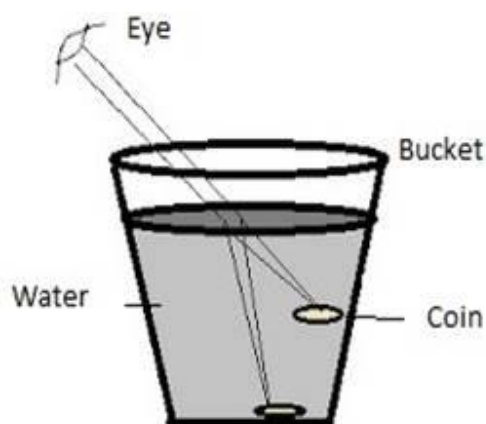
$\therefore$ Magnification is -0.5. Which tells that image is real and inverted and half of the size of the object.

Check Point 03

Q. 1. The depth of a bucket filled with water seems to be less than its actual depth. Name the phenomenon responsible for this?

Answer: The depth appears to be less because of refraction of light. Light rays bend as they move from water to the air. When the light ray from water reaches our eye, the eye traces them back as straight lines (shown as dashed lines) which intersect at a higher position than where the actual rays originated. This causes the depth of a bucket to appear higher and we cannot see the actual depth of the bucket.

The figure below illustrates the same.



Q. 2. A light ray is incident on a rectangular glass slab at an angle of 60° . What is the angle between the ray coming out of the slab and the normal to the face of rectangular slab from which it comes out?

Answer: Ray of light strikes the mirror at an angle of 60° .

⇒ It will make an angle of 30° ($90^\circ - 60^\circ$) with the normal.

∴ Angle of incidence = 30° .

Now, By laws of refraction;

$$\mu = \frac{\sin i}{\sin r}$$

Angle of incidence is 60°

Refractive index of glass slab is 1.5

Putting the value in the above equation, we get

$$1.5 = \frac{0.866}{\sin r}$$

On solving the above equation, we get

$$\sin r = \frac{0.866}{1.5}$$

Angle of refraction, $r = 35.26^\circ$

Thus the angle of refraction is 35.26° from the normal.

Q. 3. How is the refractive index of a medium related to the speed of light? Give an expression for refractive index of a medium with respect to another in terms of speed of light in these two media?

Answer: Refractive index compares the speed of light in a particular medium with the speed of light in vacuum

Relation between refractive index and speed of light:

$$\text{Refractive index } (\mu) = \frac{c \text{ (speed of light in vacuum)}}{v \text{ (speed of light in any medium)}}$$

$$\Rightarrow \mu = \frac{c}{v}$$

Let the refractive index of medium 1 be μ_1 and the speed of light in medium 1 is v_1 .

$$\Rightarrow \mu_1 = \frac{c}{v_1} \dots\dots\dots (1)$$

Similarly;

Let the refractive index of medium 2 be μ_2 and the speed of light in medium 2 is v_2 .

$$\Rightarrow \mu_2 = \frac{c}{v_2} \dots\dots\dots (2)$$

$$\text{Dividing (1) by (2)} \quad \frac{\mu_1}{\mu_2} = \frac{\frac{c}{v_1}}{\frac{c}{v_2}} = \frac{c}{v_1} \times \frac{v_2}{c}$$

$$\Rightarrow \frac{\mu_1}{\mu_2} = \frac{v_2}{v_1}$$

Hence refractive index of a medium is inversely proportional to the speed of light in that medium.

Q. 4. For the same angle of incidence, the angle of refraction in three different media A, B and C 10°, 25° and 40°, respectively. In which medium the velocity of light will be maximum?

Answer: Refractive index (μ) = $\frac{c \text{ (speed of light in vacuum)}}{v \text{ (speed of light in any medium)}}$ (1)

Hence refractive index of a medium is inversely proportional to the speed of light in that medium.

Also $\mu = \frac{\sin i}{\sin r}$ (2)

$\Rightarrow$ Refractive index is inversely proportional to the angle of refraction.

From (1) and (2)

Velocity of light is directly proportional to the angle of refraction.

Thus velocity of light is maximum in medium C because angle of refraction is 40° is maximum.

Q. 5. Calculate the angle of incidence of light ray incident of surface of a plastic slab of refractive index $\sqrt{3}$, if the angle of refraction is 30°.

Answer: Given;

Angle of refraction(r) = 30°.

Angle of incidence = i .

Refractive index (μ) = $\sqrt{3}$.

Refractive index (μ) = $\frac{\sin i}{\sin r}$

$$\Rightarrow \sqrt{3} = \frac{\sin i}{\sin 30} = \frac{\sin i}{\frac{1}{2}}$$

$$\Rightarrow \sqrt{3} = 2 \times \sin i$$

$$\Rightarrow \sin i = \frac{\sqrt{3}}{2}$$

$$\Rightarrow i = 60^\circ.$$

Hence angle of incidence is 60° .

Q. 6. If a ray of light enters from alcohol to air. The refractive index of alcohol is 1.36. Calculate the speed of light in alcohol with respect to air.

Answer: Given;

Refractive index of alcohol (μ) = 1.36.

Speed of light in vacuum = $3 \times 10^8 \text{ m/s}$.

$$\text{Refractive index } (\mu) = \frac{c \text{ (speed of light in vacuum)}}{v \text{ (speed of light in alcohol)}}$$

$$\Rightarrow 1.36 = \frac{3 \times 10^8}{\text{speed of light in alcohol}}$$

$$\Rightarrow \text{speed of light in alcohol} = \frac{3 \times 10^8}{1.36}$$

$$\therefore \text{Speed of light in alcohol} = 2.21 \times 10^8 \text{ m/s}$$

Speed of light in alcohol with respect to air is $2.21 \times 10^8 \text{ ms}^{-1}$

Q. 7. The refractive index of glass with respect to air is $\frac{3}{2}$ and refractive index of water with respect to air is $\frac{4}{3}$. What will be the refractive index of water with respect to glass?

Answer: Refractive index of air, $\mu_{\text{air}} = 1$;

Given;

$$\text{Refractive index of water w.r.t air, } \mu_{\text{w}} = \frac{4}{3}$$

Refractive index of glass w.r.t air, $\mu_{g\text{air}} = \frac{3}{2}$

Refractive index of water w.r.t glass = $\mu_{w\text{g}} = \frac{\mu_w}{\mu_g} = \frac{4}{3}$

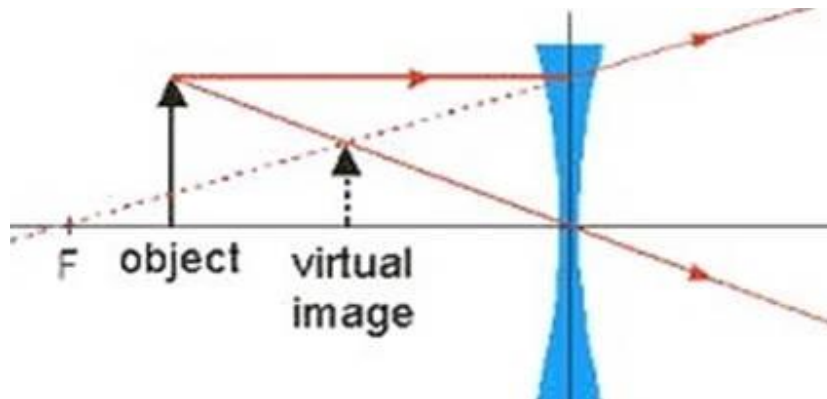
$$\Rightarrow \mu_{w\text{g}} = \frac{4 \times 2}{3 \times 3} = \frac{8}{9}$$

$\therefore$ Refractive index of water w.r.t glass is $\frac{8}{9}$.

Check Point 04

Q. 1. Name the lens which always forms a virtual image of an object.

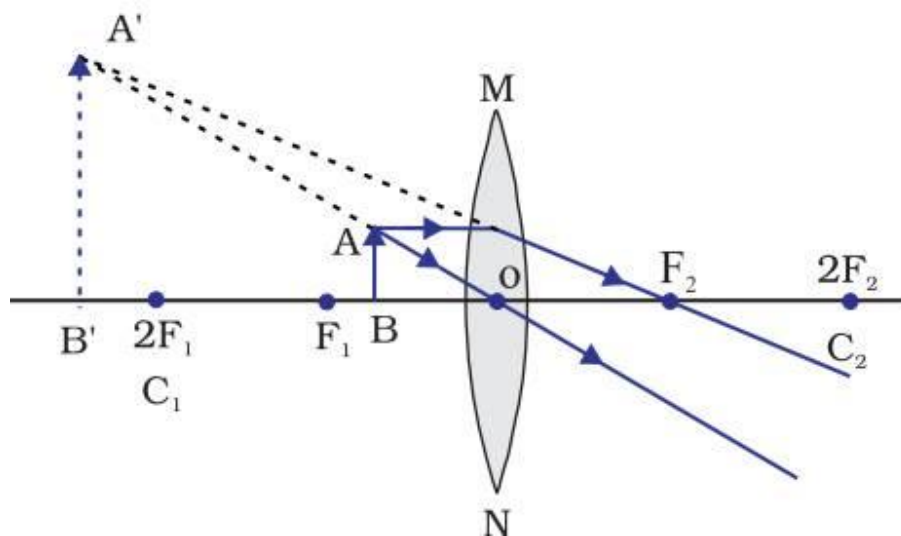
Answer: A concave lens always forms the virtual image of an object because it is diverging lens. The image formed is erect as shown in the figure below.



Q. 2. Discuss the case when a convex lens forms a virtual and enlarged image.

Answer: A virtual, erect and enlarged image is formed at the same side of lens, when an object is placed between principal focus, F_1 and optical centre, O of a convex lens.

Figure below shows the image formation.



Q. 3. Which lens would you prefer to use while reading small letters from a dictionary?

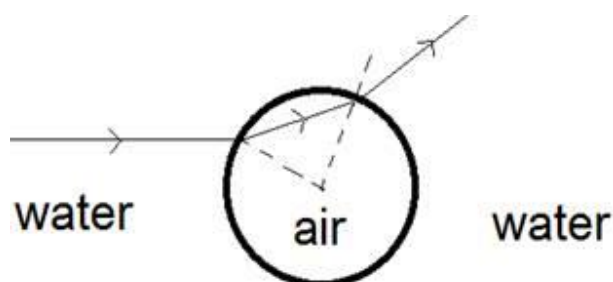
Answer: I would prefer convex lens because it gives the magnified image of an object when an object is placed between the radius of curvature and focal length. Also the magnification is more for the convex lenses having shorter focal length.

Hence for reading, a convex lens of focal length 5 cm should be used.

Q. 4. What type of lens is an air bubble inside the water?

Answer: When the light ray passes from a rarer medium to a denser medium it bends away from the normal. Thus light ray get diverge when it emerges out from the air bubble.

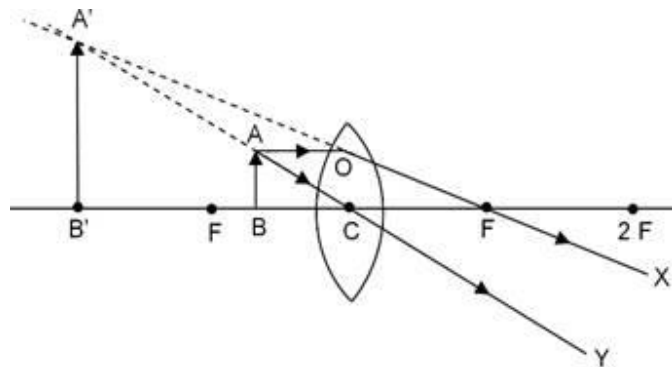
Thus the air bubble inside the water acts as Concave lens.



Q. 5. A convex lens of focal length 20 cm can produce a magnified virtual as well as real image. Is this a correct statement? If yes, where shall the object be placed in each case for obtaining these images?

Answer: Yes the above statement is correct.

A magnified virtual image can be obtained when the object is placed between optical centre and principal focus of the lens means the object is placed at distance less than 20 cm from the centre of the lens. Figure below illustrates it.

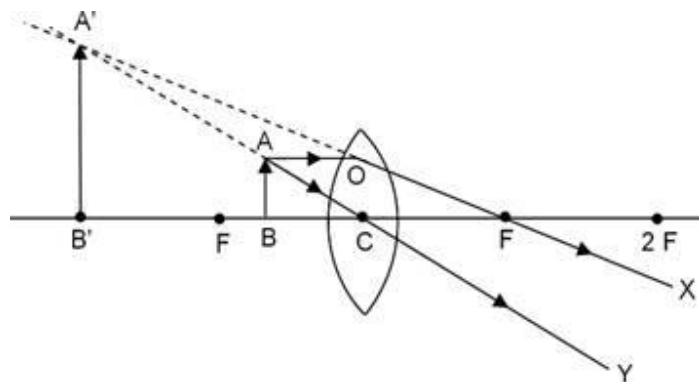


Real image of various sizes can be obtained when the object is placed beyond the principal focus.

Q. 6. A convex lens of focal length 20 cm can produce a magnified virtual as well as real image. Is this a correct statement? If yes, where shall the object be placed in each case for obtaining these images?

Answer: Yes the above statement is correct.

A magnified virtual image can be obtained when the object is placed between optical centre and principal focus of the lens means within 20cm. Figure below illustrates it.



Real image of various sizes can be obtained when the object is placed beyond the principal focus.

Check Point 05

Q. 1. A student uses a lens of focal length- 50 cm. What is the nature of the lens and its power?

Answer: Since the focal length is negative, therefore the lens is concave lens because the focal length of concave lens is negative.

$$P \text{ (in diopter)} = \frac{1}{f(\text{in meters})}$$

$$F = -50\text{cm} = -0.5\text{m} \text{ (1m = 100cm)}$$

$$\Rightarrow P = -\frac{1}{0.5} = -2 \text{ D}$$

Hence power of lens is -2 Dioptre.

Q. 2. You are provided with two lenses of focal length 20 cm and 30 cm, respectively. Which lens will you use to obtain more convergent light?

Answer: We know that Power of lens is defined as the efficiency with which a lens can converge or diverge the light ray.

$$\text{Also } P \text{ (in diopter)} = \frac{1}{f(\text{in meters})}$$

Hence power is inversely proportional to the focal length

Therefore the lens with focal length 20cm will have more power than the lens with focal length 30cm. Therefore the lens with focal length 20cm will give more convergent light.

Q. 3. A lens has power 4 D. Find the focal length that lens.

Answer: Given Focal length (f) = 4D

$$P \text{ (in diopter)} = \frac{1}{f(\text{in meters})}$$

$$\Rightarrow 4 = \frac{1}{f(\text{in meters})}$$

$$\Rightarrow f(\text{in meters}) = \frac{1}{4} = 0.25\text{m}$$

$$\text{Now } 1\text{m} = 100\text{cm}$$

$$\Rightarrow 0.25\text{m} = 25\text{cm}$$

Hence the focal length of lens is 25cm.

Q. 4. Two lenses of power -3.5 D and + 1 D are placed in contact. Find the total power of the combination of lens. Calculate the focal length of this combination.

Answer: Power $P_1 = -3.5D$; $P_2 = +1D$

Total power = $P_1 + P_2 = -3.5D + 1D$

$\Rightarrow$ Total power (P) = $-2.5D$.

Now;

$$P \text{ (in diopter)} = \frac{1}{f(\text{in meters})}$$

$$\Rightarrow -2.5 = \frac{1}{f(\text{in meters})}$$

$$\Rightarrow f(\text{in meters}) = \frac{-1}{2.5} = \frac{-1}{\frac{5}{2}}$$

$$\Rightarrow f(\text{in meters}) = -\frac{2}{5} = -0.4\text{m}$$

Now $1\text{m} = 100\text{cm}$

$\Rightarrow -0.4\text{m} = -40\text{cm}$

Hence the focal length of lens is -40cm .

Q. 5. If two lenses (convex) are in contact with each other, what happens to the ray after refraction?

Answer: If the two lenses are kept in contact than their power is added

$\Rightarrow$ Power (P) = $P_1 + P_2$.

Hence the power of combination is increased which means that the converging capacity is increased. And the focal length is decreased (because focal length is inversely proportional to the power of lens).

Therefore the ray after refraction will converge at point close to lens than earlier.

Q. 6. A lens is cut into two equal halves

(i) along the principal axis

(ii) Perpendicular to principal axis. What will be the focal length of each half?

Answer: (i) If the lens is cut along the principal axis than there will be no change in the focal length of the lens because the radius of curvature will remain the same, hence the focal length will remain unchanged.

(ii) If the lens is cut perpendicular to the principal axis than the focal length will change it will be twice the focal length of the original lens because the radius of curvature will increase and $R = 2F$.

Chapter Exercise

Q. 1. What is the radius of curvature of a plane mirror?

Answer: A plane mirror can be considered as a spherical mirror of infinite radius of curvature where the radius is infinitely large hence the aperture is straight. Therefore the radius of curvature of a plane mirror is infinite

Q. 2. What is the power of sun glasses?

Answer: The sunglasses are not used for magnification they are used to protect our eyes from the sun rays. The sun glass is the plain glass with thin polarizing film, therefore it does not have focus or the focus is at infinity.

$$\therefore \text{Power} = \frac{1}{\text{focal length}}$$

$$\text{Power} = \frac{1}{\infty} = 0$$

Hence the power of sun glasses is zero.

Q. 3. What is the value of speed of light in free space?

Answer: The refractive index of free space is 1, hence $\mu = 1$.

$$\Rightarrow \mu = \frac{c}{v} = 1$$

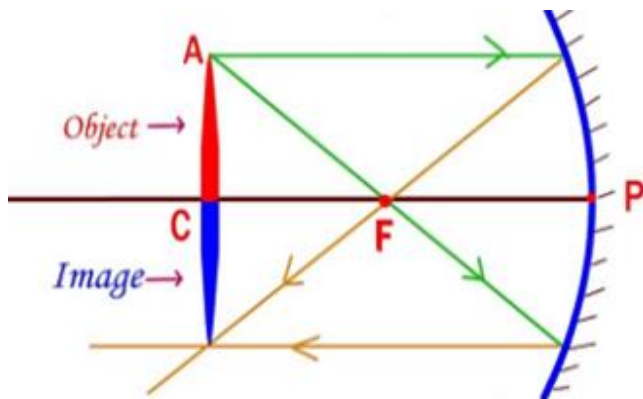
$$\Rightarrow \text{Speed of light} = c$$

Therefore speed of light in free space is $3 \times 10^8 \text{ m/s}$.

Q. 4. For what position of an object, a concave mirror forms a real image equal in size to the object?

Answer: When an object is kept at the centre of curvature of the concave mirror than the image formed is real, inverted and equal to the size of the object.

The figure below shows the ray diagram.



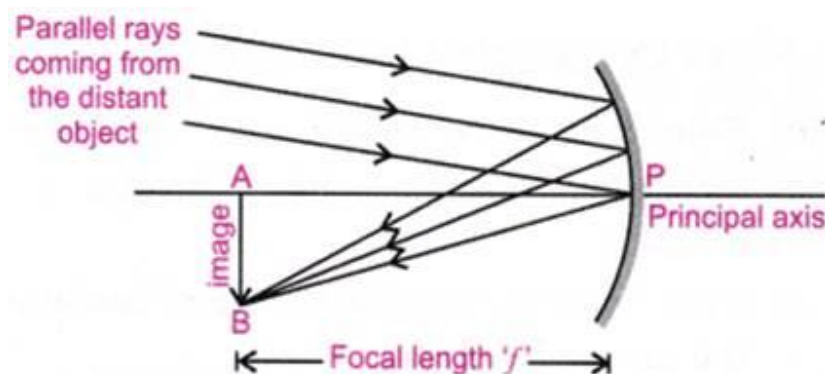
Q. 5. Does the value of speed of light change with medium?

Answer: Yes it does change with the change in medium because different mediums have different optical densities. Some are optically denser (higher refractive index) like oil, diamond etc in which the light travels at a slower speed and bends towards the normal, whereas some other materials can be optically rarer (lower refractive index) like air, water in which light speeds up and bends away from the normal.

Q. 6. A concave mirror forms sharp image of a distant tree. What is the separation between the mirror and the screen called?

Answer: When an object is kept at infinity or larger distances than the image is formed at the focus. Therefore the image of the distant tree will be formed at the focus of the concave mirror. So the screen will be placed at the focus to obtain the image. And the distance between the mirror and the screen will be the focal length.

Figure below shows the ray diagram for the same.



Q. 7. Does refractive index change with color of light?

Answer: Yes the refractive index changes with the color of the light because refractive index changes with the change in the wavelength and different colors have different wavelength. Due to it refractive index of violet color is highest and of red color is lowest.

Q. 8. Magnification produced by a concave mirror of a body 4.0 cm in size is 0.16 what is the size of image?

Answer: Given;

Magnification (m) = 0.16;

Size of object = 4cm;

Size of image =?

We know that;

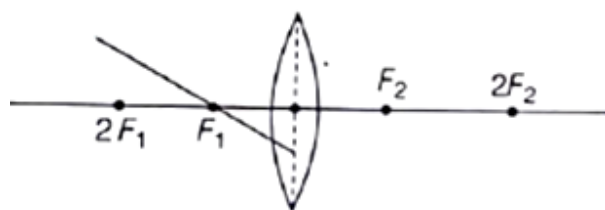
$$\text{Magnification} = \frac{\text{Size of image}}{\text{Size of object}}$$

$$\Rightarrow 0.16 = \frac{\text{Size of image}}{4}$$

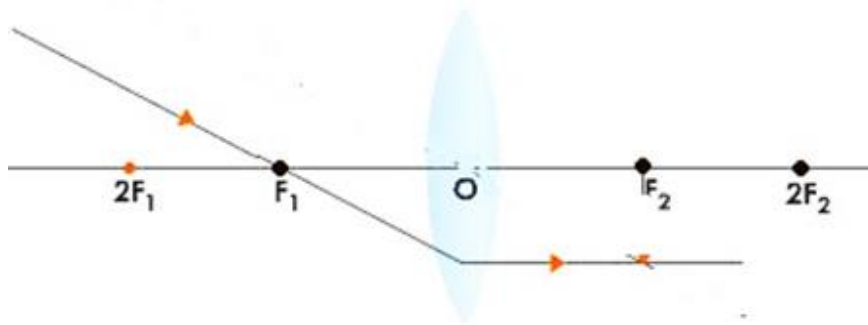
$$\Rightarrow \text{Size of image} = 0.16 \times 4 = 0.64\text{cm.}$$

Hence size of image is 0.64cm.

Q. 9. Redraw the ray diagram given below in your answer book and complete the path of ray.



Answer: When the ray of light passes through the focus of the convex lens it becomes parallel to the principal axis as shown in the figure below.



Q. 10. The refractive index of water is 1.33 and the speed of light in air 3×10^8 ms⁻¹. Calculate the speed of light in water.

Answer: Given that;

$$\text{Refractive index } (\mu) = 1.33 = \frac{4}{3}$$

Speed of light in air(c) = 3×10^8 ;

Speed of light in water =?

We know that

$$\mu = \frac{c}{v}$$

$$\frac{4}{3} = \frac{3 \times 10^8}{v}$$

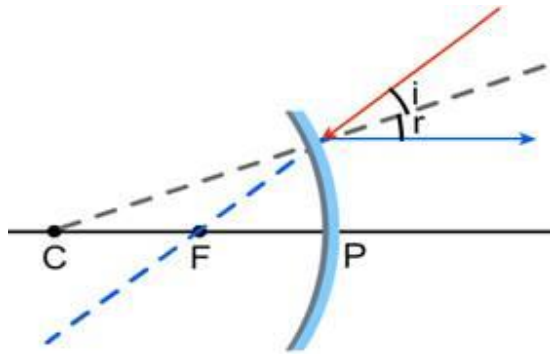
$$\Rightarrow v = \frac{3 \times 3 \times 10^8}{4} = \frac{9 \times 10^8}{4}$$

$$\Rightarrow v = 2.25 \times 10^8 \text{ m/s.}$$

Hence speed of light in water is 2.25×10^8 m/s.

Q. 11. Draw a ray diagram to show the path of the reflected ray corresponding to an incident ray of light parallel to the principal axis of a convex mirror and show the angle of incidence and angle of reflection on it.

Answer: A ray of light parallel to the principal axis after reflection appears to come from the focus of the convex mirror as shown in the figure below.



Q. 12. How do we say a medium to be rarer or denser? Give two reasons.

Answer: A medium can be classified as rarer or denser by following ways.

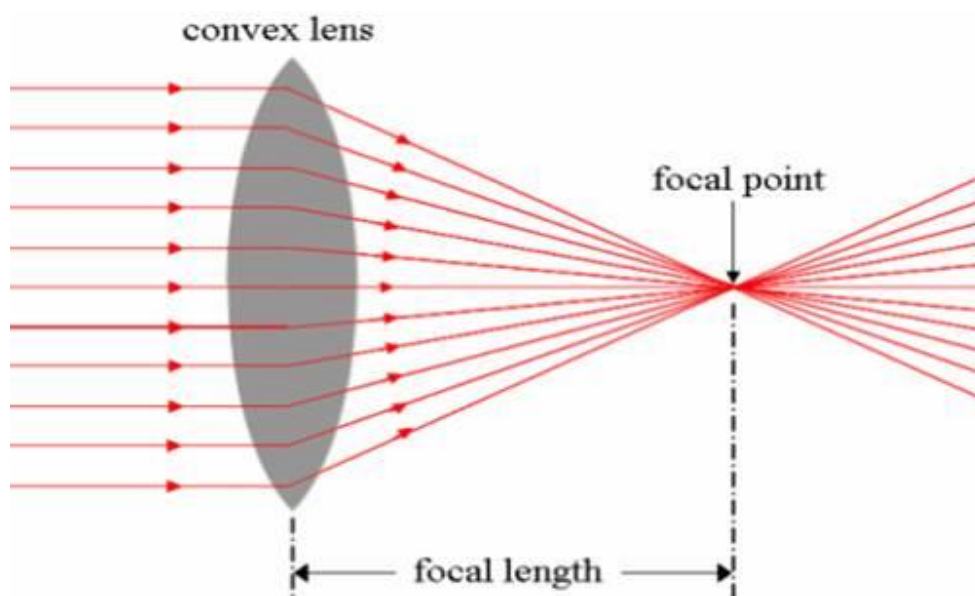
Rarer medium has less refractive index ex-water (1.33) while denser medium has higher refractive index ex-diamond (2.42).

When light goes from rarer medium to denser medium it bends towards the normal but when light goes from denser to rarer medium it goes away from the normal.

Q. 13. When we focus sunlight using a convex lens at the tip of a matchstick, what will happen? Why?

Answer: The matchstick will burn because convex lens is the converging lens. The rays of sun coming from large distance (infinity) will be converged at the focus of the convex lens, due to which too much energy will be produced and this energy will burn the matchstick kept at focus of the convex lens.

Figure below shows the ray diagram for the same.



Q. 14. A dentist uses a mirror in front of a decayed tooth at a distance of 4 cm from the tooth to get four times magnified image in the mirror. Use mirror formula to find the focal length and nature of the mirror used.

Answer: Given;

Magnification (m) = 4;

Object distance (u) = -4cm;

Image distance = v ;

$$\text{Magnification (m)} = -\frac{v}{u}$$

$$\Rightarrow 4 = -\frac{v}{-4}$$

$$\Rightarrow v = 4 \times 4 = 16\text{cm}$$

Image distance = 16cm.

By mirror formula;

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$

$$\Rightarrow \frac{1}{16} - \frac{1}{4} = \frac{1}{f}$$

$$\Rightarrow \frac{1-4}{16} = \frac{1}{f}$$

$$\Rightarrow -\frac{3}{16} = \frac{1}{f}$$

$$\Rightarrow f = -\frac{16}{3} = -5.33 \text{ cm}$$

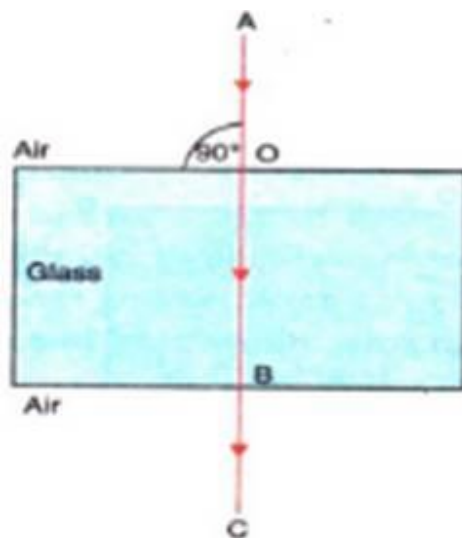
Hence the focal length is -5.33cm. Since the focal length is negative therefore the mirror is concave.

Q. 15. A ray of light strikes the glass slab at an angle of 90° . What are the angle of incidence and the angle of refraction?

Answer: Since the ray strikes the glass slab at an angle of 90° . Therefore

Angle of incidence = 0° .

Thus the ray of light will pass straight without any deviation as shown in the figure below.



Laws of Refraction of light;

$$\mu = \frac{\sin i}{\sin r}$$

Refractive index=1.5

Thus angle of refraction is given by

$$1.5 = \frac{0}{\sin r}$$

On solving, we get

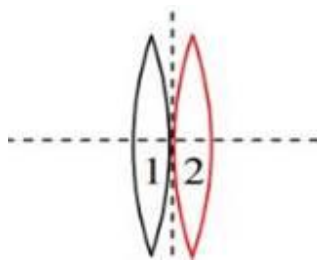
$$\sin r = 0$$

Thus the angle of refraction is 0°

Thus the refracted ray is perpendicular to the surface of the glass slab as shown in the above diagram.

Q. 16. When two or more lenses are placed in contact, what will be their combined power?

Answer: When two or more lenses each of power $P_1, P_2, P_3, P_4 \dots P_n$. are placed in contact with each other as shown in the figure below.



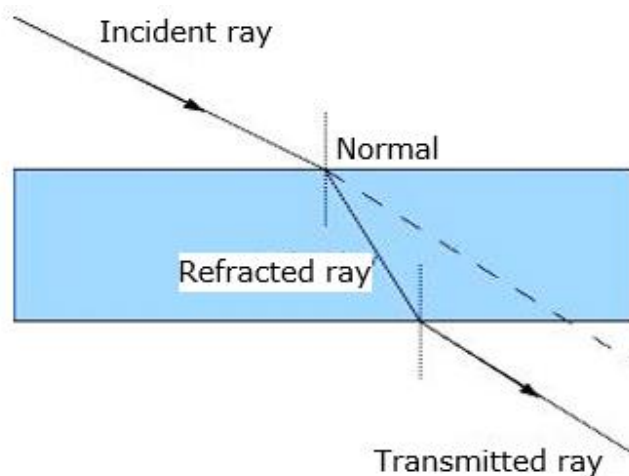
Then the combined power of the combination is the sum of all individual powers.

$$\Rightarrow P = P_1 + P_2 + P_3 + P_4 + \dots + P_n$$

Q. 17. A ray of light incident on one face of a rectangular glass slab emerges from the opposite face of the slab parallel to the direction of the incident ray. Why does it happen so?

Answer: It happens so due to the refraction in glass Slab. The incident ray bends towards the normal as the refracted ray when it enters the glass slab, and bends away from the normal as it comes out of the slab as the emergent ray. Because of the displacement between the incident ray of light and the emergent ray of light. The displacement between emergent and incident ray is called as lateral displacement.

The figure below illustrates the above situation.

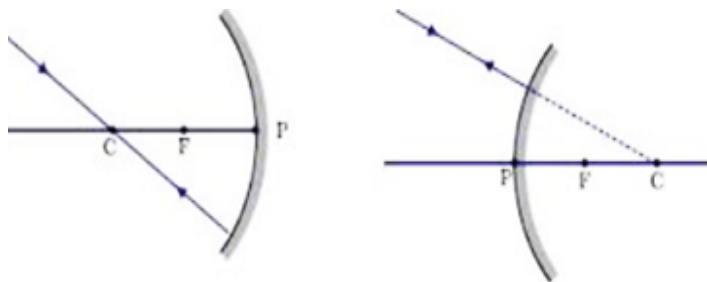


Q. 18. A ray passing through the centre of curvature of a spherical mirror after reflection returns along the same path. Why?

Answer: When ray of light passes through the centre of curvature of the spherical mirror it strikes along the normal that means it is incident on mirror at 90° . Hence the incident ray coincides with the normal and retraces its path. Therefore angle of incidence = 0 so, According to law of reflection;

Angle of reflection = 0 , hence the angle of reflection to become zero degrees, thus ray of light retraces its path.

The figure below illustrates the above situation.



Q. 19. Why does a ray of light bend from its path when it travels from one medium to other?

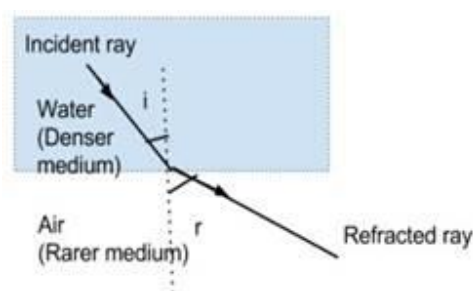
Answer: Bending of the light ray as it travels from one medium to another is due to the refraction of light. Refraction takes place because there is change in velocity as the light travels from one medium to another. Also the light always takes the shortest path between the two given points, due to this property the light gets bend.

Q. 20. A ray of light traveling from a medium x enters obliquely into another medium Y. If it bends away from the normal, then state which one of the two is relatively optically denser. Why?

Answer: When the ray of light travels from denser medium to the rarer medium than it bends away from the normal.

Therefore medium x is optically denser than medium y because the ray of light bends away from the normal when it travels from the medium x to medium y.

Figure below shows the situation.



Q. 21. Why is the refractive index of atmosphere different at different altitudes?

Answer: As we move above the earth surface the density of air goes on decreasing because the amount of air present at high altitudes is less. Thus due to the decrease in the density of the air, the refractive index gradually increases from the atmosphere to the earth's surface. Therefore the refractive index of the atmosphere is different at different altitudes.

Q. 22. For the same angle of incidence in medium P, Q and R, the angles refraction are 45° , 35° and 15° respectively. In which medium will the velocity of light be minimum? Give reason for your answer.

Answer: Refractive index,
$$\mu = \frac{c \text{ (speed of light in vaccum)}}{v \text{ (speed of light in any medium)}} \dots\dots(1)$$

Hence refractive index of a medium is inversely proportional to the speed of light in that medium.

Also
$$\mu = \frac{\sin i}{\sin r} \dots\dots\dots(2)$$

⇒ Refractive index is inversely proportional to the angle of refraction.

From (1) and (2)

Velocity of light is directly proportional to the angle of refraction.

Thus velocity of light is minimum in medium R because angle of refraction is 150 is minimum.

Q. 23. What is meant by refractive index? If the speed of light in a medium is 2/3rd of the speed of light in vacuum, find the refractive index of that medium.

Answer: Refractive index is the measure of bending of ray of light as it passes from one medium to another. It is also defined as the ratio of the speed of light in vacuum to the speed of light in any medium.

$$\text{Refractive index } (\mu) = \frac{c \text{ (speed of light in vacuum)}}{v \text{ (speed of light in any medium)}}$$

Given

$$\text{Speed of light in a medium } (v) = \frac{2c}{3}$$

$$\Rightarrow \mu = \frac{c}{\frac{2c}{3}}$$

$$\Rightarrow \mu = \frac{3c}{2c}$$

$$\Rightarrow \mu = \frac{3}{2} = 1.5$$

Hence Refractive index of medium is 1.5.

Q. 24. The radius of curvature of a concave mirror is 50 cm. Where should an object be placed in the mirror, so as to form its image at infinity? Justify your answer.

Answer: Given;

$$\text{Radius of Curvature}(R) = 50\text{cm};$$

$$R = 2f$$

$$\Rightarrow 50 = 2f$$

$$\Rightarrow f = \frac{50}{2} = 25 \text{ cm}$$

Focal length = 25cm.

When an object is kept at the focus of the concave mirror then the image is formed at infinity.

This can be shown as below:

The Mirror formula is given by:

$$\frac{1}{F} = \frac{1}{v} + \frac{1}{u}$$

Where, F is the focal length of the mirror

v is the image distance from the pole of the mirror

u is the object distance from the pole of the mirror

On solving for v, we get

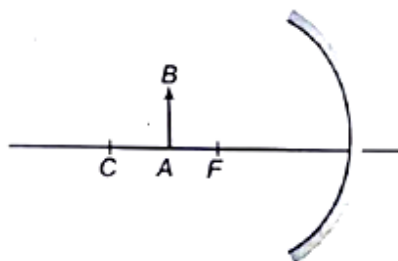
$$\frac{1}{v} = \frac{1}{f} - \frac{1}{u}$$

If F=u=25 cm, we get

$$\frac{1}{v} = 0 \text{ or } v = \frac{1}{0} = \infty$$

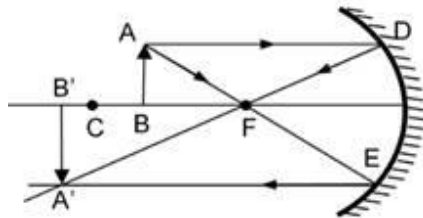
Therefore the object should be placed at 25cm from the pole of the concave mirror to get an image at infinity.

Q. 25. Draw the ray diagram in your answer book and show the formation of image of object AB with suitable rays. Mention the position and nature of image.



Answer: The mirror is the concave mirror and the object is kept between Centre of curvature and focus.

Thus the real, inverted and enlarged image will be formed beyond the center of curvature. Below is the ray diagram for it.



Q. 26. How far should an object be placed from a convex lens of focal length 20 cm to obtain its image at a distance of 30 cm from the lens? What will be the height of the image, if the objects is 6 cm tall?

Answer: According to the question;

Object distance = u ;

Image distance (v) = 30cm;

Focal length = 20cm

By lens formula;

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\Rightarrow \frac{1}{30} - \frac{1}{u} = \frac{1}{20}$$

$$\Rightarrow \frac{1}{u} = \frac{1}{30} - \frac{1}{20}$$

$$\Rightarrow \frac{1}{u} = \frac{20 - 30}{600} = \frac{-10}{600}$$

$$\Rightarrow \frac{1}{u} = \frac{-1}{60}$$

$$\Rightarrow u = -60\text{cm}.$$

Therefore object is placed at 60 cm in front of lens.

Now;

Height of object $h_1 = 6\text{cm}$;

$$\text{Magnification} = \frac{h_2}{h_1} = \frac{v}{u}$$

Putting values of v and u

$$\text{Magnification} = \frac{h_2}{6} = \frac{30}{-60}$$

$$\Rightarrow \frac{h_2}{6} = -\frac{1}{2}$$

$$\Rightarrow h_2 = -\frac{6}{2} = -3$$

Height of image is 3 cm.

Negative sign means image is real and inverted.

Q. 27. An object of size 7.0 cm is placed at a distance of 27 cm in front of concave mirror of focal length 18 cm. At what distance from the mirror should a screen be placed so that a sharply focused image can be obtained? Find the size and the nature of the image.

Answer: According to the question;

Object distance (u) = -27cm;

Focal length (f) = -18cm;

Image distance = v ;

By mirror formula;

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$

$$\Rightarrow \frac{1}{v} + \frac{1}{-27} = \frac{1}{-18}$$

$$\Rightarrow \frac{1}{v} = \frac{1}{27} - \frac{1}{18}$$

$$\Rightarrow \frac{1}{v} = \frac{-3 + 2}{54}$$

$$\Rightarrow \frac{1}{v} = -\frac{1}{54}$$

$$\Rightarrow v = -54\text{cm.}$$

Thus, screen should be placed 54cm in front of the mirror to obtain the sharp focused image.

Height of object $h_1 = 7\text{cm}$;

$$\text{Magnification} = \frac{h_2}{h_1} = -\frac{v}{u}$$

Putting values of v and u

$$\text{Magnification} = \frac{h_2}{7} = -\frac{-54}{-27}$$

$$\Rightarrow \frac{h_2}{7} = -2;$$

$$\Rightarrow h_2 = 7 \times -2 = -14.$$

Height of image is 14 cm.

Negative sign means image is real and inverted.

Thus real, inverted image of 14cm size is formed.

Q. 28. A 5.0 cm tall object is placed perpendicular to the principal axis of a convex lens of focal length 20 cm. The distance of the object from the lens is 30 cm By calculation determine

- (i) The position and**
- (ii) The size of the image formed.**

Answer: According to the question;

Object distance = -30 cm;

Image distance = v cm;

Focal length = 20 cm

By lens formula;

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\Rightarrow \frac{1}{v} - \frac{1}{-30} = \frac{1}{20}$$

$$\Rightarrow \frac{1}{v} = \frac{1}{20} - \frac{1}{30}$$

$$\Rightarrow \frac{1}{v} = \frac{30 - 20}{600} = \frac{10}{600}$$

$$\Rightarrow \frac{1}{v} = \frac{1}{60}$$

$$\Rightarrow v = 60\text{cm.}$$

Therefore image is formed at 60 cm in right of lens.

Now;

Height of object $h_1 = 5\text{cm}$;

$$\text{Magnification} = \frac{h_2}{h_1} = \frac{v}{u}$$

Putting values of v and u

$$\text{Magnification} = \frac{h_2}{5} = \frac{60}{-30}$$

$$\Rightarrow \frac{h_2}{5} = -2$$

$$\Rightarrow h_2 = -2 \times 5 = -10$$

Height of image is 10 cm.

Negative sign means image is real and inverted.

Q. 29. An object placed 45 cm from a lens forms an image on a screen place 90 cm on the other side of the lens. Identify the type of the lens and find its focal length.

Answer: According to the question;

Object distance, $u = -45\text{cm}$;

Image distance, $v = 90\text{ cm}$;

Focal length, $f = ?$

By lens formula;

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\Rightarrow \frac{1}{90} - \frac{1}{-45} = \frac{1}{f}$$

$$\Rightarrow \frac{1}{f} = \frac{1}{90} + \frac{1}{45}$$

$$\Rightarrow \frac{1}{f} = \frac{1+2}{90} = \frac{3}{90}$$

$$\Rightarrow f = \frac{90}{3}$$

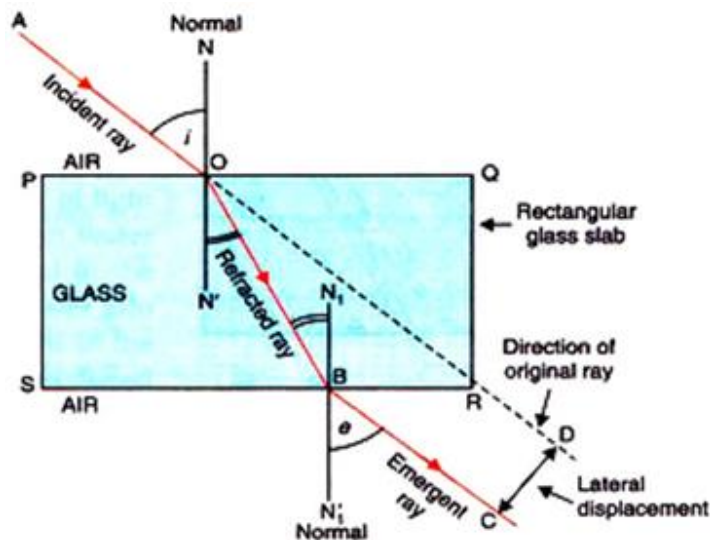
$$\Rightarrow f = 30\text{cm}.$$

Since the focal length is positive, therefore the lens is convex lens of focal length 30cm.

Q. 30. Does the incident and emergent ray coincide in the process of refraction through glass slab? Give reason.

Answer: The incident ray and the emergent ray do not coincide they are parallel to each other. The emergent ray is shifted by some distance from the incident ray while passing through the glass slab which is called the lateral displacement.

The figure below illustrates it.



Q. 31. A ray of light enters a diamond from air. If the refractive index of diamond is 2.42, what % (percentage) is speed of light in diamond with that of speed in air?

Answer: Refractive index (μ) = $\frac{c \text{ (speed of light in vacuum)}}{v \text{ (speed of light in any medium)}}$

Given $\mu = 2.42$, $c = 3 \times 10^8$.

Putting the value in the above formula, we get

$$\Rightarrow 2.42 = \frac{3 \times 10^8}{v}$$

$$\Rightarrow v = \frac{3 \times 10^8}{2.42}$$

$$\Rightarrow v = 1.23 \times 10^8 \text{ m/s.}$$

Speed of light in diamond is $1.23 \times 10^8 \text{ m/s}$

$$\% \text{ of speed in diamond} = \frac{1.23 \times 10^8}{3 \times 10^8} \times 100 = 0.41 \times 100 = 41\%$$

Thus there is 41% decrease in the speed of light in diamond than in air.

Q. 32. The image of an object placed at 60 cm in front of a lens is obtained on a screen at a distance of 120 cm from it. Find the focal length of the lens. What would be the lens? What would be the height of the image? If the object is 5 cm high?

Answer: According to the question;

Object distance (u) = -60cm;

Image distance (v) = 120cm;

Focal length = f

By lens formula;

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\Rightarrow \frac{1}{120} - \frac{1}{-60} = \frac{1}{f}$$

$$\Rightarrow \frac{1}{f} = \frac{1}{120} + \frac{1}{60}$$

$$\Rightarrow \frac{1}{f} = \frac{1+2}{120} = \frac{3}{120}$$

$$\Rightarrow f = \frac{120}{3}$$

$$\Rightarrow f = 40\text{cm.}$$

Therefore Focal length of lens is 40 cm.

Since the focal length is positive. Therefore the lens is convex lens of focal length 40cm.

Now;

Height of object $h_1 = 5\text{cm}$;

$$\text{Magnification} = \frac{h_2}{h_1} = \frac{v}{u}$$

Putting values of v and u

$$\text{Magnification} = \frac{h_2}{5} = \frac{120}{-60}$$

$$\Rightarrow \frac{h_2}{5} = -2$$

$$\Rightarrow h_2 = -2 \times 5 = -10 \text{ cm}$$

Height of image is 10 cm.

Negative sign means image is real and inverted.

Q. 33.A. Two lenses have power of (a) + 2D (b) – 4D. What is the nature and focal length of each lens?

Answer: Power $P_1 = 2\text{D}$;

Since Power is positive. Therefore, the lens is convex lens.

$$\text{Power} = \frac{1}{\text{focal length (in meters)}}$$

$$\Rightarrow 2 = \frac{1}{f}$$

$$\Rightarrow f = \frac{1}{2} = 0.5\text{m}$$

$$1\text{m} = 100\text{cm}$$

$$\Rightarrow 0.5\text{m} = 50\text{cm}.$$

Hence the focal length is 50cm

$$P_2 = -4\text{D}.$$

Since the power is negative. Therefore, the lens is concave lens.

$$\text{Power} = \frac{1}{\text{focal length (in meters)}}$$

$$\Rightarrow -4 = \frac{1}{f}$$

$$\Rightarrow f = \frac{1}{-4} = -0.25\text{m}$$

$$1\text{m} = 100\text{cm}$$

$$\Rightarrow 0.25\text{m} = 25\text{cm}.$$

Hence the focal length is -25cm

Q. 33.B. An object is kept at a distance of 100 cm from each of the above lenses.

Calculate the

- (a) image distance and**
- (b) magnification in each of two cases.**

Answer: (a) Given

Object distance (u) = -100cm

Focal length (f) = 50cm

Image distance = v

By lens formula;

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\Rightarrow \frac{1}{v} - \frac{1}{-100} = \frac{1}{50}$$

$$\Rightarrow \frac{1}{v} = \frac{1}{50} - \frac{1}{100}$$

$$\Rightarrow \frac{1}{v} = \frac{2-1}{100} = \frac{1}{100}$$

$$\Rightarrow v=100\text{cm}$$

Hence the image is formed at 100 cm behind the lens.

Object distance (u) = -100cm

Focal length (f) = -25cm

Image distance = v

By lens formula;

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\Rightarrow \frac{1}{v} - \frac{1}{-100} = \frac{-1}{25}$$

$$\Rightarrow \frac{1}{v} = \frac{-1}{25} - \frac{1}{100}$$

$$\Rightarrow \frac{1}{v} = \frac{-4 - 1}{100} = \frac{-5}{100}$$

$$\Rightarrow v = -\frac{100}{5}$$

$$\Rightarrow v = -20\text{cm}$$

Hence the image is formed at 20cm in front of the lens.

(b) For 1st case

Object distance (u) = -100cm

Image distance (v) = 100cm.

By Magnification Formula

$$\text{Magnification (m)} = \frac{v}{u}$$

$$\Rightarrow \text{Magnification} = \frac{100}{-100}$$

Therefore, Magnification for the 1st case is -1. The negative sign means the image is real and inverted.

For 2nd case

Object distance (u) = -100cm

Image distance (v) = -20cm.

By Magnification Formula

$$\text{Magnification (m)} = \frac{v}{u}$$

$$\Rightarrow \text{Magnification} = \frac{-20}{-100} = \frac{1}{5} = 0.2$$

Therefore, Magnification for 2nd case is 0.2. The positive sign means the image is erect and virtual.

Q. 34. List the sign conventions for reflection of light by spherical mirror. Draw a diagram and apply these conventions in the determination of focal length of a spherical mirror which forms three times magnified real image of an object placed. 16 cm in front of it.

Answer: Pole (P) of the mirror is taken as the origin and the Principal axis is taken as the horizontal X- axis. The sign conventions are as follows:

The object is always placed on the left side of the mirror.

All the distances measured to the right side of the origin are taken as positive, while the distances measured to the left side of the origin are taken as negative.

The object distance is always negative.

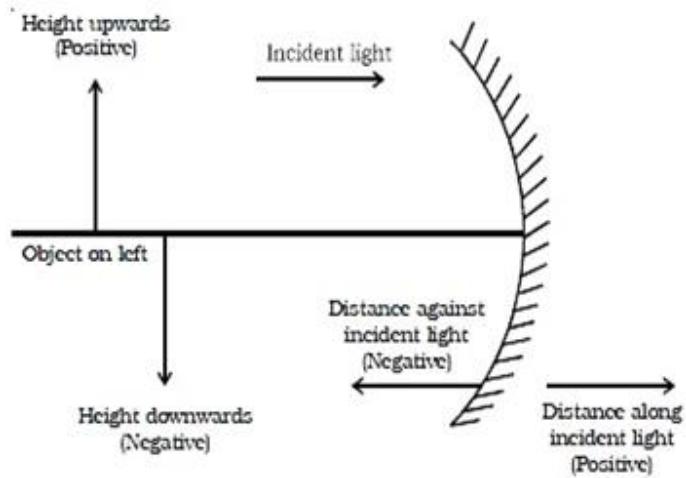
All the distances parallel to the principal axis of the mirror are measured from the pole of the mirror.

Distances measured vertically upwards from the principal axis of the mirror are taken as positive.

Distances measured vertically downwards from the principal axis of the mirror are taken as negative.

The focal length of Concave mirror is negative while that of convex mirror is positive.

The figure below illustrates the conventions used.

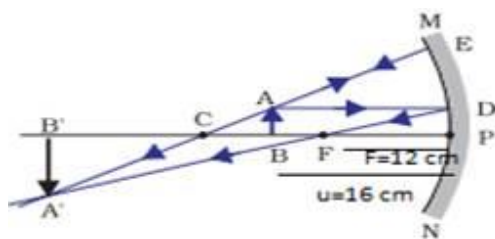


Given;

Magnification (m) = -3 (real image is inverted always).

Object distance (u) = -16cm.

Ray diagram can be shown as below



By Magnification Formula;

Magnification, $m = -\frac{v}{u}$

Where,

v is the image distance

u is the object distance

$$\Rightarrow -3 = -\frac{v}{-16}$$

$$\Rightarrow v = -3 \times 16 = -48\text{cm.}$$

∴ Image distance (v) = -48cm.

By mirror formula;

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$

$$\Rightarrow \frac{1}{-48} + \frac{1}{-16} = \frac{1}{f}$$

$$\Rightarrow f = \frac{-48}{4} = -12$$

Therefore the focal length is -12 cm. Since the focal length is negative, therefore the mirror is concave mirror.

Q. 35. List the new Cartesian sign convention for reflection of light by spherical mirrors. Draw a diagram and apply these conventions for calculating the focal length and nature of a spherical mirror which forms 1/3 times magnified virtual image of an object placed 18 cm in front of it.

Answer: According to the new Cartesian system the Pole (P) of the mirror is taken as the origin and the Principal axis is taken as the horizontal X- axis. The sign conventions for it are as follows:

The object is always placed on the left side of the mirror.

All the distances measured to the right side of the origin are taken as positive, while the distances measured to the left side of the origin are taken as negative.

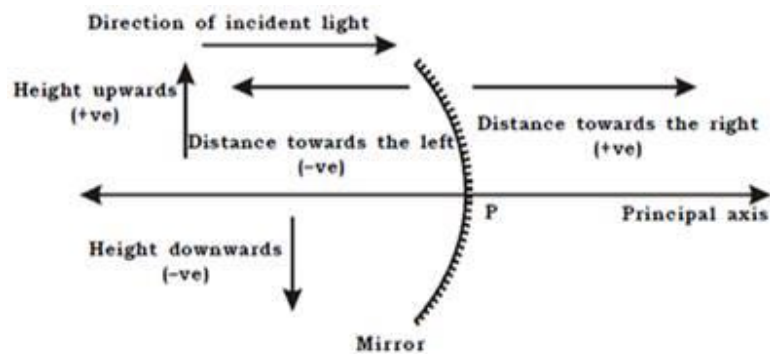
All the distances parallel to the principal axis of the mirror are measured from the pole of the mirror.

Distances measured vertically upwards from the principal axis of the mirror are taken as positive.

Distances measured vertically downwards from the principal axis of the mirror are taken as negative.

The focal length of Concave mirror is negative while that of convex mirror is positive.

The figure below illustrates the conventions used.



Given;

Magnification (m) = $\frac{1}{3}$ (virtual image is always erect).

Object distance (u) = -18cm.

By Magnification Formula;

Magnification, $m = -\frac{v}{u}$

Where,

v is the image distance

u is the object distance

$$\Rightarrow \frac{1}{3} = -\frac{v}{-18}$$

$$\Rightarrow v = \frac{18}{3} = 6$$

$$\Rightarrow v = 6\text{cm.}$$

$\therefore$ Image distance (v) = 6cm.

By mirror formula;

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$

$$\Rightarrow \frac{1}{6} + \frac{1}{-18} = \frac{1}{f}$$

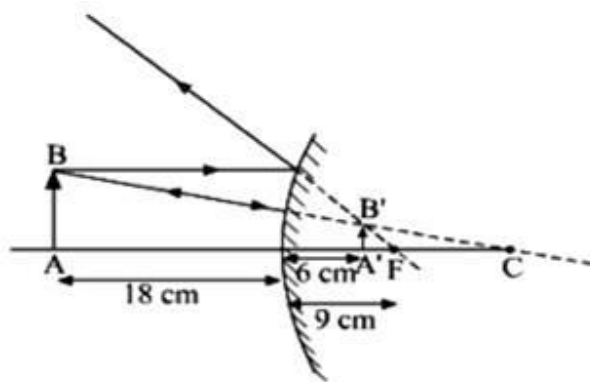
$$\Rightarrow \frac{1}{6} - \frac{1}{18} = \frac{1}{f}$$

$$\Rightarrow \frac{1}{f} = \frac{3-1}{18} = \frac{2}{18}$$

$$\Rightarrow f = \frac{18}{2} = 9 \text{ cm}$$

Therefore, the focal length is 9 cm. Since the focal length is positive, therefore the mirror is convex mirror.

Figure below shows the ray diagram for the same.



Q. 36.A. State and define the SI unit of power of a lens.

Answer: The reciprocal of focal length of the lens is called the power of the lens (P).

$$P \text{ (in dioptre)} = \frac{1}{f(\text{in meters})}$$

The S.I unit of power of lens is diopter denoted by D.

From the formula of power of lens.

$$1 \text{ D} = \frac{1}{1 \text{ m}} = 1 \text{ m}^{-1}.$$

Thus 1 Dioptre is the power of the convex lens having focal length of 1m.

Q. 36.B. A convex lens of focal length 25 cm and a concave lens of focal length 10 cm are placed in close contact with each other. Calculate the lens power of this combination.

Answer: Given

$f_1 = 25\text{cm}$ (Focal length of convex lens is positive)

$\Rightarrow f_1 = 0.25\text{m}$ ($1\text{m} = 100\text{cm}$)

P (in diopetre) = $\frac{1}{f(\text{in meters})}$

$\Rightarrow$ Power of convex lens, ($F=25\text{ cm}$) $P_1 = \frac{1}{f_1}$

$$\Rightarrow P_1 = \frac{1}{0.25} = \frac{1}{\frac{1}{4}}$$

$$\therefore P_1 = 4\text{D}$$

$f_2 = -10\text{cm}$ (Focal length of concave lens is negative)

$\Rightarrow f_2 = -0.1\text{m}$ ($1\text{m} = 100\text{cm}$)

$\Rightarrow$ Power of the concave lens ($F=10\text{ cm}$), $P_2 = \frac{1}{f_2}$

$$\Rightarrow P_2 = -\frac{1}{0.1} = -\frac{1}{\frac{1}{10}}$$

$$\therefore P_2 = -10\text{D}.$$

Power of combination = $P_1 + P_2$.

$$P = 4\text{D} - 10\text{D} = -6\text{D}.$$

Lens power of the combination is -6D . Since it is negative therefore the new lens will behave like concave lens having a focal length of 16.6cm .

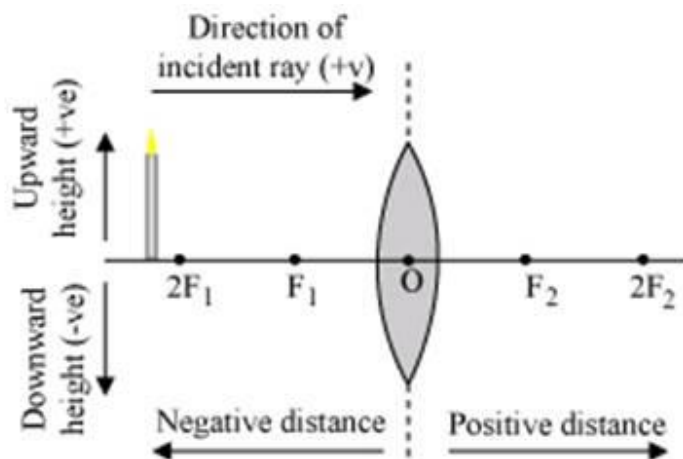
Q. 37. List the sign conventions that are followed in case of refraction of light through spherical lenses. Draw a diagram and apply these conventions in determining the nature and focal length of a spherical lens which forms three times magnified real image of an object placed 16 cm from the lens.

Answer: Sign convention for the refraction of light is as follows.

1. All the distances are measured from the optical centre of the lens.

2. All the distances which are measured in the same direction of the incident light ray (left hand side of lens) will be taken as positive.
3. All the distances which are measured against the direction of incident light (right hand side) are taken as negative.
4. The perpendicular distances to principal axis in upward direction will be positive and those in downward direction will be taken as negative.

Figure below illustrates the conventions more clearly.



According to the question.

Magnification (m) = -3 (real image is always inverted).

Object distance (u) = -16cm.

By Magnification Formula;

Magnification, $m = \frac{v}{u}$

Where,

v is the image distance,

u is the object distance

$$\Rightarrow -3 = \frac{v}{-16}$$

$$\Rightarrow v = -16 \times -3$$

$$\Rightarrow v = 48\text{cm.}$$

$$\therefore \text{Image distance } (v) = 48\text{cm.}$$

By lens formula;

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\Rightarrow \frac{1}{48} - \frac{1}{-16} = \frac{1}{f}$$

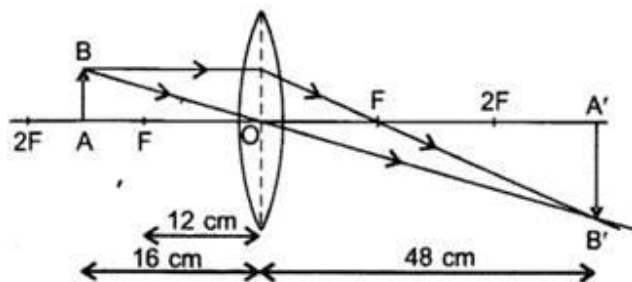
$$\frac{1}{48} + \frac{1}{16} = \frac{1}{f}$$

$$\Rightarrow \frac{1}{f} = \frac{1+3}{48} = \frac{4}{48}$$

$$\Rightarrow f = \frac{48}{4} = 12$$

Therefore the focal length is 12 cm. Since the focal length is positive, therefore the lens is convex lens.

Figure below shows the ray diagram for the same.



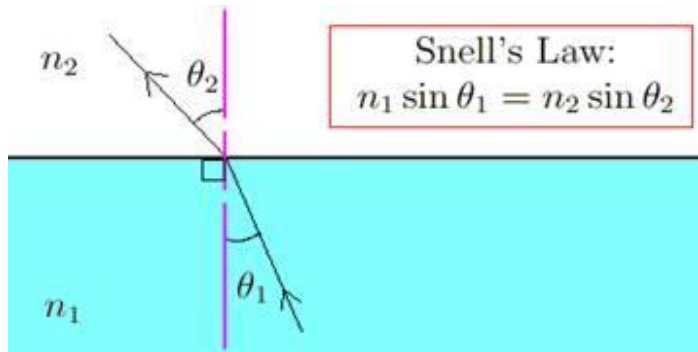
Q. 38.A. State the laws of refraction of light. Write an expression to relate absolute refractive index of a medium with speed of light in vacuum.

Answer: The refraction of light occurs according to the following laws which are as follows.

1. The incident ray refracted ray, and the normal to the surface separating two media at the point of incidence all lie in the same plane.

2. The ratio of sine of angle of incidence and sine of angle of refraction remains

constant ($\frac{\sin i}{\sin r} = \text{constant}$) subject to certain conditions. This law is called Snell's law of refraction.



Refractive index of a medium (μ) = $\frac{\text{Speed of light in a vacuum}(c)}{\text{Speed of light in a medium}(v)}$

$$\Rightarrow \mu = \frac{c}{v}$$

Q. 38.B. The refractive index of a medium x with respect to y is $\frac{2}{3}$ and the refractive index of medium y with respect to z is $\frac{4}{3}$ Calculate the refractive index of medium z with respect to medium x

Answer: Refractive index of air, $\mu_{\text{air}} = 1$;

Given;

Refractive index of medium x w.r.t medium y, $\mu_{xy} = \frac{2}{3}$

Refractive index of medium y w.r.t medium z, $\mu_{yz} = \frac{4}{3}$

Refractive index of medium z w.r.t medium x = $\mu_{zx} = \frac{\mu_z}{\mu_x} = \frac{\mu_z}{\mu_y} \times \frac{\mu_y}{\mu_x}$

$$\Rightarrow \mu_{zx} = \frac{1}{\frac{\mu_y}{\mu_z}} \times \frac{1}{\frac{\mu_x}{\mu_y}}$$

$$\Rightarrow \mu_{zx} = \frac{1}{\mu_{yz}} \times \frac{1}{\mu_{xy}}$$

$$\Rightarrow \mu_{zx} = \frac{1}{\frac{4}{3}} \times \frac{1}{\frac{2}{3}}$$

$$\Rightarrow \mu_{zx} = \frac{3}{4} \times \frac{3}{2}$$

$$\Rightarrow \mu_{zx} = \frac{9}{8}$$

$\therefore$ Refractive index of medium z w.r.t medium x is $\frac{9}{8}$.

Q. 39. Varun's mom is finding it difficult to cook in the kitchen as there was power cut and she was complaining about it to Varun. He immediately took a plane mirror from his shelf made it stand against a wall such that sun's rays were focused into the kitchen directly on the cook top, due to the reflection of the mirror. There was some light now and his mother was able to finish her work.

(i) What are the characteristic of the image formed by a plane mirror?

(ii) What values did Varun display?

Answer:

(i) Image formed by plane mirror is of the same size as of the object.

Positive value of magnification indicates that image formed by plane mirror is erect.

Image formed by plane mirror is at same distance as the object but behind the mirror.

Magnification of image is +1.

The image is virtual.

(ii) Varun made an arrangement for the light so that his mother could finish the work easily this shows that Varun is caring and responsible towards his mother. Also, he has used his knowledge of plane mirrors to get the light this shows that he is also quite

clever and intelligent also he is the serious student who focuses on the practical aspect of things taught in class and applies them in a day to day use.

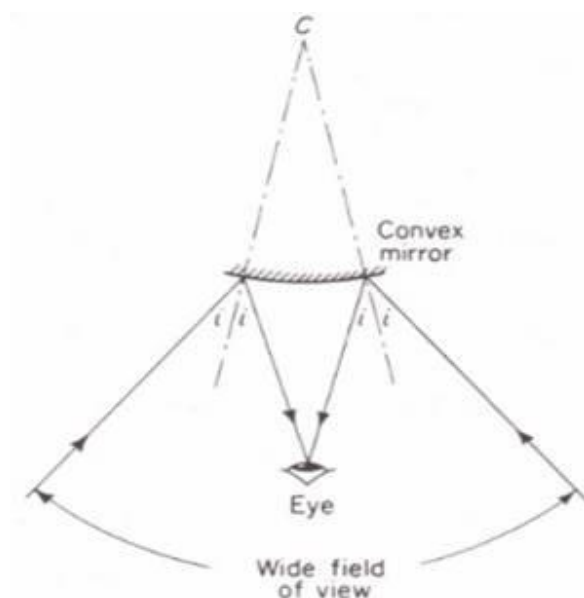
In other words, Varun had put the science to the real use.

Q. 40. Mr. Raghav, grade 6 teacher find that his students do not draw when he draws on the board. Every time he had to turn towards them to see whether they draw and label the diagrams. Arav, one of his student fixed two big convex mirrors at the two sides of the black board. With this Mr. Raghav was able to draw and also supervise his students through the mirror. All the students started doing their work property.

(i) Which characteristics of convex lens, let Mr. Raghav to do both his job at the same time?

(ii) What value did Arav and Mr. Raghav show?

Answer: (i) The convex mirrors are diverging in nature and they have the wide field of view due to which we can see the image of large area in the mirror. The light rays incident on it gets diverged following the laws of reflection, the reflected rays forms the wider path as shown in the figure below.



(ii) Mr. Raghav every time look to see whether students are drawing the diagram or not this shows that he is a responsible and caring teacher who does his job passionately. Arav puts two convex mirrors so that Mr. Raghav will not have to turn every time this shows that Arav is helpful, caring and respectful towards his teacher. Also he had used the property of convex mirrors thus he is quite intelligent and serious student who puts the practical use of concepts in day to day life use.

Challengers

Q. 1. A virtual image three times the size of the object is obtained with a concave mirror of radius of curvature 36 cm. The distance of the object from the mirror is

- A. 20cm**
- B. 10cm**
- C. 12cm**
- D. 5cm**

Answer: Given:

Magnification (m) = 3 (virtual image is erect).

Radius of the curvature, R = 36 cm

Focal Length (f) = $\frac{R}{2}$ = -18cm (Negative for concave mirror).

Now by formula,

1. Magnification,
$$m = \frac{-v}{u}$$

Where,

v is the image distance,

u is the object distance,

Putting the values in the above formula, we get

$$3 = \frac{-v}{u} \text{ or } v = -3u$$

2. Mirror formula

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

Where f is the focal length of the mirror v is the image distance from the mirror u is the object distance from the mirror Thus, putting the values in the equation, we get

$$\frac{-1}{18} = \frac{-1}{3u} + \frac{1}{u} = \frac{2}{3u}$$

Thus, on solving the above equation, we get $\frac{-1}{36} = \frac{1}{3u}$

u = -12 cm

Hence the distance of the object from the mirror is 12 cm.

Q. 2. A convex mirror of focal length f forms an image $\frac{1}{n^{\text{th}}}$ of the size of the object. The distance of the object from the mirror is

A. $\frac{n+1}{n}f$

B. $(n+1)f$

C. $(n-1)f$

D. $\frac{n-1}{n}f$

Answer: According to the question

Magnification (m) = $\frac{1}{n}$ (image is of $\frac{1}{n^{\text{th}}}$ the size of object).

Focal length = f (positive for convex mirror).

Object distance = $-u$.

Now By formula.

$$m = \frac{f}{f - u}$$

$$\Rightarrow \frac{1}{n} = \frac{f}{f+u}$$

$$\Rightarrow f + u = nf$$

$$\Rightarrow u = nf - f$$

$$\Rightarrow u = (n-1)f.$$

Therefore the object distance from the mirror is $(n-1)f$. Hence the option C is correct.

Q. 3. A perfecting reflecting mirror has an area of 1cm^2 . Light energy is allowed to fall on it for an hour at the rate of 10 Wcm^{-2} . The force that acts on the mirror is

A. $3.35 \times 10^{-7}\text{N}$

B. $6.7 \times 10^{-7}\text{N}$

C. $3.35 \times 10^{-8}\text{N}$

D. $6.7 \times 10^{-8}\text{N}$

Answer: Given: -

Area of the mirror = 1 cm^2 ,

Power transmitted to the mirror = 10 Wcm^{-2} ,

Calculations: -

The average force is given by $\frac{\Delta p}{\Delta t}$

Since the surface is perfectly reflecting we can write $\Delta p = 2 \frac{\Delta t}{c}$

$$\text{So } F = 2 \left(\frac{\Delta E}{c \Delta t} \right) = 2 \frac{P}{c}$$

$$= 2 \cdot \frac{10 \times 10^4 \times 1 \times 10^{-4}}{3 \times 10^8}$$

$$= \frac{20}{3} \times 10^{-8} \text{ N}$$

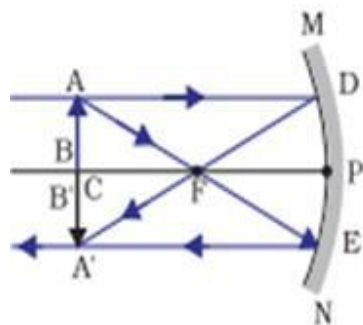
$$= 6.7 \times 10^{-8} \text{ N}$$

Q. 4. An object is placed at the centre of curvature of a concave mirror. The distance between its image and the pole is

- A. equal to f**
- B. between f and $2f$**
- C. equal to $2f$**
- D. greater than $2f$**

Answer: When an object is placed at centre of curvature of concave mirror than the real, inverted image of size same as that of object is formed at the center of curvature.

Therefore the image distance = Centre of curvature = $2f$. Hence the correct option is C



Q. 5. The refractive index of lens flint glass is 1.65 and for alcohol, it is 1.36 with respect to air, then the refractive index of the dens flint glass with respect to alcohol is

- A. 1.31
- B. 1.21
- C. 1.11
- D. 1.01

Answer: Refractive index of air, $\mu_{\text{air}} = 1$;

Given;

Refractive index of flint glass w.r.t air, ${}^{\text{air}}\mu_{\text{glass}} = 1.65$;

Refractive index of alcohol w.r.t air, ${}^{\text{air}}\mu_{\text{alcohol}} = 1.36$;

Refractive index of flint glass w.r.t alcohol = ${}^{\text{alcohol}}\mu_{\text{glass}} = \frac{{}^{\text{air}}\mu_{\text{glass}}}{{}^{\text{air}}\mu_{\text{alcohol}}} = \frac{1.65}{1.36}$

$\Rightarrow {}^{\text{alcohol}}\mu_{\text{glass}} = 1.213$

Hence the refractive index of flint glass w.r.t alcohol is 1.213.

Q. 6. Refractive index of diamond with respect to glass is 1.6. If the absolute refractive index of glass is 1.5, then the absolute refractive index of diamond is

- A. 1.4
- B. 2.4
- C. 3.4
- D. 4.4

Answer: Absolute refractive index of glass = $\frac{\text{Refractive index of glass}}{\text{Refractive index of air}} = \frac{\mu_{\text{glass}}}{\mu_{\text{air}}} = 1.5$

Refractive index of diamond w.r.t glass is

$$\frac{\mu_{\text{diamond}}}{\mu_{\text{glass}}} = 1.6$$

$\Rightarrow \mu_{\text{diamond}} = 1.6 \times \mu_{\text{glass}}$

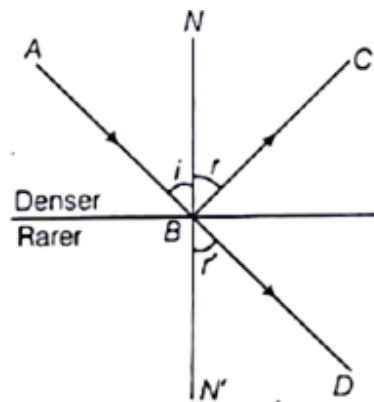
$\Rightarrow \mu_{\text{diamond}} = 1.6 \times 1.5$ ($\mu_{\text{glass}} = 1.5$).

$\Rightarrow \mu_{\text{diamond}} = 2.4$

Hence the absolute refractive index of diamond is 2.4. Therefore the option B is correct.

Q. 7. A ray of light from a denser medium strikes a rarer medium at an angle incidence as shown in figure. The reflected and refracted rays make an angle of

90° with each other. The angles of reflection and refraction are r and r' . The critical angle is



- A. $\sin^{-1}(\tan r)$
- B. $\sin^{-1}(\tan i)$
- C. $\sin^{-1}(\tan r')$
- D. $\tan^{-1}(\tan i)$

Answer: According to Snell's law

$$\frac{\sin i}{\sin r} = \mu$$

But $i + r = 90^\circ$ (Reflected and refracted rays are at an angle of 90°).

$$\Rightarrow \mu = \frac{\sin 90^\circ - r}{\sin r} = \frac{\cos r}{\sin r}$$

$$\Rightarrow \mu = \cot r.$$

$$\Rightarrow \mu = \frac{1}{\tan r}$$

$$\Rightarrow \frac{1}{\mu} = \tan r$$

$$\text{Critical angle} = \mu = \frac{1}{\sin i_c}$$

$$\Rightarrow \sin i_c = \frac{1}{\mu}$$

$$\Rightarrow \sin i_c = \tan r$$

$$\Rightarrow i_c = \sin^{-1}(\tan r)$$

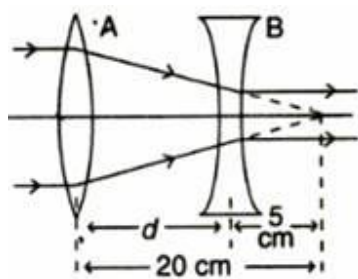
Therefore, the critical angle $i_c = \sin^{-1}(\tan r)$

Hence the option A is correct.

Q. 8. A convex lens A of focal length 20 cm and a concave lens B of focal length 5 cm are kept along the same axis with a distance d between them. If a parallel beam of light falling on A leaves B as a parallel beam, then the distance d in cm will be

- A. 25
- B. 15
- C. 30
- D. 50

Answer: According to the question following is the ray diagram.



As the incident ray is parallel to the principal axis. Therefore in absence of concave lens it will form an image at focus of convex lens.

$$\therefore v = 20\text{cm} = f$$

Distance of Image I from the concave lens B will be $= u = 20 - d$

Now, the image I will act as object for the concave lens.

Since image object (image I) is at focus of concave lens. Therefore, Image will be formed at infinity

$$\Rightarrow v = \infty$$

Focal length = -5cm.

By Lens Formula.

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\Rightarrow \frac{1}{\infty} - \frac{1}{20-d} = \frac{1}{-5}$$

$$\Rightarrow 0 - \frac{1}{20-d} = \frac{1}{-5}$$

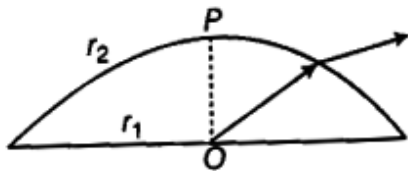
$$\Rightarrow \frac{1}{20-d} = \frac{1}{5}$$

$$\Rightarrow 20 - d = 5$$

$$\Rightarrow d = 20 - 5 = 15\text{cm.}$$

Therefore, the distance d will be 15cm. Hence the option B is correct.

Q. 9. A thick plane-convex lens made of crown glass (refractive index 1.5) has thickness of 3 cm at its centre. The radius of curvature of the spherical surface is 5 cm.



An ink mark made at the centre of its plane face, when viewed normal through the curved face, appears to be at a distance x from the curved face. Then, x is equal to

- A. 2cm
- B. 2.1cm
- C. 2.3cm
- D. 2.5cm

Answer: Given:

Radius of curvature, R = -5 cm

Object distance, $u = -3$ cm

The refractive indices $n_1 = 1.5$ (glass), $n_2 = 1.0$ (air)

We have, $\frac{n_2}{v} - \frac{n_1}{u} = \frac{n_2 - n_1}{R}$ (The Lensmaker's formula)

$$\frac{1}{v} - \frac{1.5}{-3} = \frac{1 - 1.5}{-5}$$

$$\frac{1}{v} = \frac{0.5}{5} - \frac{1.5}{3} = -\frac{2}{5}$$

$v = -2.5$ cm

Then the image will appear at distance of 2.5 cm from the plane surface of the mirror

Hence D is the correct option.

Q. 10. An object is placed in front of a screen and a convex lens is placed at a position such that the size of the image formed is 9cm. when the lens is shifted through a distance of 20 cm, the size of the image becomes 1 cm. The focal length of the lens and the size of the object are respectively.

A. 7.5 cm and 3.5 cm

B. 7.5 cm and 4.5 cm

C. 6 cm and 3 cm

D. 7.5 cm and 3 cm

Answer: If h_1 and h_2 are the sizes of the images formed in two conjugate positions, then, the size of object is given as $h = \sqrt{h_1 h_2} = \sqrt{9 \times 1} = 3$ cm.

The size of the image in the two conjugate positions is

In the first case, if the image is formed, the magnification is given as

In the first case, if the image is formed, the magnification is given as $\frac{v}{u} = \frac{9}{3}$ Such that, $v = 3u$

Also, $v = 20 + u$, since “v” and “u” interchange the conjugate positions.

$$\therefore 3u = 20 + u$$

$$\text{Or } 2u = 20$$

$$\text{Or } u = 10$$

$$\text{And, } v = 20 + u = 20 + 10 = 30 \text{ cm}$$

Now, focal length is calculated as:

$$\begin{aligned}
 \frac{1}{f} &= \frac{1}{v} + \frac{1}{u} \\
 &= \frac{1}{30} + \frac{1}{10} \\
 &= \frac{10 + 30}{300} \\
 &= \frac{40}{300} = 7.5
 \end{aligned}$$

Thus, correct answer is option (d)

Human Eye and The Colourful World

Check Point 01

Q. 1. Name the cells which are responsible for the colour determination.

Answer: Cone cells are responsible for the colour determination. As the name suggests they are cone shaped photoreceptor cells on retina. They help us see and distinguish between different colours hence making colour perception possible.

Q. 2. Name the cells which respond only to the intensity of the light.

Answer: Rod cells respond only to the intensity of light. As the name suggests they are rod shaped photoreceptor cells on retina. Rod shaped cells respond to the brightness of light.

Q. 3. Explain the nature of image formed by human eye lens.

Answer: Image found by a human eye lens is real and inverted.

The eye lens is the convex lens. The object placed beyond the focal length always forms a real and inverted image in a convex lens. The image is formed on retina. Although the image formed on retina is inverted our mind interprets the image as an erect object.

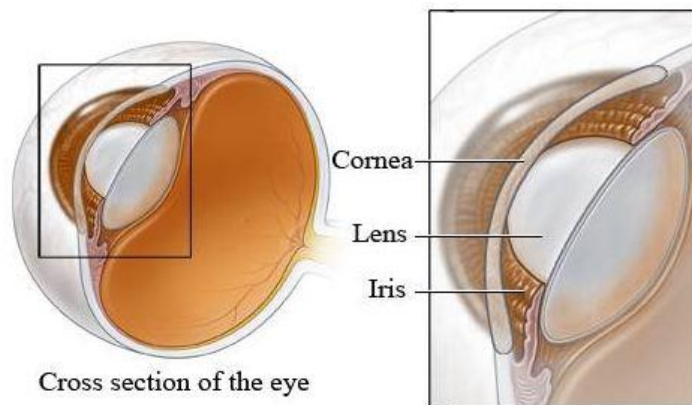
Q. 4. Give the function of the following

(i) Cornea (ii) Iris

Answer: (i) Cornea: The front part of the eye is cornea and it controls and focuses the entry of light into the eye. It also acts as a convex lens and converges most of the light rays entering the eye.

(ii) Iris: The iris automatically adjusts the size of the pupil according to the intensity of light received by the eye. The iris regulates the amount of light entering the eye and falling on the retina.

The diagram is shown below:



Q. 5. Where are light-sensitive cells present in abundance and give their function?

Answer: The light-sensitive cells are present in abundance in the **Retina**.

There are two types of photoreceptor cells on the retina:

(i) Rod cells or Rods

Function: rods are responsible for night vision and respond to the intensity of light.

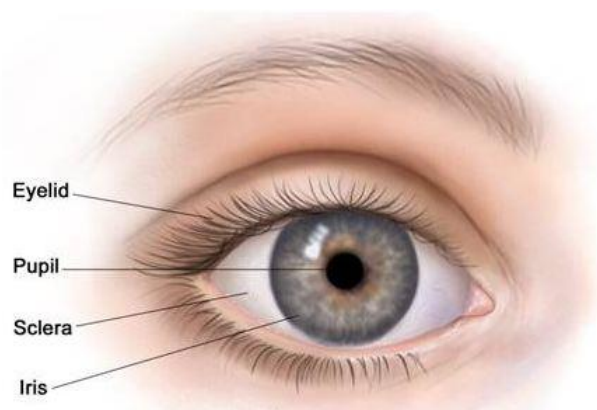
(ii) Cone cells or Cones

Function: cones respond to the colour of objects.

Q. 6. What is the function of sclera?

Answer: The white part of the eye is called Sclera. Its function is to provide strength and structure. It also provides protection to the interior parts of the eye.

The following diagram shows the sclera:



Check Point 02

Q. 1. Name the defect of vision for which

- (i) Far point of an eye is less than infinity**
- (ii) Near point of an eye is more than 25 cm.**

Answer: (i) **Myopia** is the defect of vision for which far point of an eye is less than infinity. It is also known as short-sightedness. The person is not able to see distant objects clearly (though he is able to see nearby objects clearly).

(ii) **Hypermetropia** is the defect of vision for which near point of eyes is more than 25 cm. It is also known as far sightedness. The person is not able to see nearby objects clearly (though he is able to see distant objects clearly).

Q. 2. Name the type of lens used to correct

- (i) Myopia**
- (ii) Presbyopia.**

Answer: (i) Myopia is corrected using spectacles containing concave lenses. The whole purpose of using concave lenses is to reduce the converging power of the eye lens and hence helping in forming the image of the distant object on the retina of the myopic eye.

(ii) Presbyopia defect is corrected using the spectacles containing convex lenses. The whole purpose of using concave lenses is to increase the converging power of the eye lens and hence helping in forming the image of the nearby object on the retina of the myopic eye.

Q. 3. When we look nearby objects, what happens to the focal length of our eye?

Answer: When we look at nearby objects, the focal length decreases.

The diverging rays from the nearby objects needs the convex lens of high converging power to converge them or focus them to form an image at the retina of the eye. The ciliary muscles get stretched due to which the eye lens becomes thick or more convex and its focal length decreases.

Q. 4. Name the defect which is caused when a person's eye lens hardens.

Answer: Myopia is the defect which is caused when a person's eye lens hardens. The ciliary muscles attached to the eye lens do not relax sufficiently to make the eye lens thinner to reduce its converging power. So, due to the greater converging power of the eye lens in myopic eye, the image of a distant object is formed in front of the retina and hence the eye cannot see it clearly.

Q. 5. If a milky or cloudy membrane grows over the eye lens, then which defect is the person suffering from?

Answer: If a milky or cloudy membrane grows over the eye lens, then which defect is the person suffering from **cataract**. A cataract develops when the eye lens of a person becomes cloudy (or even opaque) due to the formation of a membrane over it. Cataract decreases the vision of the eye gradually. It can even lead to total loss of vision of the eye.

Check Point 03

Q. 1. How many surfaces bound a prism? How many refractions does a beam of white light suffer, when it is passed through a prism?

Answer: Five surfaces bound a prism. In a triangular prism, there are two triangular and three rectangular surfaces. A white light passing through a prism suffers two refractions.

Q. 2. Give the relationship between the wavelength of light and its angle of deviation, when it is passed through a prism.

Answer:

Let,

A = angle of prism

D = angle of deviation

N = refractive index

λ_{vacuum} = wavelength in vacuum

λ_{medium} = wavelength in medium

We know

$$n = \frac{\sin\left(\frac{A+D}{2}\right)}{\sin\left(\frac{A}{2}\right)}$$

$$n = \lambda_{\text{vacuum}} / \lambda_{\text{medium}}$$

So,

$$\lambda_{\text{medium}} = \lambda_{\text{vacuum}} \times \frac{\sin\left(\frac{A}{2}\right)}{\sin\left(\frac{A+D}{2}\right)}$$

Q. 3. Name the colour for which angle of deviation while passing through the glass prism is

(i) Maximum

(ii) Minimum

Answer: (i) The angle of deviation while passing through the the glass prism is maximum for violet colour since it has minimum wavelength.

(ii) The angle of deviation while passing through the the glass prism is minimum for red colour since it has maximum wavelength

Q. 4. Which colour of light has

- (i) Minimum speed in glass?
- (ii) Minimum frequency?

Answer:

- (i) Violet colour has minimum speed in the glass, since it has the minimum wavelength.
- (ii) Red colour has the minimum frequency.

Q. 5. Name the processes which occur during the formation of the rainbow on a rainy day.

Answer: The formation of a rainbow on a rainy day is due to the dispersion of the sun's light by the raindrops in the atmosphere. Each raindrop acts as a tiny glass prism splitting the sunlight into a spectrum. As white light enters and leaves these raindrops, the various coloured rays present in white light are refracted by different amounts due to which an arc of seven colours called rainbow is formed in the sky.

Q. 6. A glass has a larger refractive index for which colour, violet or green?

Answer: Violet has a larger refractive index than green since it has a lower wave length. On refraction, wavelength and velocity change, whereas frequency does not. The colour of light or the wave having a higher wavelength will get refracted less.

Q. 7. Water in deep sea is blue in colour. Why?

Answer: Sea has many tiny particles to scatter light. The sunlight is made up of seven colours, most of the longer wavelength lights (red, orange, yellow etc.) present in it do not get scattered much and hence pass straight through. The shorter wavelength blue light is however scattered all around. The scattering of the blue component of the white sunlight by tiny molecules causes the blue colour of the sea.

Chapter Exercise

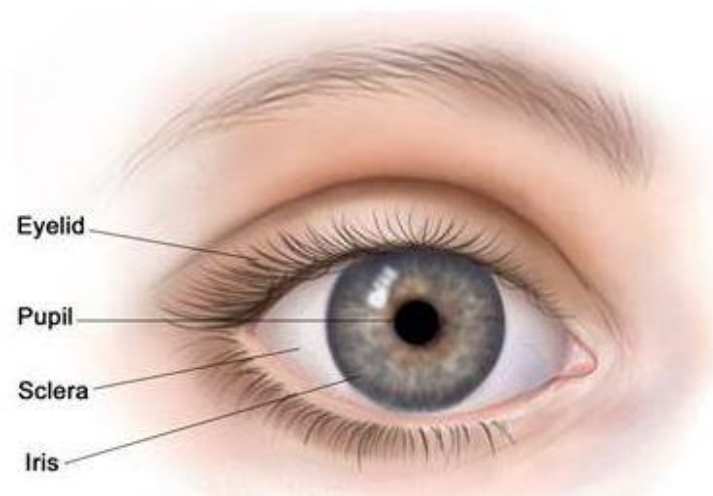
Q. 1. Which part of the eye acts as a cable which connects the eye with the brain?

Answer: The optical nerve acts as a cable which connects the eye with the brain. The image is formed at the retina and retina then sends the electrical signals to the brain through optical nerve and gives rise to the sensation of vision.

Q. 2. What is the black opening between the aqueous humor and the eye lens called?

Answer: The black opening between the aqueous humor and the eye lens is called pupil. It is the hole in the middle of the iris. It is black because no light is reflected from it.

The diagram is shown below:



Q. 3. Which part of the eye acts as the primary lens of an eye through which light enters?

Answer: Cornea acts as the primary lens of an eye through which light enters. It is convex in shape and acts as a convex lens to converge most of the light rays entering the eye.

Q. 4. What will be the focal length of the eye lens when eye muscles are relaxed?

Answer: The focal length of the eye lens is large when eye muscles are relaxed. When the ciliary muscles of the eye are fully relaxed then the eye lens is very thin. Since the eye lens is very thin, its focal length is the maximum in this position.

Q. 5. Name the condition of the eye lens becoming cloudy.

Answer: The condition of the eye lens becoming cloudy is called cataract. It results in blurred vision. It gradually leads to loss of sight.

Q. 6. Our eye is sensitive for which range of wavelength of light?

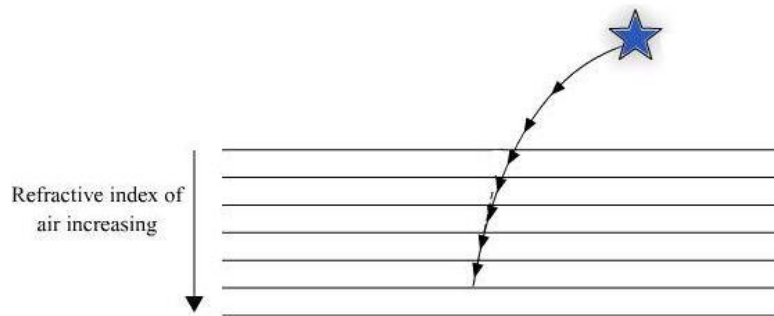
Answer: Our eye is sensitive to a wavelength range of **400 - 700 nanometers**.

This range is called the visible range. Any radiation having a wavelength greater or less is not sensitive to the human eye.

Q. 7. Give an example of optical phenomena which occur in nature due to atmospheric refraction.

Answer: twinkling of stars: The twinkling of stars is due to the atmospheric refraction of the star's light

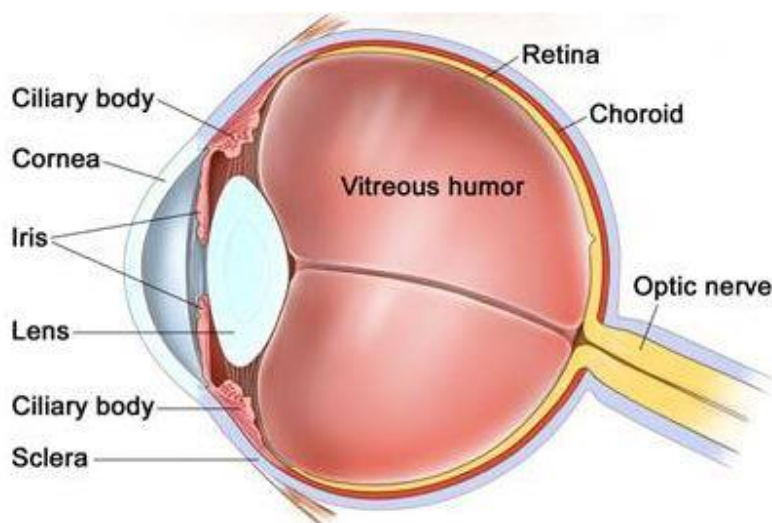
When the light coming from a star enters the earth's atmosphere, it undergoes refraction due to the varying optical densities of air at various altitudes. The atmosphere is continuously changing (due to which the optical densities of air at different levels in the atmosphere keep on changing).



The continuously changing atmosphere refracts the light from the stars by different amounts from one moment to the next. When the atmosphere refracts more star light, the star appears bright and when the atmosphere refracts less star's light then star appears to be dim. This leads to the twinkling of stars.

Q. 8. Name the part of our eyes that help us to focus near and distant objects in quick succession.

Answer: Ciliary muscles help us to focus near and distant objects. The ciliary muscles can change the thickness of the soft and flexible eye lens and hence its focal length which, in turn, change the converging power of the lens.



When looking at the distant object, ciliary muscles are fully relaxed and the eye lens is very thin. Its focal length is maximum in this position and converging power is minimum to focus the parallel rays on the retina.

When looking at the nearby object, ciliary muscles get stretched and the eye lens becomes thick. Its focal length is minimum in this position and converging power is maximum to focus the diverging rays on the retina.

Q. 9. Why does water in deep-sea seem to be bluish?

Answer: Sea has many tiny particles to scatter light. The sunlight is made up of seven colours, most of the longer wavelength lights (red, orange, yellow etc.) present in it do not get scattered much and hence pass straight through. The shorter wavelength blue light is however scattered all around. The scattering of the blue component of the white sunlight by tiny molecules causes the blue colour of the sea.

Q. 10. Name the part of the eye where the image is formed by the eye lens. What is the nature of the image formed? How is this image sent to the brain?

Answer: The eye lens converges the light rays to form the image on the **retina**. The image formed is real and inverted since the eye lens is convex in shape and we know that if the object is kept beyond the focal length the image formed is real and inverted. When the image falls on the retina the light-sensitive cells get activated and generate electrical signals. The retina sends these electrical signals to the brain through the optical nerves and gives rise to the sensation of vision. Although the image formed on the retina is inverted our mind interprets the image as that of an erect object.

Q. 11. State the role of ciliary muscles in accommodation.

Answer: Ciliary muscles help us to focus near and distant objects. The ciliary muscles can change the thickness of the soft and flexible eye lens and hence its focal length which, in turn, change the converging power of the lens.

When looking at the distant object, ciliary muscles are fully relaxed and the eye lens is very thin. Its focal length is maximum in this position and converging power is minimum to focus the parallel rays on the retina.

When looking at the nearby object, ciliary muscles get stretched and the eye lens becomes thick. Its focal length is minimum in this position and converging power is maximum to focus the diverging rays on the retina.

Q. 12. Why we have two eyes to view the objects?

Answer: We have two eyes to view objects because

(i) Two eyes give a wider view

The horizontal field of view having one eye is 150 degree while having both eyes is 180 degree. This means that with two eyes open we can see a wider area.

(ii) Two eyes enable in judging the distance more accurately

Our two eyes are a few centimeters apart from each other, due to this both the eyes see the same object from two slightly different angles and send two slightly different images of the same object to the brain. The brain combines these two slightly different images to create a three dimensional picture of objects which enable us to judge the distance of objects clearly.

Q. 13. A boy uses spectacles of focal length -60cm. Name the defect of vision he is suffering from. Which lens is used for the correction of this defect? Compute the power this lens.

Answer: Focal length = f

f = -60 cm (Given)

= -0.60m

The negative sign of focal length indicates that the lens used is concave hence the boy is suffering from myopia (short sightedness).

Power of the lens = $\frac{1}{f(\text{in m})}$

= $\frac{1}{(-0.60)}$

= -1.667 D

Q. 14. What is the result of the dispersion of white light?

Answer: The dispersion of white light results in splitting up of white light into seven colours also known as a spectrum of white light. This shows that white light is a mixture of seven colours: red, orange, yellow, green, blue, indigo and violet. The dispersion of white light occurs because the angle of refraction of lights of different colours is different when passing through a glass prism, the red colour deviates the least and blue colour deviates the most.

Q. 15. What is the difference in colours of the Sun observed during sunrise/sunset and noon? Give an explanation for each.

Answer: At the time of sunrise or sunset the sun is near the horizon hence the sunlight has to travel the maximum distance to reach us. Due to this large distance, the most of

the shorter wavelength blue-colour present in the white light gets scattered out and away from our line of sight, leaving behind mainly red color in direct sunlight beam that reaches our eye. Hence the sky appears red at the time of sunrise and sunset.

At noon the sun is overhead in the sky. The light coming from the sun has to travel a shorter distance through the atmosphere to reach us. Due to this short journey, only a little blue light gets scattered. Since the light coming is having almost all the components in right proportion hence the sun in the sky overhead appears white to us at noon.

Q. 16. How does the thickness of the eye lens change when we shift looking from a distant tree to reading a book?

Answer: Distant: The parallel rays of light coming from distant tree needs a convex eye-lens of low converging power to focus then to form an image on the retina. When looking at the distant tree, ciliary muscles are fully relaxed and the eye lens is very thin. Its focal length is maximum in this position and converging power is minimum to focus the parallel rays on the retina.

Nearby: The diverging rays of light coming from book needs a convex eye-lens of high converging power to focus then to form an image on the retina. When looking at the nearby object, ciliary muscles get stretched and the eye lens becomes thick. Its focal length is minimum in this position and converging power is maximum to focus the diverging rays on the retina.

Q. 17. No rainbow could be observed from the surface of Moon by the astronauts. What could be the possible reason?

Answer: The formation of a rainbow on is due to the dispersion of sun's light by the raindrops in the atmosphere. But the moon neither has the atmosphere nor the rain drops to create the dispersion and refraction of light hence the astronauts cannot observe the rainbow from the surface of the moon.

Q. 18. When a light ray passes obliquely through the atmosphere in an upward direction how does its path generally change?

Answer: When a light ray passes obliquely through the atmosphere in an upward direction its path generally changes due to refraction. When the light ray enters the earth's atmosphere, it undergoes refraction due to the varying optical densities of air at various altitudes. The atmosphere is continuously changing (due to which the optical densities of air at different levels in the atmosphere keep on changing). The air higher up in the sky is rarer but that nearer to the earth's surface is denser. The continuously changing atmosphere refracts the light. Hence the path generally changes.

Q. 19. The minimum power of the eye lens is 40 D. If the far point of the normal eye is infinity. Find the size of the eye ball.

Answer: Power of eye lens = P

$$P = 40 \text{ D}$$

Focal length = f

$$f = \frac{1}{P} \text{ (in meters)}$$

$$f = \frac{1}{40}$$

$$= 0.025 \text{ m}$$

$$= 2.5 \text{ cm}$$

Radius of curvature = 2f

$$= 5 \text{ cm}$$

The eye ball has the radius of 5 cm

Q. 20. A person got his eyes tested. The optician prescription for the spectacle read.

Left eye = -3 D are right eye = -3.5 D

Discuss the defects of which person is suffering.

Answer: Optician prescription for the spectacle reading

Left eye = -3 D are right eye = -3.5 D

Powers of the spectacles required to correct both the eyes are negative. This means that the person requires a concave lens for the correction.

Myopia (short-sightedness or near sightedness) is corrected using spectacles containing concave lenses. Hence the person suffers from myopia.

Myopia is the defect of vision due to which a person cannot see the distant objects clearly (although he can see the nearby objects clearly).

The far point of an eye suffering from myopia is less than infinity. It is caused:

(i) Due to the high converging power of the eye lens (because of its short focal length) or

(ii) Due to eye ball being too long.

Q. 21. The power of a lens is + 1.5 D. Name the type of defects vision that can be corrected by using this lens. Find the focal length of the lens.

Answer: Power of a lens is = $P = + 1.5 \text{ D}$.

Since power is positive hence the lens used is a convex lens.

Types of defects vision that can be corrected by using this lens Hypermetropia and presbyopia.

A person suffering from any of these defects is not able to see the nearby objects clearly.

The purpose of the convex lens is to increase the converging power of the lens and help to form the image of nearby objects on the retina.

Focal length = f

$f = 1/P$ (in meters)

$= 1/1.5 \text{ m}$

$= 0.667 \text{ m}$

Q. 22. If the far point of eye lens is 10 m, find power of the lens required to correct the defect.

Answer: Far point of the eye lens = v

$v = -10 \text{ m}$

Object distance = u

$u = \infty$

Lens Formula:

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$\frac{1}{f} = \frac{1}{-10} - \frac{1}{\infty}$$

Power of lens, $P = 1/f$

= -10 D

Hence the power of the lens required to correct the defect is -10 D. The lens used is a concave lens.

Q. 23. Mention the position where the image is focused in the eye of a person having Hypermetropia.

Answer: The image of an object is focused behind the retina in the eye of a person having Hypermetropia.

Hypermetropia is the defect of vision due to which a person is not able to see the nearby objects clearly. It is caused

(i) Due to the low converging power of the lens

(ii) Due to eye-ball being too short.

Hence the image of nearby objects is formed behind the retina due to which the eye cannot see the nearby objects clearly.

Q. 24. A person is able to see objects clearly only when these are lying at distance between 50 cm and 300 cm from his eyes.

Answer: The person is suffering from both myopia and Hypermetropia.

The far point of the person is 300 cm that's less than infinity hence myopic.

The near point of the person is 50 cm that is more than 25 cm hence the person is suffering from Hypermetropia.

The person needs a bifocal lens to clearly see the object.

The upper part of this bifocal lens is concave to correct myopia and the lower part is a convex lens to correct Hypermetropia.

Q. 25. What will be the angle of deviation through a prism and 60° , when angles of incidence and emergence are 45° each?

Answer: Given: Angle of prism, $A = 60^\circ$

Angle of incidence, $i = 45^\circ$

Angle of emergence $e = 45^\circ$

To find: Angle of deviation = D

We know

$$A + D = i + e$$

$$\text{So, } D = i + e - A$$

$$D = 45^\circ + 45^\circ - 60^\circ$$

$$= 30^\circ$$

Hence angle of deviation is 30°

Q. 26.A. List the parts of the human eye that control the amount of light entering into it. Explain, how they perform this function?

Answer: Iris controls the amount of light entering in the eye. The iris automatically adjusts the size of the pupil according to the intensity of light received by the eye. If the amount of light received by the eye is great, then iris reduces the size of the pupil. If the amount of light received by the eye is small, then iris increases the size of the pupil hence allowing a larger amount of light to enter our eyes.

Q. 26.B. Write the function of the retina in the human eye.

Answer: Retina acts as a screen on which image is formed. The eye lens focuses the rays on the retina to form a real and inverted image. The photoreceptors in retina then convert this into electrical signals. The retina sends these electrical signals through the optical nerve to the brain and hence we see the object.

Q. 26.B. Write the function of the retina in the human eye.

Answer: Retina acts as a screen on which image is formed. The eye lens focuses the rays on the retina to form a real and inverted image. The photoreceptors in retina then convert this into electrical signals. The retina sends these electrical signals through the optical nerve to the brain and hence we see the object.

Q. 26.C. Do you know that the corneal-impairment can be cured by replacing the defective cornea with the cornea of the donated eye? How and why should we organize groups to motivate the community members to donate their eyes after death?

Answer: The eyesight of most of the blind people can be restored if they are given the eyes donated by other people after their death. Two eyes can give a gift of vision to two people.

We should be grateful to God that he has given us the gift of vision to see this wonderful world. Let us pass on this priceless gift of vision to our less fortunate blind brothers and sisters by registering our name for eye donation. We should organize groups to motivate people to donate their eye after death.

Q.27. A student finds the writing on the blackboard as blurred and unclear when sitting on the last desk of the classroom. He, however, sees clearly when sitting on the front desk at an approximate distance 2 m from the blackboard.

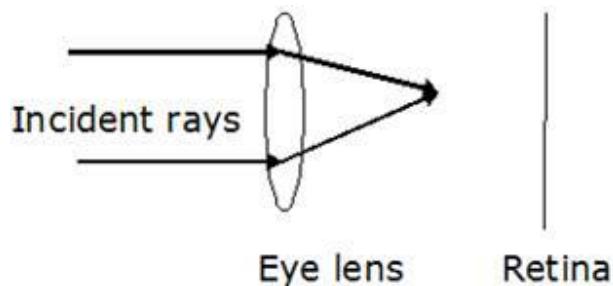
(i) Draw the ray diagram to illustrate the formation of image of the blackboard writing by his eye lens when he sits at the (a) last desk, (b) front desk

(ii) Name the defect of vision the student is suffering from. Also, list two causes of this defect.

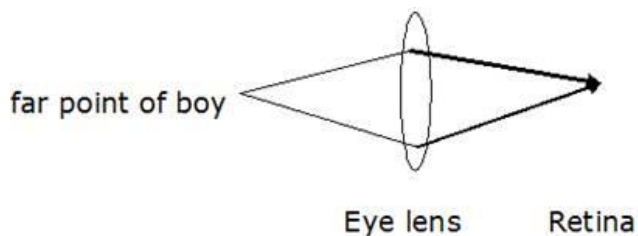
(iii) Name the kind of lens would enable him to see clearly when he is seated at the last desk. Draw the ray diagram to illustrate how this helps him to see clearly.

Answer: (i) The following is the ray diagram to illustrate the formation of image of the blackboard writing by his eye lens when he sits at the

(a) At last desk: due to myopia image is formed in front of retina.



(b) Front desk

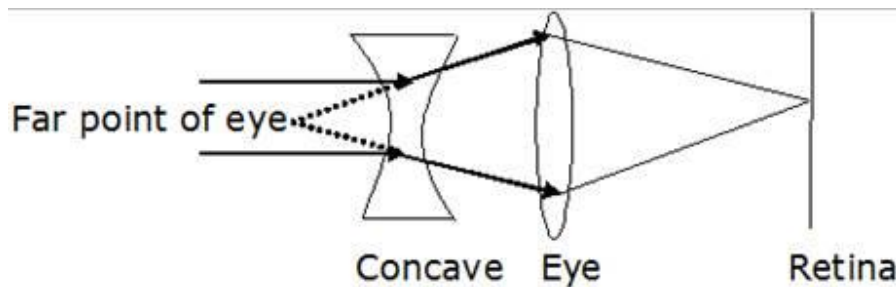


(ii) The student suffers from Myopia. Myopia is the defect of vision due to which a person cannot see the distant objects clearly (although he can see the nearby objects clearly).

The far point of an eye suffering from myopia is less than infinity. It is caused:

- Due to high converging power of the eye lens(because of its short focal length) or
- Due to the ball being too long.

(iii) The concave lens would help him to see clearly when he is seated at the last desk.



The whole purpose of concave lens is to decrease the converging power of the eye lens and focus the image on the retina.

Q. 28. 'Vision is one of the wonderful gifts given to us by God. But most of the people never take care of their eyes.'

- Care for eyes should be taken; suggest some methods for proper eye care.
- What value is associated with a given statement?

Answer: (i) Care of eyes should be taken. Some ways as listed below

- Eating healthy food such as green vegetables and fruits.
- Don't stress your eyes by working on computers or watching television for too long.
- Manage your weight and diet.
- Get proper sleep.
- Keep eyes away from harmful radiations
- Wear sunglasses while going out on a sunny day to protect eyes from UV rays

(ii) Value associated with the given statement is that we should be grateful to the God for giving us the precious gift of vision to see this beautiful world. We should take care of this gift throughout our life. We should also pass this priceless gift of vision by donating our eyes after death to those in need.

Q. 29. Sunil is a student of class VIII in a public school in Delhi. During summer vacation, his parents planned a visit to Haridwar by their car. During the journey from Delhi to Haridwar, Sunil sat on the front seat and his father was driving the

car. Sunil observed that the road ahead on the highway appears to be wet but when the car reached the spot, road is found to be dry. He was perplexed by this observation. He asked his father. His father advised Sunil not to disturb him during driving and said that he will discuss the problem on reaching Haridwar. In the evening, when they were settled in a hotel at Haridwar, Sunil's father told him that the illusion observed by Sunil was on account of atmospheric refraction. Now, Sunil was happy as he knew the real explanation of his observation.

(i) What is atmospheric refraction?

(ii) Name any two phenomena based on atmospheric refraction

(iii) What characteristic was shown by Sunil during his journey?

(iv) What advice was given by Sunil's father to him and why?

Answer: (i) In the atmosphere we have air layers having different optical densities. When the light rays pass through the atmosphere then refraction of light takes place. The refraction of light caused by the earth's atmosphere (having varying optical densities) is called atmospheric refraction.

(ii) Two phenomenon based on atmospheric refraction are

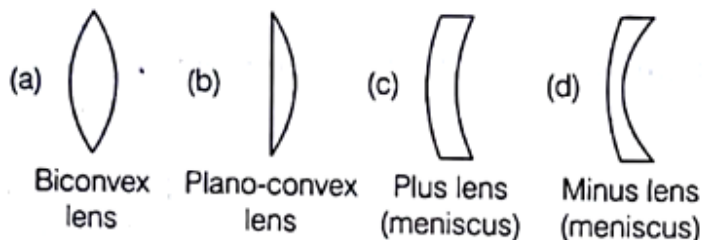
- Twinkling of stars at night
- Advanced sunrise and delayed sunset.

(iii) Curiosity and an urge to learn are shown by Sunil during his journey.

(iv) His father advised Sunil not to disturb him during driving because it may lead to distraction. One should drive very carefully and should not be distracted for a safe journey.

Challengers

Q. 1. For a healthy eye, the rays of light entering the eye form a sharp image on retina. For a myopic eye, the rays from distant objects focus in front of the retina forming a blurred image. Which of the following lenses shown below will help to correct myopia?



- A. (a)
- B. (b)
- C. (c)
- D. (d)

Answer: Myopia is caused due to large converging power of eye lens or due to too long eye ball. In both the cases image is formed before the retina. To form image on retina we must use the lens that diverges the ray of light such that the net convergence decreases, also minus power lens that is a concave lens does exactly the same. Whereas the other lens converge the beam. Hence option D is correct

Q. 2. A near sighted person wears eye glass of power 5.5D for distant vision. His doctor prescribes a correction of + 1D in near vision part of his bifocals, which is measured relative to the main part of the lens. Then, the focal length of his near vision part of the lens is

- A. -18.18 cm
- B. -20 cm
- C. -22.22 cm
- D. + 20.22 cm

Answer: It is given that Power of Lens, $P = 5.5 \text{ D}$

Now, since this lens is used for Myopic Eye, so it will be concave lens and hence the sign will be negative. So $P = - 5.5 \text{ D}$

Now, for near vision power is to be increased by $+ 1 \text{ D}$.

Therefore, Power = $-5.5 \text{ D} + 1 \text{ D}$

$$= -4.5 \text{ D}$$

Now, we know,

$$P = 1/f$$

$$f = 1/p$$

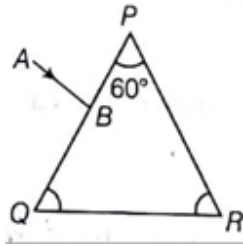
$$f = 1/ 4.5$$

$$= - 22.22 \text{ cm}$$

Hence, Option C is correct

Q. 3. In given figure, a light ray AB is incident normally on one face PQ of an equilateral glass prism.

Find out the angles at faces PQ and PR.



- A. 60°
- B. 30°
- C. 45°
- D. 90°

Answer: Angle of incidence, $i = 0^\circ$

Angle of refraction, $r = \sin(i) \times n$

Where n = refractive index

So, $r_1 = 0^\circ$

Where,

r_1 = angle of refraction at PQ

r_2 = angle of incidence from inside on side PR

A = angle of prism

We know that

$$A = r_1 + r_2$$

$$r_2 = A - r_1$$

$$= 60^\circ - 0^\circ$$

$$= 60^\circ$$

Q. 4. A thin prism p_1 with angle 4° and made from glass of refractive index 1.54 is combined with another prism p_2 made from glass of refractive index 1.92 to produce dispersion without deviation. Then the angle of prism P_2 is

- A. 2.3°
- B. 4.3°
- C. 3.2°
- D. 2.0°

Answer: The angle of deviation for a prism is given by

$$\Delta = (n - 1) \times A$$

Where,

n = refractive index of prism

A = angle of prism

Given: The two prisms when combined produce dispersion without deviation.

Conclusion: For no deviation for the two prisms the deviation caused by two prisms should be opposite to each other

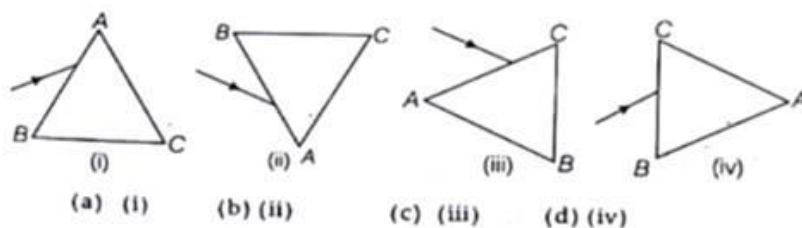
$$(n_1 - 1) \times A_1 = (n_2 - 1) \times A_2$$

$$A_2 = \frac{(n_1 - 1) \times A_1}{(n_2 - 1)}$$

$$A_2 = \frac{(1.54 - 1) \times 4}{(1.92 - 1)}$$

$$A_2 = 4.3^\circ$$

Q. 5. A prism ABC (with BC as base) is placed in different orientations. A narrow beam of white light is incident on the prism as shown in figure. In which of the following cases, after dispersion, the third colour from the top corresponds to the colour of the sky?

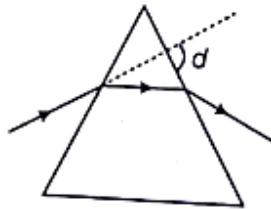


- A. (a)
- B. (c)
- C. (c)
- D. (d)

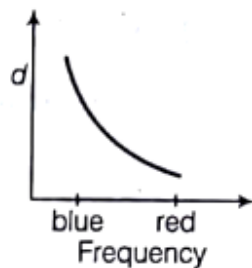
Answer: The colour of sky is blue. The colour having the maximum wavelength is deviated the least. The deviation is towards the base of the prism. The white light consists of seven colours red, orange, yellow, green, blue, indigo, violet. Violet is deviated the most and red the least. Blue is the third colour starting from violet. So we

see that image B has based on the top hence having colours in such an order that blue is the third. Hence option B is correct.

Q. 6. Light rays are deviated by a prism



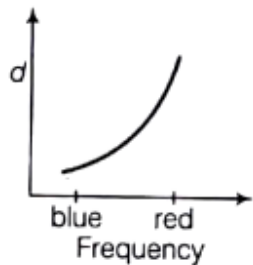
The deviation angle d is measured for light rays of different frequency including blue light and red light. Which graph is correct?



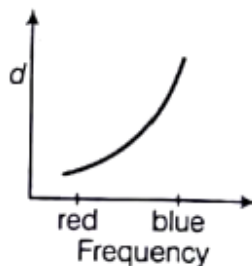
(a)



(b)



(c)



(d)

- A. (a)
- B. (b)
- C. (c)
- D. (d)

Answer: Since the red light is deviated the least and the violet is deviated the most so we can devise that the wavelength of blue is less than that of red. Wavelength and frequency have inverse relation. Hence red light has minimum frequency and frequency keeps on increasing as we go towards blue light.

Q. 7. Even in absolutely clear water, a diver cannot see very clearly because

- A. rays of lights get diffused**
- B. velocity of light is reduced in water**
- C. ray of light passing through the water makes it turbid.**
- D. The focal length of the eye lens in water gets changed and the image is no longer focused sharply on the retina.**

Answer: When we are underwater, incoming light rays are hardly bent, or focused, at all. Our eye lens is designed to see in air. The eye lens bends the rays a little, but due to the lost corneal refraction, the light that reaches the retina isn't focused and thus cannot see very clearly underwater even if the water is absolutely clear. Hence diver observes a blurred vision.

Q. 8. A glass slab is placed over a page on which the word VIBGYOR is printed with each letter in corresponding colour. Then, which of the following is correct?

- A. The image of all the letters will be in the same place as that on paper**
- B. Letter V is raised more**
- C. Letter R is raised more**
- D. None of the above**

Answer: Due to refraction of light an object placed in a denser medium, when viewed from rarer medium appears to be at a lesser depth than its real depth.

This depth is called the apparent depth.

Apparent depth = real depth/ n

Where,

n = refractive index of the denser medium with respect to the rarer medium

Violet light slows down more than red light, so it is refracted at a slightly greater angle, so refractive index (n) is maximum for the violet colour. Hence its apparent depth would be the least, the violet coloured letter V would be raised to the maximum.

Q. 9. Which amongst the given radiation is preferred for taking photographs in fog?

- A. Ordinary visible light**
- B. Infrared**
- C. Microwave**
- D. X-rays**

Answer: Infrared radiation has the maximum wavelength and minimum frequency.

Energy is directly proportional to frequency; hence energy associated with them is also low.

Thus the infrared radiation gets least scattered by the tiny particles in the fog.

That is why infrared wave is preferred over all others which have a higher frequency and gets scattered hence can't be focused.

Electricity

Check Point 01

Q. 1. If a body has positive charge, then what does it mean?

Answer: If a body has positive charge it means that it has less no. of electrons than the no. of protons. Due to this imbalance of the charges, the body will attract the negative charged body.

Q. 2. In which direction does current flow in an electric circuit?

Answer: In an electrical circuit the current flows from the positive to the negative. The conventional current always flows in the direction opposite to the direction of flow of the electron.

Q. 3. The charge on an electron is $1.6 \times 10^{-19}\text{C}$. Find the number of electrons that will flow per second to constitute a current of 2A.

Answer: We know that;

$$Q = ne$$

Where,

n is an integral multiple can take values 1, 2, 3....

e- is the charge on the electron.

$$\text{And, } I = \frac{Q}{t}$$

$$\therefore I = \frac{ne}{t}$$

$$\text{Thus, } n = \frac{I \times t}{e}$$

$$n = \frac{2 \times 1}{1.6 \times 10^{-19}}$$

$$\therefore n = 1.25 \times 10^{19}$$

Q. 4. Write a low resistance device name which is always connected in series with the device through which the current is to be measured.

Answer: Ammeter is a device that is connected in series so as to measure the current through the circuit. It has a very low resistance so that maximum current passes through it and thus the correct amount of current through the circuit can be measured.

Q. 5. If work done in moving a charge of 20 mC from infinity to a point O in an electric field is 15 J, then what is the electric potential at this point?

Answer: We know that work done in moving a charge Q in a potential V is given by:

$$W = Q \times V$$

$$\therefore V = \frac{W}{Q}$$

$$V = \frac{15\text{J}}{20 \times 10^{-3}}$$

Since, $Q = 20\text{mC} = 20 \times 10^{-3}\text{C}$

$$V = 7.5 \times 10^2\text{C}$$

Q. 6. Write a high resistance device name which is always connected in parallel.

Answer: Voltmeter is a high resistive device that is used to measure the voltage across a component. It is always connected in parallel to the component whose voltage is to be measured. It is highly resistive so that the current cannot pass through it and thus the current will pass through the component connected in parallel to it so as to measure the accurate voltage drop across the component.

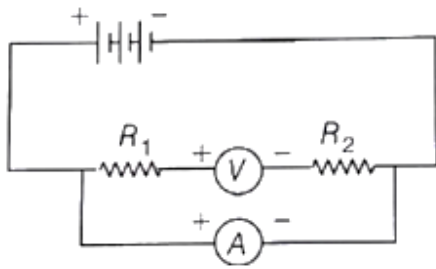
Check Point 02

Q. 1. What does it mean a circuit is closed or open?

Answer: If a circuit is closed that means electrons can easily flow through the circuit and thus electric current will flow through it.

If a circuit is open that means the electrons will not be able to flow through the circuit which means that there will be no current flowing through it.

Q. 2. A student made an electric circuit as shown below

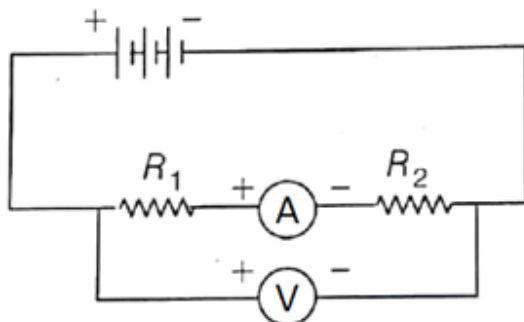


Is there any mistake in this circuit? If any then correct it.

Answer: Here, in this circuit, the student has kept the ammeter in parallel and the voltmeter in series with the circuit.

But actually, the ammeter should always be connected in series as it has a very low resistance so when we connect the ammeter in series, maximum current will pass through it and thus the correct amount of current through the circuit can be measured.

In the same way, the voltmeter should always be connected in parallel as it is highly resistive due to which the current cannot pass through it and thus the current will pass through the component connected in parallel to it so as to measure the accurate voltage drop across the component.



Q. 3. Define the electric resistance of a wire and also write its SI unit.

Answer: Electric resistance (R) is defined as the ratio of the voltage applied (V) to the current (I) flowing through the circuit.

It is given by the formula:

$$R = \frac{V}{I}$$

Its SI unit is known as ohm (Ω).

Q. 4. Keeping the potential difference constant, the resistance of a circuit is halved. Then, how much does the current changes?

Answer: We know that by Ohm's Law:

$$V = I \times R$$

$$\therefore I = \frac{V}{R}$$

Now,

$$R = \frac{R}{2}$$

$$\therefore I = \frac{V}{R/2} = 2\frac{V}{R}$$

We know that: $\frac{V}{R} = I$

$$\therefore I = 2I$$

Thus, from this we can conclude that if the resistance of the circuit is halved then the current gets doubled.

Q. 5. What is the difference between a good conductor and a poor conductor? Give two example of each.

Answer:

Good Conductor	Poor Conductor
1. It allows the electricity to pass through it easily.	1. It doesn't allow the electricity to pass through it.
2. It has less resistivity towards the flow of current.	2. It have more resistivity towards the flow of current
3. Example: Iron, Graphite	3. Example: Wood, Plastic

Q. 6. The potential difference across wire is 75V and its electric resistance is 30Ω. Find out the electric current through the wire.

Answer: We know that by Ohm's Law: $V = I \times R$

$$\therefore I = \frac{V}{R}$$

Here: $V = 75V$

And, $R = 30\Omega$

$$I = \frac{75V}{30\Omega}$$

$$\therefore I = 2.5A$$

Q. 7. If the length of a wire is halved and its cross-sectional area is doubled, then what would be the resistance of the wire?

(Given, initially the resistance of the wire is R)

Answer: The formula of resistance is:

$$R = \frac{\rho \times l}{A}$$

Where, ρ = resistivity

l = Length of the conductor

A = Area of the conductor

If length of the conductor is halved then, $l_1 = \frac{l}{2}$

And, the cross sectional area is doubled, $A_1 = 2A$

$$\therefore R_1 = \frac{\rho \times l_1}{A_1}$$

$$R_1 = \frac{\rho \times l/2}{2A}$$

$$R_1 = \frac{1}{4} \times \frac{\rho \times l}{A}$$

$$\text{Now, } \frac{\rho \times l}{A} = R$$

$$\therefore R_1 = \frac{R}{4}$$

Thus, we can conclude that the new resistance of the wire when the area of wire is doubled and length is halved becomes $\frac{1}{4}$ the initial resistance.

Q. 8. Define the electric resistivity of material and also write its SI unit.

Answer: Resistivity: It is defined as the resistance offered by a conductor having unit length and unit cross-sectional area. It is denoted by ρ (rho).

$$\rho = \frac{R \times A}{l}$$

The SI unit of resistivity ρ is Ωm .

Check Point 03

Q. 1. In which type of combination of different resistors will have equal value of electric current through them?

Answer: When different resistors are connected in series combination the current passing through them remains the same.

$$V_{eq} = V_1 + V_2 + V_3 + \dots + V_n$$

Since, $V = IR$

Putting the value in the above equation.

$$V_{eq} = I(R_1 + R_2 + R_3 \dots + R_n)$$

$$I R_{eq} = I(R_1 + R_2 + R_3 \dots + R_n)$$

$$R_{eq} = (R_1 + R_2 + R_3 \dots + R_n)$$

Thus, we can say that the current remain constant in series connection.

Q. 2. IF different resistors have the same value of electric potential across them, in which way they are connected to each other?

Answer: When different resistors are connected in parallel combination the voltage drop remains the same.

Q. 3. Why, we do not use series combination of connecting electric appliances in household circuit?

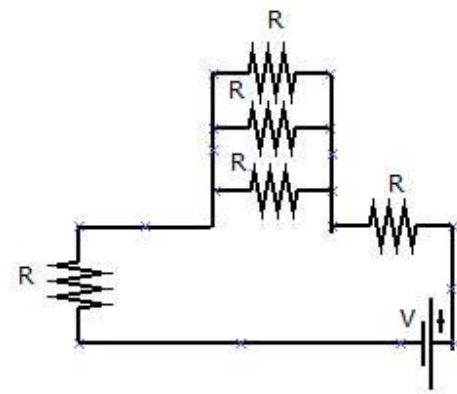
Answer: We do not use series combination for connecting electrical appliances in household circuit because if there will be a short circuit in one of the appliance which led to break in the circuit will cause the working of other appliance connected in the series.

Thus, Parallel combination is used for connecting electrical appliance in the household circuit.

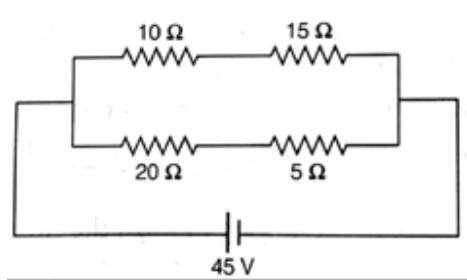
Q. 4. What do you understand by a mixed combination of resistances?

Answer: A Mixed combination of resistances means When two more resistance are connected in series and parallel simultaneously.

These type of combination are known as Mixed combination.



Q. 5. In the circuit shown below, calculate the net resistance of the circuit.



Answer: Here, the resistances 10Ω and 15Ω are connected in series and also the resistances 20Ω and 5Ω are also connected in series.

Thus, $R_1 = 10\Omega + 15\Omega = 25\Omega$

$R_2 = 20\Omega + 5\Omega = 25\Omega$

Now, these two resistances R_1 and R_2 are connected in parallel

$$\therefore \frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$R = \frac{R_1 \times R_2}{R_1 + R_2}$$

$$R = \frac{25 \times 25}{25 + 25} \Omega = \frac{625}{50} \Omega$$

$$R = 12.5\Omega$$

Thus the net resistance is 12.5Ω .

Check Point 04

Q. 1. What is the heating effect of electric current?

Answer: When current flows through a conductor, it produces some amount of heat. This phenomenon is known as the heating effect of electric current.

The heat (H) produced during the heating effect of electric current is given by the formula:

$$\text{Heat, } H = I^2 R t$$

Where, I = Current

R = Resistance of conductor

t = time

The SI unit of the heat produced is Joules (J).

Q. 2. State the factors on which the heat produced in a current conductor depends. Give one practical application of this effect.

Answer: The factors on which heating effect in a current conductor depends are:

- a) The time for which the current is flowing through the circuit. Greater the time greater will be the heating effect.
- b) Resistance of the conductor. More resistance yields more heating effect.
- c) The amount of current flowing through the circuit.

Application: This principle of heating effect of current carrying conductor is used in the iron.

Q. 3. A fuse wire consists of an alloy of lead and tin. Why?

Answer: The fuse wire is made up of lead and tin alloy as this alloy has a very low melting point and a very high resistivity. When a large amount of current flows through this alloy, due to the high resistivity heat is produced due to the flow of high current. Which make the alloy melts (as it has a very low melting point). Thus, as alloy melts the circuit breaks and the appliances connected to it are saved from any damage due to the high amount of current flowing in the circuit. The iron heats up as current flows through it and thus we are able to press the clothes easily.

Q. 4. An electric heater of resistance 500Ω is connected to a mains supply for 30 min. If 15A current flows through the filament of the heater, then calculate the heat energy produced in the heater.

Answer: We know that the formula of heat is given by:

$$\text{Heat, } H = I^2 R t$$

Where;

$$t = 30 \text{ min} = 30 \times 60 \text{ sec} = 1800 \text{ sec}$$

$$I = 15 \text{ A}$$

$$R = 500\Omega$$

$$\therefore H = (15)^2 \times 500 \times 1800 \text{ J}$$

$$H = 225 \times 500 \times 1800 \text{ J}$$

$$\therefore H = 20.25 \times 10^7 \text{ J}$$

Thus Total heat produced by the heater is $20.25 \times 10^7 \text{ J}$ in 30 min due to flow of 15 A current.

Q. 5. Why are electric bulbs filled with chemically inactive nitrogen and argon?

Answer: The electric bulbs are filled with chemically inactive as Nitrogen or Argon.

As when the current is passed through the bulb, the bulb filament made of tungsten glow due to its high resistivity if exposed to air will cause the decomposition of tungsten metal in air which can lead

Tungsten element to melt thus causing circuit to break.

Thus for the long life of the bulb the electric bulb is filled with chemically inactive as nitrogen and argon.

Q. 6. What is the maximum power in kilowatts of the appliance that can be connected safely to a 13A, 230V mains socket?

Answer: We know that the formula of power is: $P = VI$

Here;

$$V = 230V$$

$$I = 13A$$

$$P = 230 \times 13 W$$

$$\therefore P = 2990W$$

$$\text{or, } P = 2.99kW$$

Thus, the maximum power is 2.99kW can be drawn from the circuit.

Q. 7. Power of a lamp is 60 W. Find the energy in joules consumed by it in 1s.

Answer: We know that the power can be stated as the amount of electric energy consumed per unit time.

$$\text{Power, } P = \frac{\text{Energy consumed, } E}{\text{Unit Time, } T}$$

On solving For Energy, we get

$$\text{Energy, } E = \frac{P}{T}$$

Here;

$$P = 60W$$

$$t = 1s$$

$$E = 60W \times 1sec$$

$$\therefore E = 60\text{J}$$

Thus, the energy in joules is 60J.

Chapter Exercise

Q. 1. Electric fuse is an important component of all domestic circuits. Why?

Answer: Electric fuse is used as a safety device. Whenever, there is a large amount of current flowing through a circuit due to some faults, due to the lower melting point of the alloy, the fuse melts down which breaks the circuit connection.

Thus, electric fuse is an important component of all domestic circuits.

Q. 2. State the law which governs the amount of heat produced in a metallic conductor when current is passed through it for a given time. Express this law mathematically.

Answer:

When current flows through a conductor for a unit time, it produces some amount of heat. This phenomenon is known as the heating effect of electric current.

The heat (H) produced during the heating effect of electric current is given by the formula:

$$H = I^2Rt$$

Here, I = Current

R = Resistance of conductor

t = time

The SI unit of the heat produced is Joules (J).

Q. 3. Name two common materials, used as heating elements.

Answer: The two common materials, used as heating element are:

- i. Tungsten wire.
- ii. Nichrome Wire (It is made of 80% of Nickle and 20% of chromium.

Q. 4. Relate 1 kWh and SI unit of energy.

Answer: 1kwh = 1000watt×3600seconds

$$= 3.6 \times 10^6 \text{ wattsecond}$$

$$= 3.6 \times 10^6 \text{ joule (J)}$$

The SI unit of energy is joules (J).

Thus, we conclude that the 1kWh is 3.6×10^6 J

Q. 5. You are given three bulbs of 40 W, 60 W and 100W. Which of them has lower resistance?

Answer: We know that the formula of power is given by: $P = \frac{V^2}{R}$

So, from this equation we can see that power is inversely proportional to the resistance R. which means that lower is the resistance, more will be the power.

Thus we can say that: 100W will have the lower resistance.

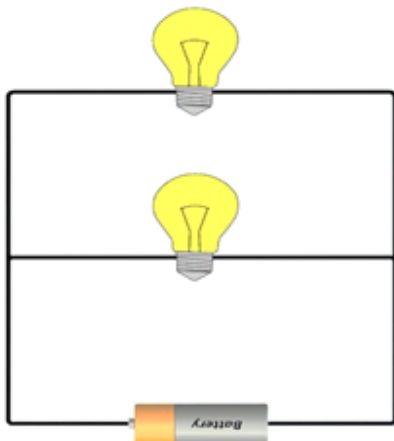
Q. 6. Mention two special features of the material used as an element of an electric iron.

Answer: Two features of the material used as an element of an electric iron are:

- a) It should have low melting point.
- b) It should have a very high resistance.

Q. 7. Write the advantages of connecting electrical appliances in parallel and disadvantages of connecting them in series in a household circuit.

Answer: Parallel Connection: The electrical appliances should always be connected in parallel combination because if there is any fault/damage in any of the appliances then in series combination the whole circuit will get open but in parallel combination only that part containing the damaged appliance is open which will have no effect on the working of other appliances in the circuit.



Series Connection: We do not use series combination for connecting electrical appliances in household circuit as whenever there will be a damage/breakage in the circuit of any one appliance of the household then, due to the series connection all other connections will also break.

Q. 8. Derive the relation between kilowatt hour and joule.

Answer: $1\text{kwh} = 1000\text{watt} \times 3600\text{seconds}$
 $= 3.6 \times 10^6 \text{ wattsecond}$
 $= 3.6 \times 10^6 \text{ joule (J)}$

The SI unit of energy is joules (J).

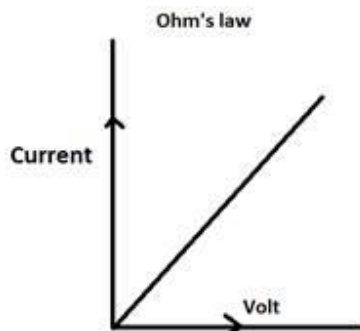
Q. 9. What kind of graph is obtained by plotting values of V and I? Why?

Answer: The graph obtained by plotting the values of V and I is a linear graph. We will observe that as the voltage V increases the value of current I also increases linearly.

This happens because we know that according to the Ohm's Law:

$$V \propto I$$

$$\therefore V = IR$$



Q. 10. It is possible to replace resistors joined in series by an equivalent single resistor of resistance. How?

Answer: Yes, it is possible to replace resistors joined in series by an equivalent single resistor.

Example: Suppose there are three resistors of 1Ω , 2Ω and 3Ω connected in series.

So, if we want to attach only one resistor instead of these three resistors then we add these resistors i.e.

$$1\Omega + 2\Omega + 3\Omega = 6\Omega$$

Thus, we can place a single equivalent resistance of 6Ω instead of these three resistors.

Q. 11. Aluminium wire has radius 0.25 mm and length or 75 m. If the resistance of the wire is 10Ω , calculate the resistivity of aluminium.

Answer: The formula of resistance is: $R = \frac{\rho \times l}{A}$

Where, ρ = resistivity

l = Length of the conductor

A = Area of the conductor

$$\therefore \rho = \frac{R \times A}{l}$$

Here:

$$R = 10 \, \Omega$$

$$r = 0.25 \text{ mm}$$

$$l = 75 \text{ m}$$

We know that the area of the wire will be: $A = \pi r^2$

$$\therefore A = 3.14 \times (0.25 \times 10^{-3})^2$$

$$A = 0.196 \times 10^{-6} \text{ m}^2$$

Putting the given values in the above formula,

$$\rho = \frac{10 \times 0.196 \times 10^{-6}}{75}$$

$$\rho = 26.133 \times 10^{-6} \text{ Am}$$

Q. 12. You are given three resistors each of 3Ω and you are asked to get all possible values of resistance when you connect them in different combinations. How many values of resistance can you get?

Answer: Here: $R_1 = 3\Omega$

$$R_2 = 3\Omega$$

$$R_3 = 3\Omega$$

• Parallel combination:

R_1 , R_2 and R_3 connected in stair like pattern one above the other.

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$\frac{1}{R_{eq}} = \frac{1}{3} + \frac{1}{3} + \frac{1}{3}$$

$$\frac{1}{R_{eq}} = \frac{3}{3}$$

$$R_{eq} = \frac{3}{3} \Omega$$

$$R_{eq} = 1 \Omega$$

• Series Combination:

R1, R2 and R3 connected in same line across the potential difference V

$$R_{eq} = R_1 + R_2 + R_3$$

$$R_{eq} = 3 + 3 + 3$$

$$R_{eq} = 9 \Omega$$

• Mixed combination:

R1 is connected in series with the parallel combination of R2 and R3.

$$\frac{1}{R_p} = \frac{1}{R_2} + \frac{1}{R_3}$$

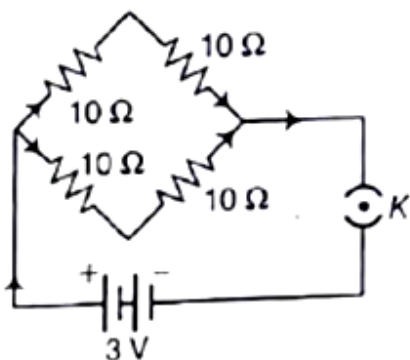
Putting the values of the resistance, we get

$$\text{Thus, we get } R_p = 1.5 \Omega$$

$$R_s = R_1 + R_p = 3 + 1.5 = 4.5 \Omega$$

Thus, the net resistance of the circuit is 4.5Ω

Q. 13. Find the current drawn from the battery by network of four resistors shown in the figure?



Answer: Given:

$$V = 3V$$

$$R_1 = R_2 = R_3 = R_4 = 10\Omega$$

Here, R_1 and R_2 are connected in series

And, R_3 and R_4 are connected in series.

$$\therefore \frac{1}{R_{eq}} = \frac{1}{R_1 + R_2} + \frac{1}{R_3 + R_4}$$

$$\frac{1}{R_{eq}} = \frac{1}{10 + 10} + \frac{1}{10 + 10} = \frac{1}{20} + \frac{1}{20} = \frac{2}{20}$$

$$R_{eq} = \frac{20}{2}$$

Now, by Ohm's Law

$$V = I \times R$$

$$I = \frac{V}{R} = \frac{3}{10}$$

$$\therefore I = 0.3A$$

Thus, Current drawn by the resistor from the battery is 0.3 A

Q. 14. A wire is cut into three equal parts and then connected in parallel with the same source. How will its.

(i) resistance and resistivity gets affected?

(ii) How would the total current and the current through the parts change?

Answer: i. Here, the new resistance: $R = \frac{R}{3}$

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$\frac{1}{R_{eq}} = \frac{1}{\frac{R}{3}} + \frac{1}{\frac{R}{3}} + \frac{1}{\frac{R}{3}}$$

$$\frac{1}{R_{eq}} = \frac{3}{R} + \frac{3}{R} + \frac{3}{R}$$

$$\frac{1}{R_{eq}} = \frac{9}{R}$$

$$R_{eq} = \frac{R}{9} \Omega$$

The resistivity is dependent on the nature of the material.

Hence, there will be no change in the resistivity of the wire.

ii. Now, by Ohm's Law

$$V = I \times R$$

$$I = \frac{V}{R} = \frac{V}{R/9} = \frac{9V}{R}$$

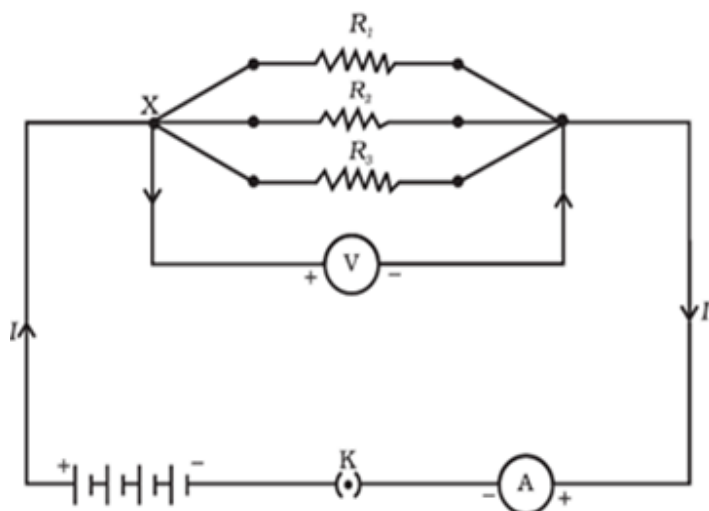
$$\therefore I = 9 \times I$$

Thus, the current will increase 9 times than the previous current.

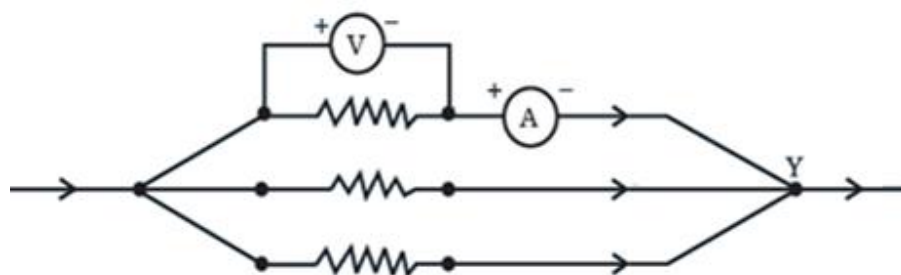
Q. 15. How will you conclude that the same potential difference (voltage) exists across three resistors connected in a parallel arrangement to a battery?

Answer: • Suppose 3 resistances are R_1 , R_2 and R_3 . We will connect these resistances in parallel with an ammeter (A), a voltmeter (V), a plug key (K) and a battery of known voltage as shown in figure given below.

• We will close the key K and record the ammeter and voltmeter readings.



- Now we will open the key and switch the position of voltmeter and ammeter as show in the figure given below.



- We will close the switch and note the readings. Similarly, we will switch the position of voltmeter to resistances R_2 and R_3 and observe the readings.
- We will find that readings of ammeter keeps on changing but readings of voltmeter in all cases almost remain same in all cases.

Q. 16. What will be the length of a nichrome wire resistance 5.0Ω , if the length of similar wire of 120 cm has resistance of 2.5Ω ? Why?

Answer: Here,

$$l_2 = 120\text{cm} = 1.20\text{m}$$

$$R_1 = 5.0\Omega$$

$$R_2 = 2.5\Omega$$

Now,

$$R_1 = \frac{\rho \times l_1}{A}$$

And

$$R_2 = \frac{\rho \times l_2}{A}$$

(Here, resistivity ρ and the area A remain same as the wires are similar.)

$$\therefore \frac{R_1}{R_2} = \frac{\rho \times l_1 / A}{\rho \times l_2 / A}$$

$$\frac{R_1}{R_2} = \frac{l_1}{l_2} = \frac{l_1}{120 \times 10^{-2}}$$

Now,

$$\frac{5.0}{2.5} = \frac{l_1}{120 \times 10^{-2}}$$

$$l_1 = 2 \times 120 \times 10^{-2} \text{ m}$$

$$l_1 = 24 \times 10^{-1} \text{ m}$$

$$\therefore l_1 = 240 \text{ cm}$$

Q. 17. Disha was given two thin wires A and B in science laboratory. The teacher asked her to find out which wire was “fuse wire” and which one was “nichrome wire”. Disha was given batteries of 3 V and 12 V and some connecting wires. The teachers also advised her to switch off fan while performing the activities and take necessary precautions to avoid burns. Disha performed the activities for testing and concluded that wire A is nichrome wire, whereas wire B is fuse wire.

On the basis of above information, answer the following questions

- (i) Describe the activity which Disha performed to conclude that wire A is nichrome wire.
- (ii) Describe the activity which Disha performed to conclude that wire B is fuse wire.

Answer: i) • Disha connected wire A with both the batteries.

- When wire A was connected with 3v battery, Disha found that the wire started heating.
- When the wire A was connected with 12V battery, she found that the wire is emitting a large amount of heat.

- Thus, she concluded that wire A is a nichrome wire as nichrome wire has a very large resistance and it produces a large amount of heat.

ii) • Disha connected wire B with both the batteries.

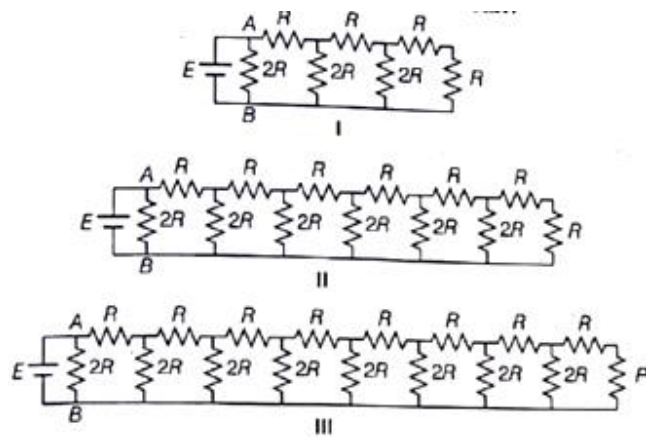
- When wire B was connected with 3v battery, did not find anything.

- When the wire B was connected with 12V battery, she found that the wire has started melting and.

- Thus, she concluded that wire B is a fuse wire as fuse wire has a very low melting point and it melts as a large amount of current is made to pass through it.

Challengers

Q. 1. Three different circuits (I, II and III) are constructed using identical batteries and resistors of R and $2R$ ohm. What can be said about current I in arm AB of each circuit.



A. $I_I > I_{II} > I_{III}$

B. $I_I < I_{II} < I_{III}$

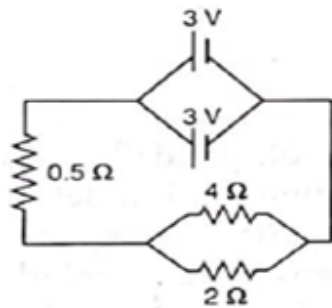
C. $I_{II} < I_I < I_{III}$

D. $I_I = I_{II} = I_{III}$

Answer: The equivalent in all the three circuits comes out to be the same so $I_I = I_{II} = I_{III}$. The reason being, the two end resistors of R and R ohms add upto $2R$ and the subsequently the two resistors of $2R$ in parallel are equivalent to a single resistor of R ohms and then the process repeats until the arm AB is reached, so, finally the equivalent resistance of all the circuits is same.

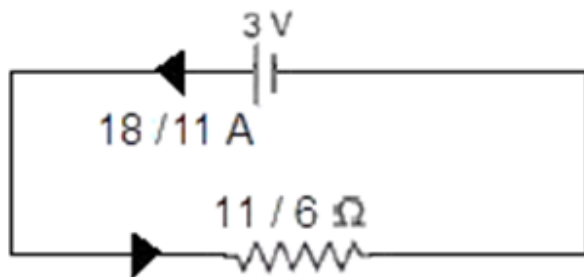
Q. 2. Two cells of 3V each are connected in parallel. An external resistance of 0.5Ω is connected in series to the junction of two parallel resistors of 4Ω and 2Ω

and then to common terminal of battery through each resistor as shown in figure.
What is the current flowing through 4Ω resistor?



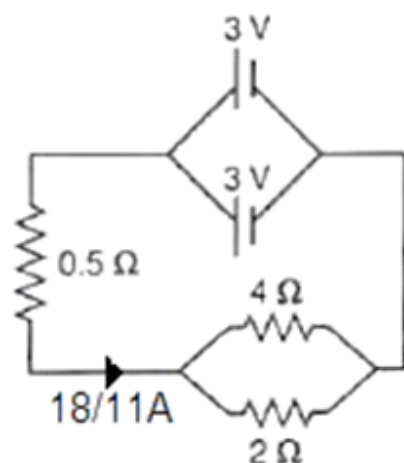
- A. 0.25 A
- B. 0.55A
- C. 0.35 A
- D. 1.50A

Answer:



The given circuit can be reduced to: -

The equivalent resistance can be calculated as: -



$$R_{eq} = \frac{4.2}{4+2} + 0.5 = \frac{11}{6} \Omega$$

$$R_{eq} = \frac{11}{6} \Omega$$

The net current in the circuit is given as $I = \frac{V}{R}$

$$= \frac{3}{\left(\frac{11}{6}\right)}$$

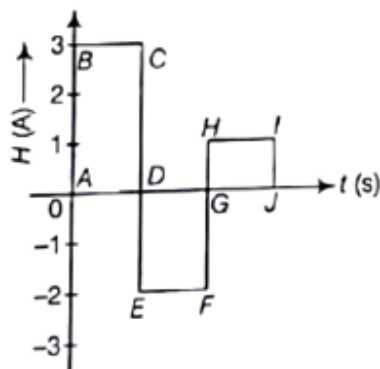
$$= \frac{18}{11} \text{ A, so,}$$

$$I_{net} = 18/11 \text{ A.}$$

The circuit can be drawn as shown aside,

The voltage drop across the parallel resistance combination is $\frac{24}{11} \text{ V}$, so net current in the 4 Ω resistor is $\frac{6}{11} = 0.55 \text{ A}$.

Q. 3. The current flowing through a wire of resistance 2 Ω varies with time as shown in figure alongside. The amount of heat produced



(in J) in 3 would be

- A. 2J
- B. 18J
- C. 28J
- D. 10J

Answer: Assuming that each interval is of 1 seconds, we can calculate the heat for each interval and just sum it up to find the net heat produced,

Heat, $H = I^2 RT$

Where,

I is the current,

R is the resistance,

T is the time taken

For AD,

$I=3$, $R=2\ \Omega$, $T=1\ \text{sec}$

Putting the values in the above formula, we get

$$H_{AD} = 3^2 \cdot 2 \cdot 1 = 18\ \text{J}$$

For DG,

$I=-2\ \text{A}$, $R=2\ \Omega$, $T=1\ \text{sec}$

Putting the values in the above formula, we get

$$H_{DG} = (-2)^2 \cdot 2 \cdot 1 = 8\ \text{J}$$

For GJ,

$I=1\ \text{A}$, $R=2\ \Omega$, $T=1\ \text{sec}$

Putting the values in the above equation, we get

$$H_{GJ} = 1^2 \cdot 2 \cdot 1 = 2\ \text{J}$$

So Total amount of heat generated in 3 sec

$$H_{\text{NET}} = 18 + 8 + 2 = 28\ \text{J}$$

Q. 4. In the movie Tang and Cash, Kurt Russell and Sylvester Stallone escape from a prison by jumping off the top of a tall wall through the air and onto a high voltage power line. Before the jump, Stallone objects to the idea, telling Russell respond with "You did not take high school Physics. Did you? As long as you are only touching one wire. And your feet are not touching the ground, you do not get electrocuted. "Is this a correct statement?

Answer: The statement is correct.

Explanation: The statement is true since for the motion of charges through a material requires a high potential and a low potential. Since, there feet are not touching the ground, the electric charges are not able to flow their body.

Thus we conclude that the electric charges require a potential difference to flow across a material. This only the region that the bird sitting on the High tension line are not electrocuted.

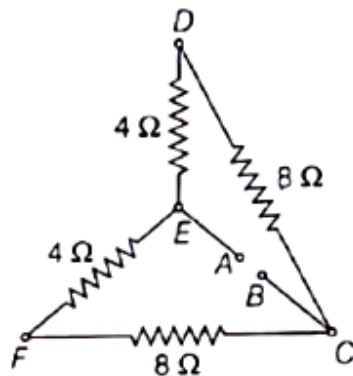
Q. 5. Two wire A and B with circular cross-sections having identical lengths and are made of the same material. Yet, wire A has four times the resistance of wire B. How many times greater is the diameter of wire B than wire A?

Answer: If wire A has four times the resistance, then it must have the smaller cross-sectional area since resistance and cross-sectional area are inversely proportional. In fact, A must have one-fourth the cross-sectional area of B. Since the cross-sectional area of a circular cross-section is given by the expression:

$$A = \pi \times r^2$$

Wire A must have one-half the radius of wire B and therefore one-half the diameter. Put another way, the diameter of wire B is two times greater than the diameter of wire A.

Q. 6. Calculate the equivalent resistance of the network across the points A and B shown in figure.



Answer: Here in this diagram, say:

$$R_1 = 4\Omega$$

$$R_2 = 8\Omega$$

$$R_3 = 4\Omega$$

$$R_4 = 8\Omega$$

When we want to find the resistance across points A and B then resistance R_1 and R_2 are connected in series and resistances R_3 and R_4 are also connected in series.

Thus,

$$R_5 = R_1 + R_2 = 4\Omega + 8\Omega = 12\Omega$$

$$\text{And, } R_6 = R_3 + R_4 = 4\Omega + 8\Omega = 12\Omega$$

Now, this R_5 and R_6 are connected to each other in parallel. Thus the equivalent resistance R_{AB} across points A and B is:

$$\frac{1}{R_{AB}} = \frac{1}{R_5} + \frac{1}{R_6}$$

$$\frac{1}{R_{AB}} = \frac{1}{12} + \frac{1}{12}$$

$$\frac{1}{R_{AB}} = \frac{2}{12} = \frac{1}{6}$$

$$\therefore R_{AB} = 6\Omega$$

Q. 7. The amount of energy transferred when 10C of charge passes through a potential difference of 20 V is the same as the energy needed to raise a 2kg mass through a distance x. Find the value of x, take the value of g as 10 m/s²

Answer: Given:

Mass of the object = 2 kg,

Charge = 10 C,

Potential difference = 20 V,

Calculations:

We know that the Energy transferred which a charge q is moved through a potential difference V is given by

$$E = q \cdot V$$

Where,

Q is the charge

V is the potential difference

Also gravitational potential energy stored in an object is given as:

$$E = m \times g \times H$$

Where,

M is the mass of the object,

G is gravitational acceleration,

H is the displacement,

As per the problem both are equal,

$$m \cdot g \cdot x = q \cdot V$$

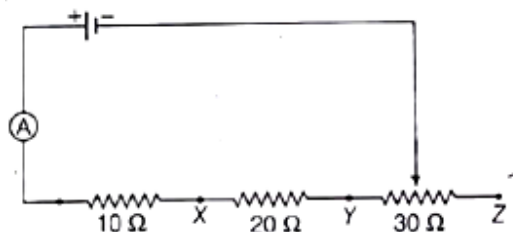
Putting the values in the equation, we get

$$2 \times 10 \times x = 10 \cdot 20$$

$$x = \frac{20}{2}$$

= 10 meters.

Q. 8. The diagram shows a cell connected in series with an ammeter and three resistors ($10\ \Omega$, $20\ \Omega$, $30\ \Omega$). The circuit can be completed by a movable constant M. When M is connected to x, then ammeter reads 0.6 A. what is the ammeter reading when M is connected to y?



Answer: The current when it is connected to x is 0.6 A, so net resistance is 10 ohms so the cell voltage is $10 \times 0.6 = 6\text{ V}$.

Now when M is connected to y

The net resistance is sum of the resistance of $10\ \Omega$ and $20\ \Omega$

$$R_{\text{net}} = 10 + 20 = 30\ \Omega$$

As we know by ohms law,

$$V = I R$$

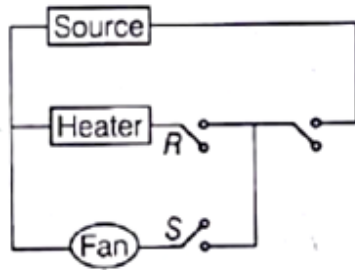
Putting the values in the equation, we get

$$6\text{ V} = I \times 30\ \Omega$$

$$I = \frac{6}{30} = 0.2\text{ A}.$$

Thus, the reading of ammeter is 0.2 A.

Q. 9. The circuit diagram is for a fan dryer that blows either hot air of cold air. Both switches R and S are as shown often. Which switch (s) is/are to be closed to obtain either hot or cold air?



Answer: In this circuit if we want Hot air to come out of the hair dryer then we will have to close both the switches R and S.

If we want cold air then we need to close the switch S. This will cause only the fan to work and the heater will be OFF and thus we'll get cold air as an output.

Magnetic Effects Of Electric Current

Check Point 01

Q. 1. What is the SI unit of magnetic field?

Answer: The SI unit of magnetic field is Tesla denoted by T.

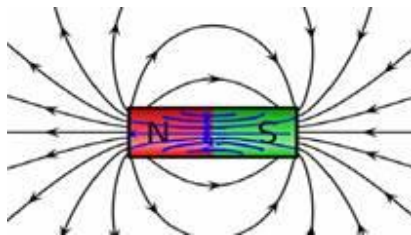
1 T is defined as the magnetic field in which particle of charge 1 Coulomb moving perpendicularly to a magnetic field at a speed of 1 m/s experiences the force of 1N.

Q. 2. What is the direction of magnetic field inside a bar magnet?

Answer: The Magnetic field lines always begin from the North 'N' pole of the magnet and ends on south 'S' pole of the magnet.

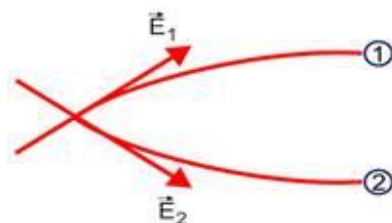
However inside the magnet the direction of magnetic field lines is from 'S' pole to 'N' pole.

The figure below illustrates the magnetic field lines direction inside the bar magnet.



Q. 3. Why can't two field lines intersect each other?

Answer: The two magnetic field lines never intersect each other because if they intersect then two tangents can be drawn from the point of intersection of the field lines which will give the two directions of the field from the same point (shown in figure below) which is impossible because the resultant force on a pole (north/south) at any point can only be in one direction. Hence the field lines never intersect.



Q. 4. How can we predict about the strength of a magnetic field in a space?

Answer: Following are the ways by which we can determine the magnetic field in a space.

1. Magnetic field can be written in terms of vector potential and by determining the potential we can find the strength.
2. By using the magnetometer we can measure the strength of the magnetic field. Figure below shows the magnetometer.



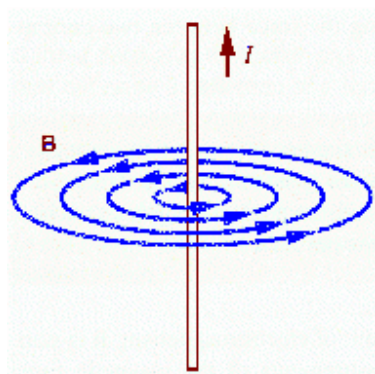
Q. 5. Where is the magnetic field due to a straight current wire

- (i) Stronger
- (ii) Weaker?

Answer: (i) Stronger = the magnetic field lines are stronger in the region around the wire and it decreases with the increase in the distance from the wire.

(ii) Weaker = the magnetic field lines are weaker in the region far away from the wire because as the distance from the wire increases the magnetic field intensity decreases.

Figure below shows the field lines due to wire.



Check Point 02

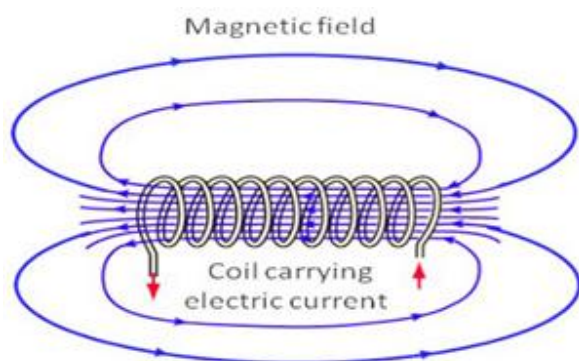
Q. 1. What happens to the strength of the magnetic field if the number of turns is increased?

Answer: The magnetic field is directly proportional to the number of turns in the magnet. Therefore on increasing the number of turns the magnetic field will increase because, with addition of each turn there will be an increase in number of charge carriers that contribute to the field at a point.

Q. 2. What is the nature of magnetic field inside a solenoid?

Answer: When current is passed through a solenoid, the magnetic fields act almost like that of a bar magnet. One end acts as the magnetic north pole, and the other end acts as the magnetic South Pole.

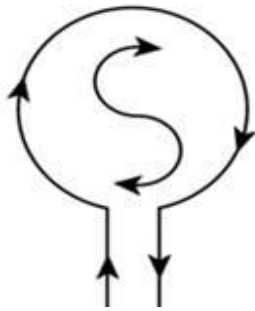
The magnetic curves inside the solenoid are in parallel straight lines, which indicate that the magnetic field is same at all points inside the solenoid. However, the field lines outside the solenoid travels from one pole to the other. Figure below shows the magnetic field lines inside the solenoid.



Q. 3. A circular loop carrying a current is placed on a horizontal surface (current is in the clockwise direction). What is the direction of its magnetic field at the centre? What is the direction of the magnetic field at a point outside the surface of the loop?

Answer: The direction of the current in the circular current carrying coil is given by the Thumb rule.

Direction of magnetic field at centre for the loop carrying current in clockwise direction is perpendicular to the plane and is inward (going into the plane) which is south pole shown in the figure below.



For the point outside the surface of the loop the direction is outwards (going outside of the plane).

Q. 4. What is difference in the pattern of magnetic field due to a circular loop and inside a solenoid?

Answer:

Circular Loop	Solenoid
1. Induced North Pole and South Pole are close to each other.	Induced north pole and south pole are some distance apart from each other due to many turns of wire.
2. Magnetic field is present inside circular loop.	No magnetic field inside because it gets cancelled by each circular loop

Q. 5. What is the principle of an electromagnet?

Answer: An electromagnet is a device used to generate a magnetic field with the help of an electric current.

Under the influence of electric current, all atoms are reoriented to start pointing in the same direction. All these individual magnetic fields together create a strong magnetic field. As the current flow increases, this degree of reorientation also increases, resulting in a stronger magnetic field.

Once all the particles are reoriented perfectly in the same direction, increasing current flow will not affect the magnetic field produced. At this point, the magnet is said to be saturated.

Check Point 03

Q. 1. When is the force on a current carrying wire.

(i) Maximum

(ii) Minimum

Answer: (i) Maximum: When the direction of current is perpendicular to the direction of the magnetic field the force on wire is maximum.

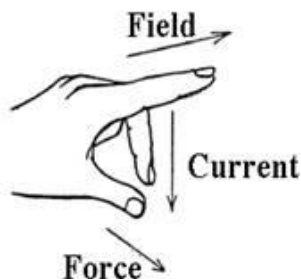
(ii) Minimum: When the direction of current is parallel to the direction of the magnetic field the force on wire is minimum.

Q. 2. Name the rule that gives the direction of force on a current carrying conductor placed perpendicular to the magnetic field.

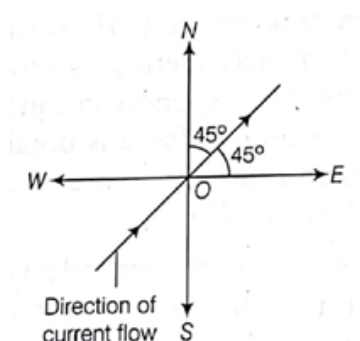
Answer: Fleming's Left hand rule gives the direction of force on a current carrying conductor placed perpendicular to the magnetic field.

Fleming's Left hand rule: According to this rule, stretch the thumb, fore-finger and middle finger of left hand such that they are mutually perpendicular. If the middle finger points in the direction of the magnetic field, the fore-finger points in the direction of flow of current, then the thumb points in the direction of motion i.e., force acting on the conductor.

Figure below illustrates it.



Q. 3. The direction of magnetic field at a place is coming out of the paper. A wire whose direction of current flow is as shown in the figure is placed there. In which direction is the force due to the magnetic field experienced by the wire?



Answer: By the right hand rule the thumb pointing in the direction of the current and the forefingers pointing in the direction of the magnetic field, then perpendicular to the palm is the direction of the force on the conductor. Therefore the direction of the force on the conductor is south west.

Q. 4. What is the cause of magnetic field inside a human body?

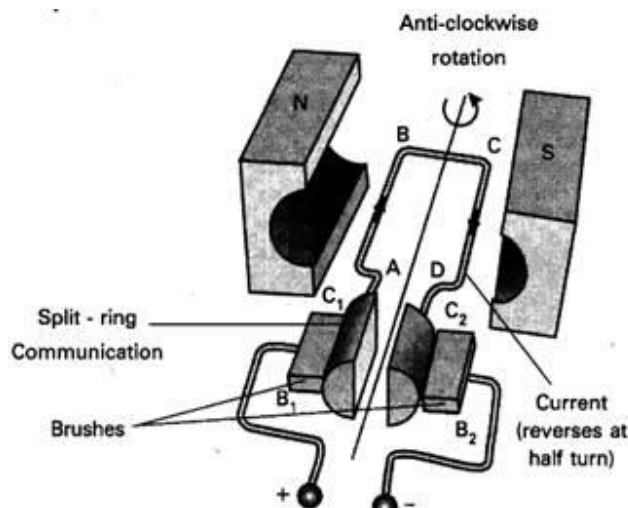
Answer: The human body magnetism comes from two sources one is magnetism from earth and other is the metabolism within the cells in the body.

In human body small electric current travel along the nerve cells due to ions, same way as electricity flows through the wire. This current produces very weak magnetic field in the human body. **Heart** and **Brain** are the two main organs in the human body where this field is significant.

Q. 5. What is an electric motor?

Answer: Electric motor is the device in which electrical energy is converted into the mechanical energy.

It works on the principle that when a rectangular coil is placed in a magnetic field and current is passed through it. A force acts on the coil which rotates it continuously. Figure below shows the electric motor



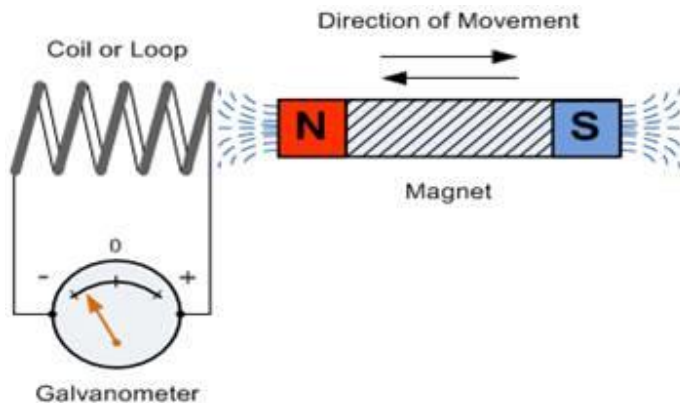
Check Point 04

Q. 1. What is electromagnetic induction?

Answer: Electromagnetic Induction is a current produced because of voltage production (electromotive force) due to a changing magnetic field. This either happens

when a conductor is placed in a moving magnetic field (when using AC power source) or when a conductor is constantly moving in a stationary magnetic field.

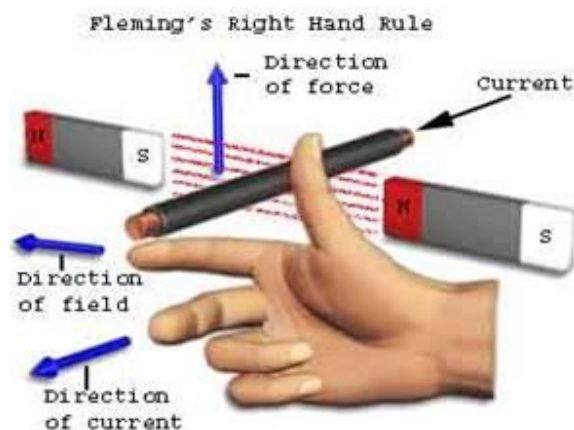
This phenomenon was discovered by Michael Faraday. Figure below shows the setup for electromagnetic induction.



Q. 2. Where is Fleming's right hand rule used?

Answer: It can be used to determine the direction of current in a generator's windings. It can also be used to show the direction of induced current when a conductor attached to a circuit moves in a magnetic field.

Fleming right hand rule is mainly applicable for the electric generator. Figure below shows how to determine the direction of current using Fleming right hand rule.



Q. 3. Differentiate between the time varying and constant currents.

Answer:

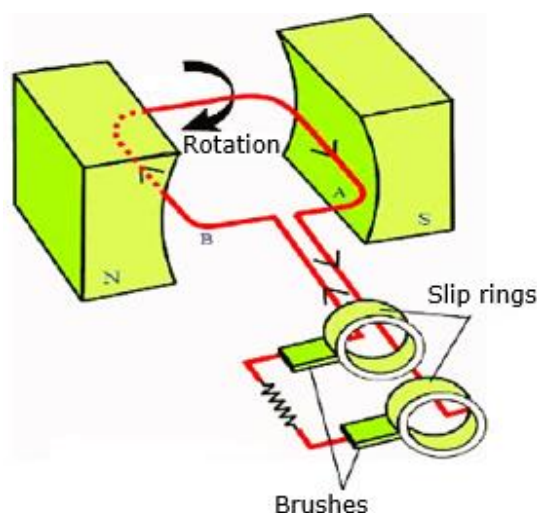
Time Varying current	Constant current
1. It is the current of magnitude varying with time	It is the current of constant magnitude.
2. It reverses its direction while flowing in a circuit.	It flows in one direction in the circuit.
3. The frequency of this current is 50Hz or 60Hz depending upon the country	The frequency of constant current is zero.
4. Safe to transfer over longer city distances and can provide more power	Voltage of constant current cannot travel very far until it begins to lose energy.

Q. 4. What is an electric generator?

Answer: Electric generator is the device which converts the mechanical energy into the electrical energy.

It works on the Faraday's law of the Electromagnetic Induction which says that whenever a conductor is placed in a varying magnetic field, EMF is induced and this induced EMF is equal to the rate of change of flux.

Electric generators are of two types A.C generator and D.C generator. Figure below shows the A.C generator.



Q. 5. Write down the differences between AC and DC generators.

Answer:

AC Generators	DC Generators
1. AC generator is a mechanical device which converts mechanical energy into AC electrical power.	DC generator is a mechanical device which converts mechanical energy into DC electrical power.
2. In an AC generator, the electrical current reverses direction periodically.	In a DC generator, the electrical current flows only in one direction.
3. AC generator does not have commutators.	DC generators have commutators to make the current flow in one direction only.
4. AC generators have slip-rings.	DC generators have split-ring commutators.

Check Point 05

Q. 1. At what potential and frequency are the domestic electric circuits operated?

Answer: In our country the potential difference is **220 V** and the frequency is **50 Hz**. It is different for the different countries. And the potential difference is between the live wire and the neutral wire.

Q. 2. Usually, three insulated wires of different colours are used in an electrical appliance. Identify the three colours.

Answer: Electrical wires follow standard color coding that helps classify each wire function in the circuit. In India wires are RGB mode i.e. Red- Green- Black. Each of these RGB wire have different functions.

1. RED = Red wire signifies the phase in electric circuit. It is the live wire which cannot be connected to another red wire or black wire.

2. BLACK = Black wires signifies neutral wire in electric circuit. The neutral wire is connected to neutral bus bar inside an electric panel.

3. GREEN = Green wire stands for grounding/ Earthing in electric circuit. A green wire should be on can be connected to green wire only (no other wire).

Q. 3. Why should a fuse wire of defined rating not be replaced by one with a larger rating?

Answer: Fuse is used for protecting appliances due to short-circuiting or overloading. The fuse is rated for a certain maximum current and blows off when a current more than the rated value flows through it.

If a fuse is replaced by one with larger ratings, the appliances may get damaged while the protecting fuse does not burn off. This practice of using fuse of improper rating should always be avoided.

Q. 4. What does it mean when we say that a circuit is short circuited?

Answer: A short circuit is an electrical circuit that allows a current to travel along an unintended path with no or a very low resistance. This results in an excessive amount of current flowing into the circuit

A common type of short circuit occurs when the positive and negative terminals of a battery are connected with a low-resistance conductor, like a wire. With a low resistance in the connection, a high current will flow, causing the delivery of a large amount of energy in a short period of time

Q. 5. What is overloading of an electric circuit?

Answer: The current in a circuit depends on the rating of the appliances connected to it. The choice of wires depends upon the maximum current estimated to pass through them. If the total power rating of the appliances exceeds this permitted limit, they tend to draw a large current. This is known as overloading due to excessive heating takes place.

Overloading occurs when too many appliances are connected in a single socket or live and neutral wires come in contact with each other.



Chapter Exercise

Q. 1. What name is given to the device which automatically cut-off the electrical supply during short circuiting in household wiring?

Answer: A fuse is an electrical safety device that is used to cut electrical supply during short circuit. It is a metal wire or strip that melts when too much current flows through it, thereby interrupting the current.

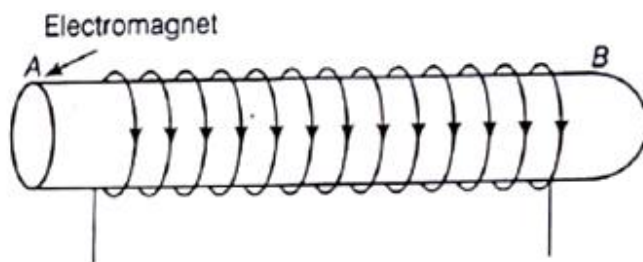
Figure below shows the fuse.



Q. 2. In which wire in an AC housing circuit, is the switch introduced to operate the light?

Answer: In order to prevent us from getting electric shock we have to connect all wires to the earth wires, and lights operate in live wire. Also we have to connect neutral wire to complete the circuit.

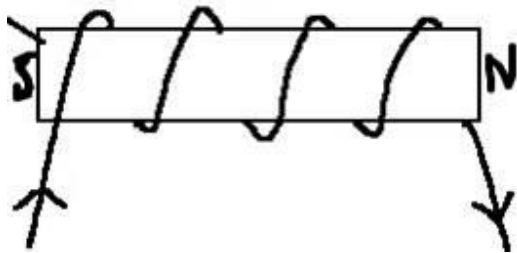
Q. 3. The diagram shows a coil of wire wound on a soft iron core forming an electromagnet. A current is passed through the coil in the direction indicated by the arrows. Mark the N and S-poles produced in the iron core.



Answer: By using the clock face rule which states that "When an observer, looking at the face of the coil, finds the current to be flowing in the anti-clockwise direction, then the face of the coil will behave like the North Pole. While if the current is in the clockwise direction, the face of the coil will behave like South Pole.

South Pole: A

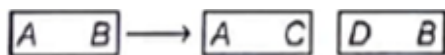
North Pole: B



Q. 4. Why is an alternating current considered to be advantageous over direct current for long range transmission of electric energy.

Answer: Alternating current can be transmitted over the long distances without the loss of energy. Also alternating voltage can be stepped up and stepped down using transformer.

Q. 5. A magnet AB is broken into two pieces. Point out the polarity of A,B,C and D.



Answer: When the magnet AB is broken into pieces as shown in the figure below.



Polarity of A and C is north

Polarity of B and D is south

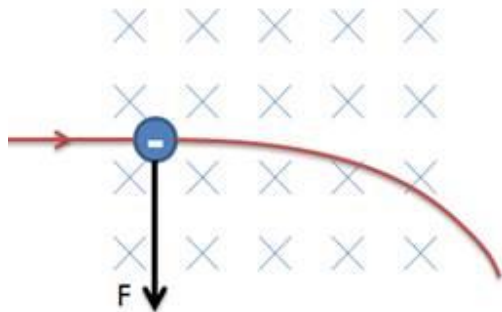
Because single poles of magnet do not exist when the magnet is broken the two poles (north and south) are created immediately.

Q. 6. The diagram shows a beam of electrons about to enter a magnetic field. The direction of the field is into the page. What will be the direction of the deflection, if any beam passes through the field?

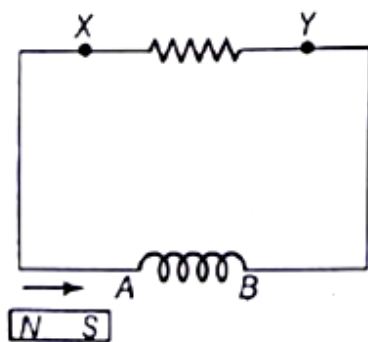
	XXXX	
Electron	XXXX	Magnetic field
beams	XXXX	into page
	XXXX	

Answer: The direction of current is from left to right as the electron beam enters from left to right and the magnetic field is into the page.

According to the Fleming's left hand rule the force is perpendicular to the flow of current and is in its left side. So electron beam deflects towards bottom of the page. As shown in the figure below.

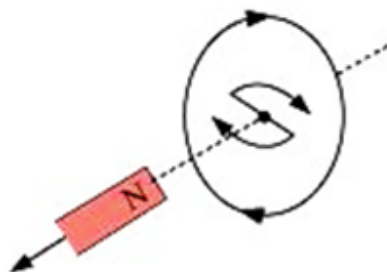


Q. 7. A small valued resistance XY is connected across the ends of a coil. Predict the direction of induced current in the resistance XY when.

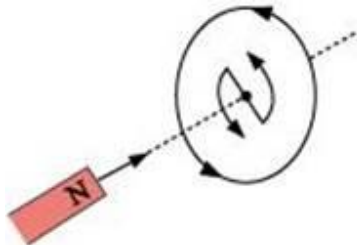


- (i) South pole of a magnet moves towards end A of the coil.
- (ii) South pole of a magnet moves away from end A of the coil.

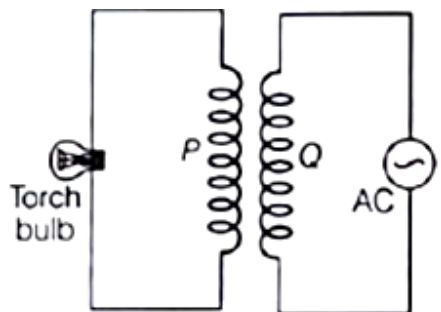
Answer: (i) According to the Lenz's Law induced emf will oppose the source of the charge, thus to oppose the approaching South Pole magnetic South Pole will be developed at the end of the magnet. Thus the current will flow in the clockwise direction as shown in the figure below.



(ii) According to the Lenz's Law induced emf will oppose the source of the change, thus to oppose the going away South Pole magnetic North Pole will be developed at the end of the magnet so that the south pole of the magnet do not go away. Thus the current will flow in the anticlockwise direction as shown in the figure below.



Q. 8. A coil P is connected to a torch bulb and placed to another coil Q as shown in figure below:



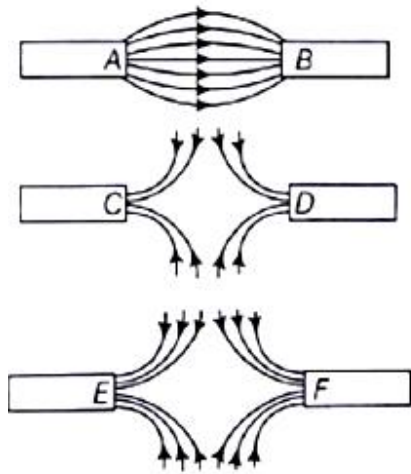
Explain the following observations:

- (i) Bulb lights and
- (ii) bulb gets dimmer, if the coil P is moves upwards.

Answer: (i) The bulb lights due to the mutual induction. The emf is produced in the conductor when the magnetic flux linked with the conductor changes. Due to this emf the bulb gets lighted.

(ii) When the coil P is move upwards the magnetic flux linked with the coil gets decreased due to which the induced emf gets decreased, hence the bulb gets dimmer.

Q. 9. Three diagrams in the following figures show the magnetic field lines between the poles of the magnets. Identify the poles between A,B,C,D,E and F.



Answer: (i) A is North Pole and B is South Pole because magnetic field lines originate from North Pole and ends at South Pole.

(ii) C and D are South Pole because the magnetic field lines end at the South Pole and same type of poles repel each other.

(iii) E and F are South Pole because the magnetic field lines end at the South Pole and same type of poles repel each other.

Q. 10. Why does a magnetic compass needle pointing North and South in the absence of a nearby magnet gets deflected when a bar magnet or a current carrying loop is brought near it. Describe some salient features of magnetic field lines concept.

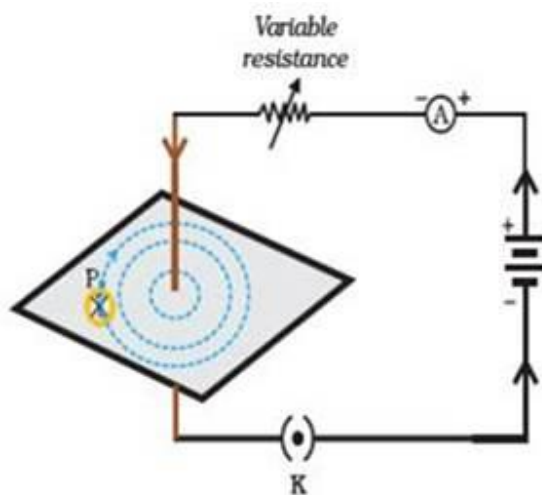
Answer: A magnetic compass needle pointing North and South shows deflection when a bar magnet or a current carrying loop is brought near it. This happens because the magnetic fields of the compass needle and the bar magnet (or current carrying loop) interact with each other.

Salient features of magnetic field lines:-

- a. Magnetic field lines follow the direction from the North Pole to the South Pole.
- b. Magnetic field lines always show concentric pattern.
- c. Magnetic field lines do not cross one another.
- d. Closer the field lines; stronger is the magnetic field and vice-versa is also true.
- e. Magnetic field lines are closer near the poles; which shows greater strength of magnetic field near the poles.

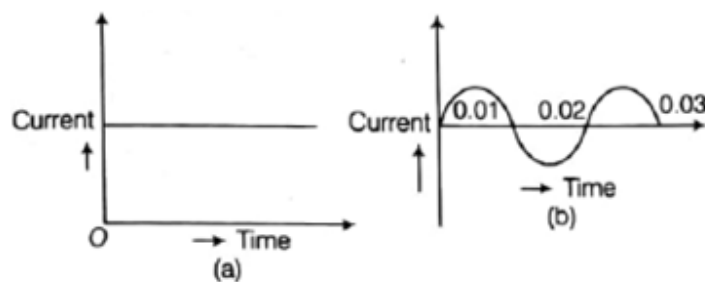
Q. 11. With the help of a labelled circuit diagram illustrate the pattern of field lines of the magnetic field around a long current carrying straight conducting wire. How is the right hand thumb rule useful to find direction of magnetic field associated with a current carrying conductor?

Answer: The magnetic field lines around a straight conductor (straight wire) carrying current are concentric circles whose centers lie on the wire. Figure below shows the field lines.



Right hand thumb rule states that if a current carrying straight conductor is supposedly held in the right hand with the thumb pointing towards the direction of current, then the fingers will wrap around the conductor in the direction of the field lines of the magnetic field.

Q. 12. You are given the following current- time graphs from two different sources:



Now, answer the following questions:

- Name the type of current in two cases.
- Identify any one source for each type of these currents.

(iii) What is the frequency of current in case (b) in India?

(iv) Use above graphs to write two differences between the current in two cases.

Answer: (i) The current in first case is the **Direct current** because it is constant with the time. The current in second case is the **Alternating current** because its direction and magnitude changes continuously with the time.

(ii) Source of direct current are solar cell, fuel cell etc.

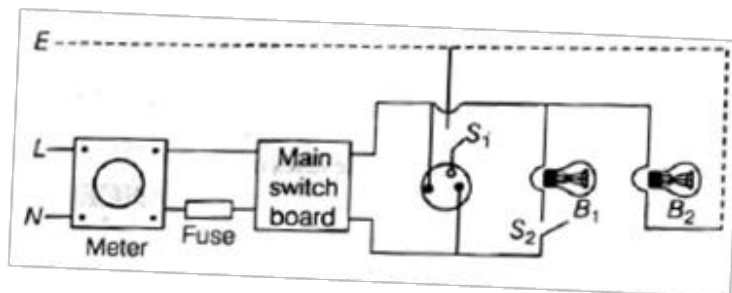
Source of alternating current the electricity coming to our home.

(iii) The frequency of the Alternating current in India is **50 Hz**.

(iv)

Alternating current	Direct current
1. The frequency of alternating current is 50Hz or 60Hz depending upon the country.	The frequency of direct current is Zero.
2. It is the current of magnitude varying with time	It is the current of constant magnitude.

Q. 13.



(i) The figure shows a domestic electric circuit. Study this circuit carefully and list any three errors in the circuit and justify your answer.

(ii) Give one difference between the wires used in the element of an electric heater and in a fuse.

(iii) List two advantages of parallel connection over series connection.

Answer:

(i) Following are the errors in the circuit given above.

a) Fuse is incorrectly connected to the Neutral wire (N) it must be connected to the live wire (L).

b) Bulb B2 is not connected to the neutral wire.

(ii) Element of electric heater has high melting point in order to stand high temperatures while element of fuse has low melting point.

(iii) 1. Each appliance will have an equal potential difference.

2. Each appliance will have a separate switch to ON/OFF the flow of the current.

Q. 14. Overloading in an electric circuit causes fire. Many people are unaware of this fact. Amit, an intelligent student told people of his building about overloading. He told them various precautions to avoid it questions:

(i) What harm does overloading in the circuit cause?

(ii) What values are shown by Amit?

Answer: (i) Overloading can lead to damage, poor performance and possible failure. There may be a risk of fire or damage to components. It can also lead to sparks, arcs or insulation failure. Current overload will cause things to heat up, and then possibly melt, set of fire, damage insulation or cause components to fail. Some components will be damaged by the excessive current without overheating

(ii) Amit is very caring and worried towards his society and people. He is also quite aware and intelligent. He uses his knowledge of science for helping society which is the sole purpose of education.

Q. 15. Raja had gone to his aunt's home in a foreign country, where domestic electric supply is DC. An electrician working in her kitchen was trying to locate the electric wiring in a particular wall for some electrical work but failed to do so. Electrician, then suggested the breaking of substantial position of wall to Rajat's aunt.

But Rajat told his aunt that he could locate the position of current carrying wires in the kitchen without any breakage. He brought a small device from market and within ten minutes, located the position of all current carrying wires on wall of his aunt got very happy from him.

Read the above passage and answer the following questions:

(i) Which device was purchased by Rajat?

(ii) What was noticed by Rajat when he moved this device slowly over the current carrying wires embedded kitchen?

(iii) What values are shown by Rajat in this episode?

Answer: (i) Rajat has purchased a Compass because it contains the magnet and in presence of the electric current the needle in it deflects which helps in detecting the current carrying wires. Figure below shows the compass.

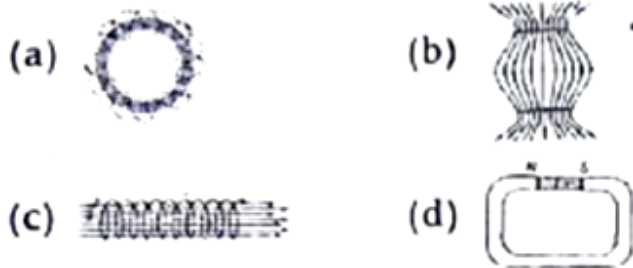


(ii) Rajat noticed the deflection in the needle of the compass when he was moving the device slowly over the wires. Actually due to interaction between the magnetic field of the compass and of the current carrying wires the deflection is produced.

(iii) Rajat is very aware and clever. He quickly brought the instrument to help his aunt this shows he is very helping and caring towards his aunt.

Challengers

Q. 1. Which of the following figures shows the correct magnetic field lines?

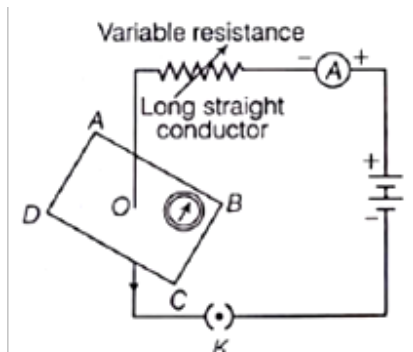


- A. (a)
- B. (b)
- C. (c)
- D. (d)

Answer: In option A the magnetic field lines are circular; also they start and end at definite point.

But in option D the magnetic field lines are shown as square in shape therefore it is incorrect. In option B and C they are not starting and ending at definite point.

Q. 2. If the key in the arrangement as shown below is taken out (the circuit is made open) and magnetic field lines are drawn over the horizontal plane ABCD, the lines are



- A. Concentric circles
- B. elliptical in shape
- C. Straight lines parallel to each other
- D. Concentric circles near the point O but of elliptical shapes as we go away from it

Answer: Since the key is taken out due to which there is no magnetic field due to wire. Hence only magnetic field of earth is present and the magnetic field lines of the earth are straight lines parallel to each other.

Q. 3. Three plotting compasses are to a solenoid carrying a current. How many of the compass needles will change direction, if the current through the solenoid is increased?

(Ignore the effect of the earth's magnetic field).

- A. Only 1 compass needle
- B. 2 compass needle
- C. 3 compass needle
- D. None of the above

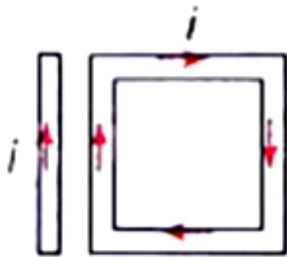
Answer: Since the magnetic field outside the solenoid is zero because it gets cancelled due to the each circular ring. Hence no compasses will get deflected.

Q. 4. A ship is to reach a place 8° south of west. In what direction should the ship be steered if declination at the place is 18° west?

- A. West of magnetic north at angle 64°
- B. East of magnetic south at angle 64°
- C. West of magnetic south at angle 50°
- D. East of magnetic north at angle 18°

Answer: Initially the ship is at 8° south of west. Declining 180 from 80 south of west results in actual direction. Now from north we get the direction of $90 - 18 - 8 = 90 - 26 = 64^\circ$ West of North.

Q. 5. A rectangular loop carrying a current is situated near a long straight wire such that the wire is parallel to one of the sides of the loop and is in the plane of the loop. If a steady current is created in wire as shown in figure below, then the loop will.



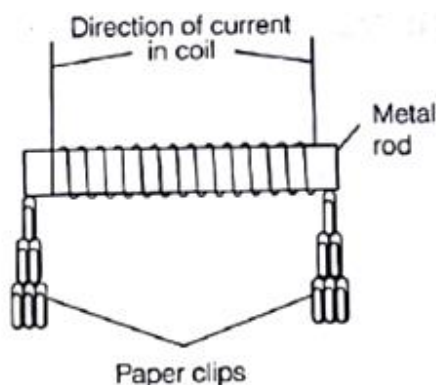
- A. rotate about an axis parallel to the wire
- B. move towards the wire
- C. move away from the wire or towards right
- D. remains stationary

Answer: For the loop, using Lenz's Law, the force on the part which is nearer, due to the current in the long wire is attraction and force on the part which is farther is repulsion.

$$F (\text{attraction}) > F (\text{repulsion})$$

Hence loop moves towards the wire.

Q. 6. Four metal rods are placed, in turn, inside a coil of copper wire,



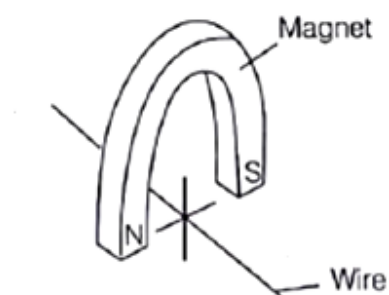
The table below gives the results of the experiment. Which rod would be the most suitable to use for the case of a coil in a circuit breaker?

Metal rod	Number of paper clips picket up when there is a current in the coil	Number of paper clips still attracted when the current is switched off
(a)	1	0
(b)	20	2
(c)	35	0
(d)	35	30

- A. (a)
- B. (b)
- C. (c)
- D. (d)

Answer: The core of solenoid must be of some soft type magnetic material which can be strongly magnetized but does not retain induced magnetism.

Q. 7. A cooper wire is held between the poles of a magnet.



The current in the wire can be reversed. The pole of the magnet can also be changed over. In how many of the four directions shown can the force act on the wire?

- A. 1
- B. 2
- C. 3
- D. 4

Answer: The force on the wire due to the interaction of magnetic fields of the bar magnet and current carrying wire can act only in upwards or downwards direction.

Source Of Energy

Check Point 01

Q. 1. What are the two characteristics of a good source of energy?

Answer: The basic characteristics of a good source of energy are as follows:

1. The source of energy should not cause any kind of environmental pollution.
2. The source of energy should produce a great amount of energy per unit mass or volume.
3. It should not cause any kind of harm to people and should not be risky to the health of people handling it.
4. The source of energy should be easily available and should have the capacity to generate energy for maximum amount of time.

Q. 2. When do you say that a source of energy is non-renewable?

Answer: Non-renewable sources of energy refer to that class of sources of energy which are dependent on materials which are limited in quantity and has the possibility of getting completely depleted in the future if used in very rapid rate. For example, petroleum or coal is available through the deposit which is formed over thousands of years back and thus is limited in quantity to the generation of coal or petroleum takes thousands to millions of years.

Q. 3. What is the difference between petroleum gas natural gas?

Answer:

Petroleum Gas	Natural Gas
1. Petroleum gas contains higher concentration of butane and propane.	Natural Gas contains higher concentration of methane in it.
2. Petroleum gas like LPG has higher calorific value [approx. 94MJ/m ³].	Natural Gas has lower calorific value [approx. MJ/m ³].
3. Petroleum Gas is a constituent of crude oil.	Natural gas is not at all a constituent of crude oil and it is found above the crude oil deposit.
4. Petroleum Gas is harmful to the environment as it causes a large amount of emission of carbon dioxide.	Natural Gas is safer to for the environment as it emits very less amount of carbon dioxide in the atmosphere as compared to petroleum gas.

Q. 4. What are a conventional sources of energy?

Answer: Non-renewable sources or conventional sources of energy refer to that class of sources of energy which are dependent on materials which are limited in quantity and has the possibility of getting completely depleted in the future if used in very rapid rate. For example, petroleum or coal is available through the deposit which is formed over thousands of years back and thus is limited in quantity to the generation of coal or petroleum takes thousands to millions of years.

Conventional sources of energy cause environmental pollution as emit carbon dioxide and other pollutants on combustion.

Q. 5. Why should we avoid the use of fossil fuels as sources of energy?

Answer: The main reasons to avoid the use of fossil fuels as sources of energy:

1. Fossil Fuels cause heavy environmental pollution on being combusted as they emit carbon dioxide and other pollutants in the air.
2. Fossil fuels are limited or finite in quantity and hence their use should be limited to save it for future.

Check Point 02

Q. 1. Write any two points about good source of energy?

Answer: The basic characteristics of a good source of energy are as follows:

1. The source of energy should be sustainable and renewable.
2. It should not cause any kind of environmental pollution.
3. It should produce a great amount of energy per unit mass or volume.
4. It should not cause any kind of harm to people and should not be risky to the health of people handling it.
5. The source of energy should be easily available and should have the capacity
6. Energy and Good Fuel

Q. 2. According to pie-chart which of the fossil fuel is most widely used in India?

Answer: According to the pie chart, coal is the fossil fuel which is widely used in India for energy production.

Q. 3. Write two disadvantages of burning fossil fuels.

Answer: The main reasons to avoid the use of fossil fuels as sources of energy:

1. Fossil Fuels cause heavy environmental pollution on being combusted as they emit carbon dioxide and other pollutants in air.
2. Fossil fuels are limited or finite in quantity and hence their use should be limited to save it for future.
3. Incomplete combustion of fossil fuels causes liberation of carbon monoxide which is highly injurious to health.

Q. 4. Write anyone way in which a thermal power plant differs from a hydro power plant.

Answer:

Thermal Power Plant	Hydro Power Plant
1. Thermal Power Plant as the name suggests it refers to the generation of electricity by burning of fossil fuels.	Hydro Power Plant as the name suggests it refers to the generation of electricity by flowing water.
2. In this plants, the chemical energy of the fossil fuels is converted to electrical energy.	In this plants, the stored potential energy of water is converted into electrical energy.
3. Thermal Power plants release pollutants in the air and cause pollution.	Hydropower plants do not cause environmental pollution but the blocking of water causes harm to aquatic organisms.
4. Thermal power plant relies on conventional sources of energy that is fossil fuels.	Hydro Power energy rely on a renewable source of energy that is flowing of water.

Q. 5. What are the two negative impacts of a hydro power plant on the ecosystem?

Answer: The negative impacts of hydro power plant on ecosystem are as follows:

1. Since dams always have a reservoir where the abundant quantity of water is stored, the blocking of flowing water causes harm to aquatic animals and their migration.
2. Dams also causes submerging of the nearby lands and all the natural areas, agricultural lands and hence requires relocating of the people who lived previously near the dam area.
3. Water from the reservoirs of the dams is lost due to evaporation at a faster rate as compared to flowing water.
4. Normally reservoir water has a lesser amount of dissolved oxygen and is cooler as compared to normal water. So when such water is released, it causes negative impacts on the organisms and plants downstream.

Check Point 03

Q. 1. What are the popular biomass used in India?

Answer: The popular biomass used in India are as follows:

1. Cow Dung

2. Residues left after harvesting of crops.
3. Agricultural Waste
4. Sewage
5. Vegetable Waste
6. Wood

Q. 2. What is the composition of bio-gas?

Answer: The typical composition of biogas is as follows:

Methane lies in the range of 50-75%

Carbon Dioxide lies in the range of 25-50%

Nitrogen lies in the range of 0-10%

Hydrogen lies in the range of 0-1%

Q. 3. Why bio-gas is also known as gobar-gas?

Answer: Bio gas is the gas formed in the biogas plant due anaerobic oxidation of organic material. But the majority of the starting material for the biogas plant is the cow dung which is known as “gobar” in Hindi Language and hence the gas formed in the biogas plant is termed as the “gobar gas”

Q. 4. How does bio-gas plant help to reduce the problem of pollution?

Answer: Biogas is an excellent fuel for cooking purposes and it also contains 75% of methane because of which biogas burns without giving any kind of smoke and also do not leave any residue after being heated.

Since biogas also uses waste water, it removes the oxygen demanding pathogens present in the waste thereby preventing the pollution of water bodies.

Biogas plants contain the residue after all the organic matter is converted to gas. This residue is rich in phosphorous and nitrogen which are the two main nutrients for plants. Hence this residue can be used as an organic fertilizer for plants.

Q. 5. What are the two limitations of harnessing wind energy?

Answer: The limitations of harnessing wind energy are as follows:

1. The setting up and maintenance of the wind farms is a costly affair.
2. Wind Mills and Wind Farms requires a large area of their setup.
3. Wind farms can be established only those areas where wind flows throughout the year and the speed of wind remains above 15km/hr.

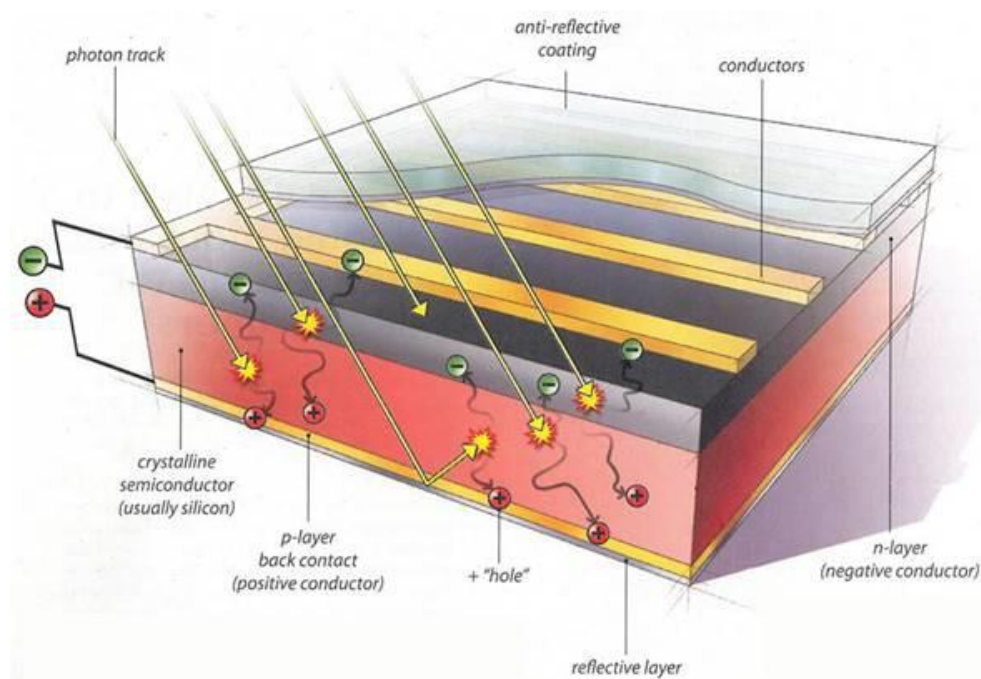
Check Point 04

Q. 1. Why is solar energy considered renewable?

Answer: The raw material required for the solar energy is sunlight which is freely available and sunlight is available as long as the sun exists and at the same time sunlight is inexhaustible. Hence solar energy is considered to be renewable source of energy.

Q. 2. Which element is used to make solar cells?

Answer: All the solar cells available in the market are made from silicon, germanium [rarely]. Silicon is the only material in which the electrons flow when it exposed to sunlight.



Q. 3. Why is the solar cooker box covered with a glass sheet?

Answer: Solar cooker box is used to cook food with help of sunlight. The sunlight when it shines on the solar cooker the food inside gets cooked due to the absorbed heat from sun rays.

To avoid the escaping of the heat from the solar cooker, the solar cooker is covered with glass as sunlight can pass through glass effectively but the heat inside the cooker will not be radiated out.

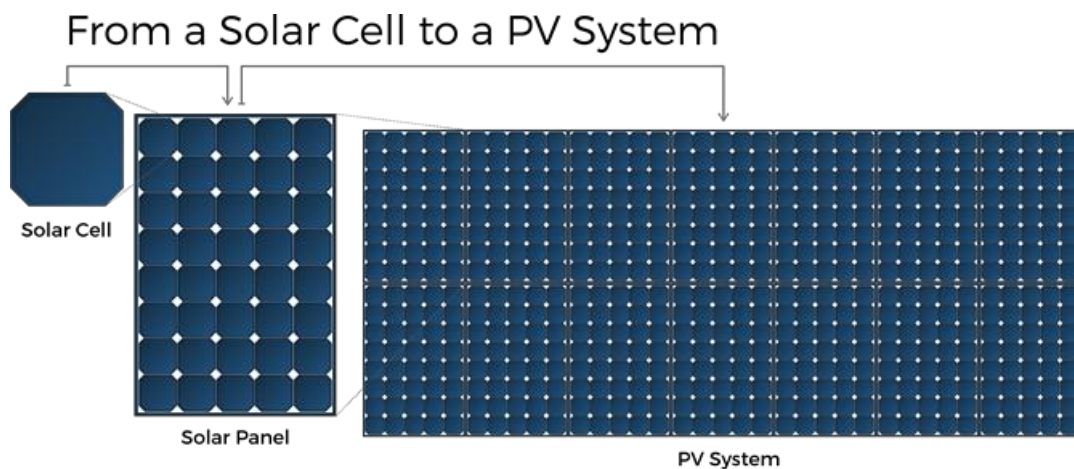
Q. 4. A solar cell transforms energy from one form into another form. What are these two forms of energy?

Answer: Solar Cell as the name suggests it has to deal with sun or more specifically sun's energy or solar energy. Cell means any device which gives electricity.

So a solar cell will convert solar energy into electrical energy.

Q. 5. What is a solar panel?

Answer: A single solar cell cannot generate large amount of electricity. So an array of connected solar cells constitute to form a solar panel which can give large amount of electricity.



Check Point 05

Q. 1. What are the different forms of energy available in ocean?

Answer: The different forms of energy available in ocean are as follows:

1. Tidal Energy due to tides in oceans.
2. Wave Energy due to fast-moving ocean waves.

3. Ocean current energy due to ocean currents under the ocean.

4. Ocean thermal energy due to difference in water's temperature at surface and deep inside the water.

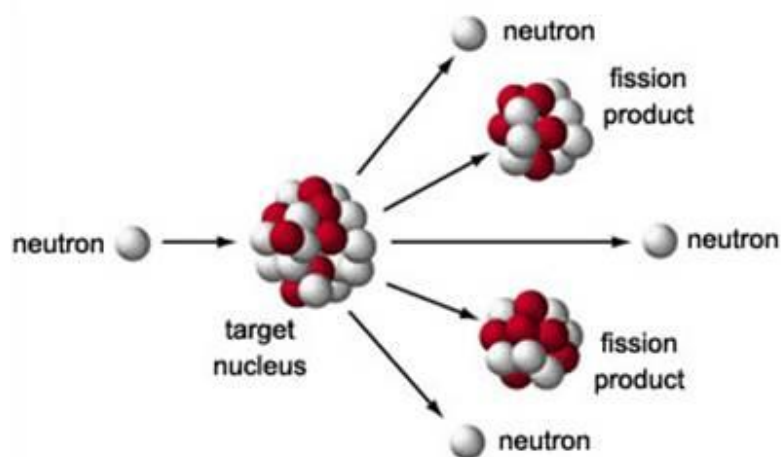
Q. 2. State one difference between tidal and wind energy.

Answer:

Tidal Energy	Wind Energy
1. Tidal energy is due to the rotation of propellers due to the tides occurring the in seas or oceans.	Wind energy is due to rotation of turbine due to the fast moving wind.
2. Since tidal energy is dependent on tides which are predictable.	Flowing of wind is cannot be predicted.

Q. 3. What is nuclear fission?

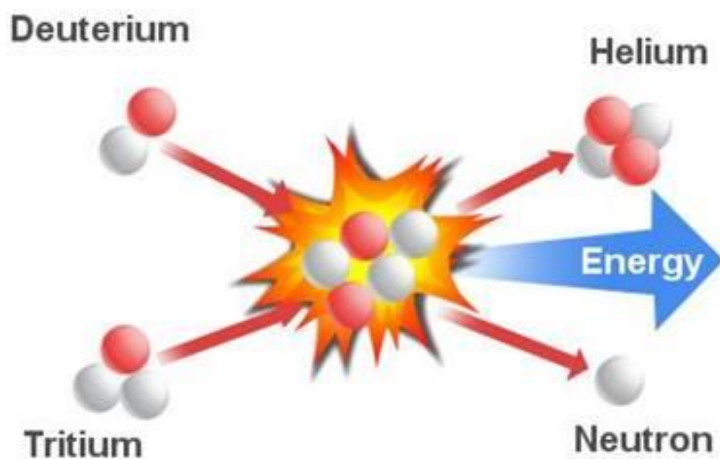
Answer: Nuclear Fission as the name suggests nuclear which means relating to nucleus and fission means to break. So nuclear fission is a process in which a heavy nucleus breaks into smaller particles spontaneously or due to collision with a moving particle releasing a vast amount of energy.



Q. 4. What is nuclear fusion?

Answer: Nuclear Fusion as the name suggests nuclear which means relating to nucleus and fusion means to join. So nuclear fusion is a process in which two lighter nuclei come close enough to form one or more different atomic nuclei releasing a large amount of energy. The nuclear fusion reaction takes place at Sun where two hydrogen

nuclei combine to form helium resulting in liberation of large amount of heat and light energy.



Fusion

Q. 5. What are the disadvantages of using nuclear power?

Answer: The disadvantages of nuclear power are as follows:

1. Nuclear power is mainly generated due to fission of a heavy nucleus and this reaction results in a chain reaction which can become uncontrollable.
2. Nuclear power generates large amount of radiation which is harmful to all living beings as this radiation can cause incurable diseases and genetic disorders.
3. Radioactive waste generated due to nuclear power plants cannot be disposed of easily.

Chapter Exercise

Q. 1. Justify in one sentence that hydro power (hydroelectricity) is a renewable source of energy.

Answer: Conventional sources of energy or Renewable Sources of Energy are those energy sources which will never be depleted as they are virtually unlimited in quantity.

In case of hydro power plant, flowing water causes the turbines to rotate and the water can be refilled due to rains and hence Hydro energy is considered to a renewable source of energy.

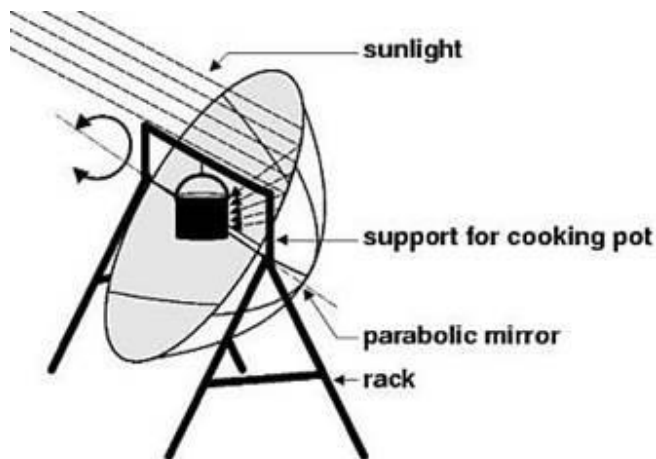
Q. 2. Name any two devices used to harness solar energy.

Answer: The two solar based devices which use solar energy are as follows:

1. Solar Cell
2. Solar Cooker
3. Solar Water Heater

Q. 3. In parabolic reflector type cookers, even temperature up to 1800°C-2000°C can be attained. How?

Answer: The reason for the attainment of such high temperatures is that by the use of parabolic reflectors the rays of sunlight get concentrated at a particular point causing a greater elevation in temperature.



Q. 4. What type of energy transformation takes place during winding of spring of a clock?

Answer: During the winding of the spring of a clock, the kinetic energy gets converted into stored potential energy of the spring.

Q. 5. In many applications, solar cells are connected to rechargeable batteries. Why is it so?

Answer: A solar cell is a type of cell in which the electrons flow when sunlight is concentrated on it. Thus the flow of electron constitutes an electric current. So when we connect rechargeable batteries to solar cell, the batteries get charged due to the current

flowing out of solar cell and hence in many applications solar cells are connected to rechargeable batteries.

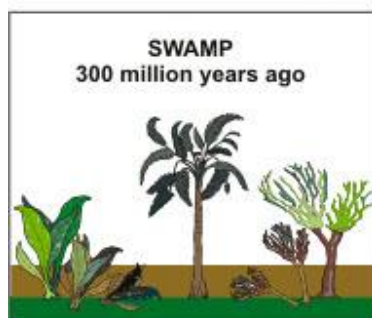
Q. 6. How is the increase in demand for energy affecting our environment adversely?

Answer: The major energy production sources in the present world are due to fossil fuels and petroleum. Since the rise in energy demand, causes an extensive use of these resources and at the same time, the use of such resources causes heavy environmental pollution. Also, the extensive use of fossil fuels for energy production will cause the fossil fuel to deplete off completely in near future.

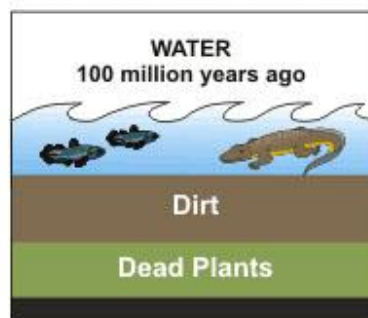
Q. 7. How were fossil fuel formed?

Answer: Fossil fuels are formed due to decaying of remains of plants, animals and organic matter over the period of thousands of years where the matter gets converted to solid form due to action of environmental agents like temperature pressure and heat.

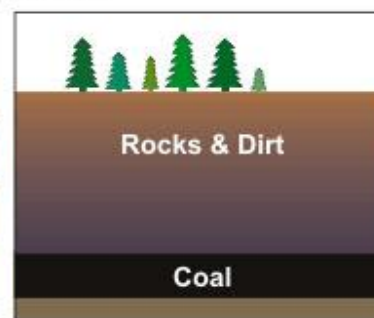
HOW COAL WAS FORMED



Before the dinosaurs, many giant plants died in swamps.



Over millions of years, the plants were buried under water and dirt.

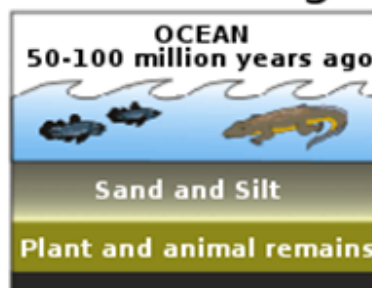


Heat and pressure turned the dead plants into coal.

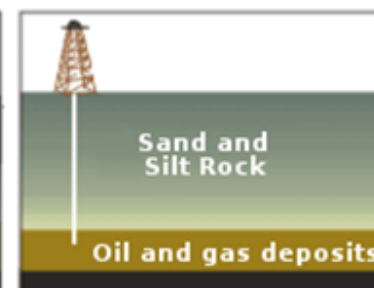
Petroleum and natural gas formation



Tiny sea plants and animals died and were buried on the ocean floor. Over time they were covered by layers of silt and sand.



Over millions of years, the remains were buried deeper and deeper. The enormous heat and pressure turned them into oil and gas.



Today we drill down through layers of sand, silt and rock to reach the rock formations that contain oil and gas deposits.

Q. 8. Name four gases commonly present in biogas. State two advantages of using this gas over fossil fuels.

Answer: The typical gases present in biogas are as follows:

1. Methane
2. Carbon Dioxide
3. Hydrogen
4. Hydrogen Sulphide

Biogas is more efficient as fuel as compared to fossil fuels in the following ways:

1. Biogas does not leave any ash and residue after combustion.
2. Biogas does not burn with a smoke and does not cause pollution.

Q. 9. Of the major requirement of different forms of energies, write which one is the greater requirement of India and which is the least? What is the percentage of the hydro energy requirement of India?

Answer: India requires tidal energy on a larger scale as it is covered with water on all the three parts and on the other hand it requires the nuclear energy the least as it has less reserves of nuclear raw material.

Hydro power makes up 14.01 percent, with 44,189.43 MW of the total power generated in the country.

Q. 10. For producing electricity, the energy from flowing water is preferred to energy obtained by burning coke. State two reasons for it.

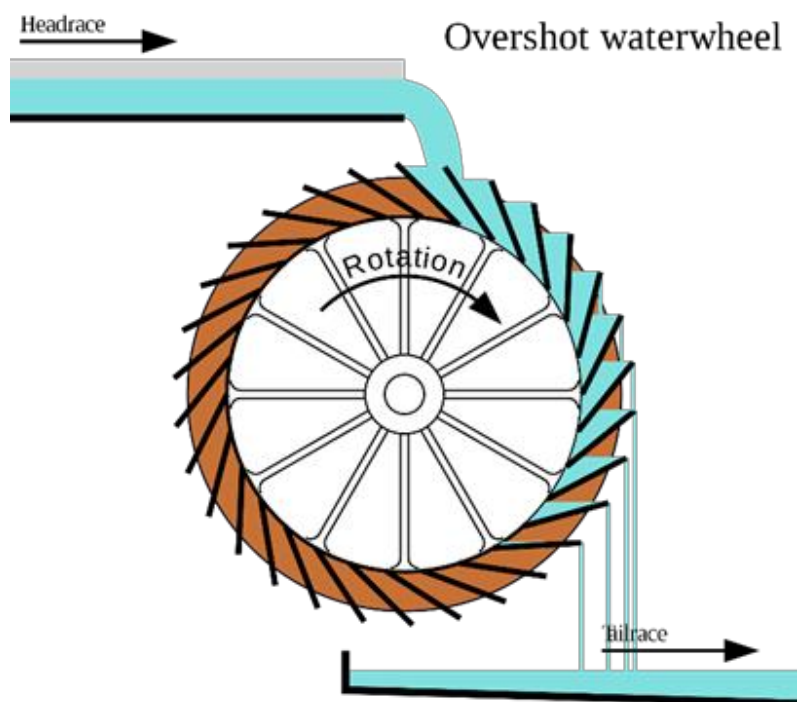
Answer: In case of hydro power plant, flowing water causes the turbines to rotate and the water can be refilled due to rains and hence Hydro energy is considered to renewable source of energy. Moreover, hydro energy does not release any kind of environmental pollutants.

Coke, on the other hand, belongs to the category of non-renewable sources of energy and also leads to the evolution of gaseous pollutants.

Q. 11. Give a few examples of how our ancestors used the energy possessed by the wind and water.

Answer: In older days the energy of the wind was used for sailing purposes on a large scale as the wind used to drive the boat or raft in the direction of wind.

Water was used in water wheels which were used to grind the wheat into flour and also the water steam used in steam engine.



Q. 12. Out of two solar cookers, one was covered by a plane glass slab and the other was left open. Which of the two solar cookers will be more efficient and why?

Answer: Solar cooker is used to cook food with help of sunlight. The sunlight when it shines on the solar cooker the food inside gets cooked due to the absorbed heat from sun rays.

To avoid the escaping of the heat from the solar cooker, solar cooker is covered with glass as sunlight can pass through glass effectively but the heat inside the cooker will not be radiated out.

Hence the solar cooker covered by a plane glass slab will be more efficient as compared to the uncovered one.

Q. 13. People living on hills often get sunburns on their skin. Which component of sunlight is responsible for this effect? Why is this effect generally not observed near sea level?

Answer: People living in the hilly areas are exposed to the strong rays of the sun because of which they get sunburns. Sunburns are normally caused due to the ultraviolet rays present in the sunlight which has the intense heating effect causing the skin to get reddened.

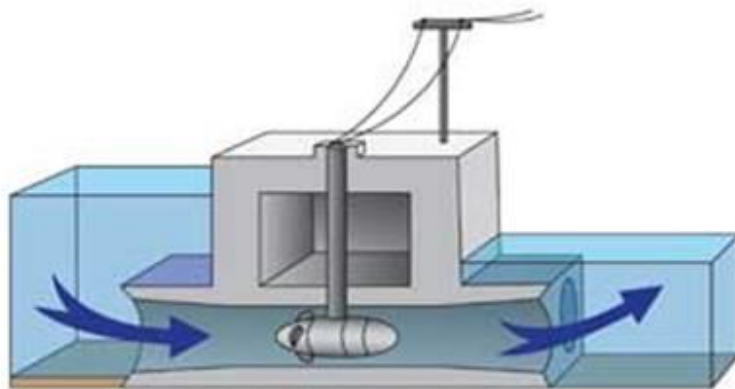
This effect is not generally observed near the sea regions because the sun rays are not that strong near the sea surface in technical terms the intensity of sun rays is less at sea level.

Q. 14. A certain form of energy which is not sourced directly or indirectly from the sun and does not cause any pollution is very easily converted into electricity. This form of energy is however, not available everywhere. Moreover, it is technically very difficult and expensive to obtain it. Name the form of energy.

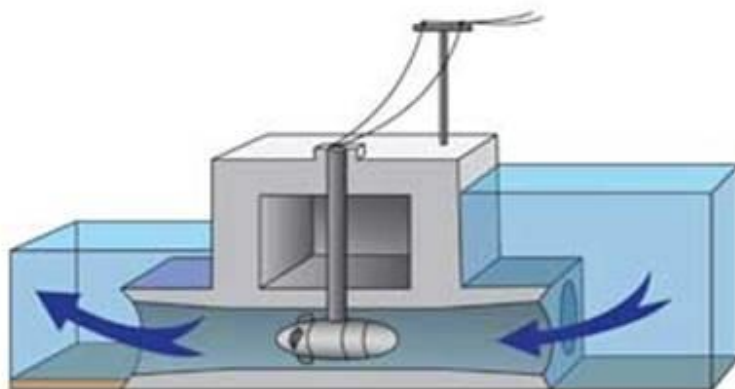
Answer: Since the given source of energy is not sourced directly or indirectly from the sun, chances of solar energy are eliminated.

Since the energy is pollution free and at the same time technically difficult and also costly which implies that the energy is tidal energy.

Tidal energy is not available everywhere and also the initial cost for tidal energy is very high as compared to other forms of energy. Tidal energy is difficult to construct and it is also pollution free.



Tide Coming In



Tide Going Out

Q. 15. Why any source of energy has less consequence? Explain your answer with suitable example.

Answer: Any source of energy whether renewable or non-renewable source of energy contributes to environmental pollution directly or indirectly.

Let us take the example of hydro energy. Hydro energy does not emit any air pollutant but it harms environment in the following ways:

The negative impacts of hydro power plant on ecosystem are as follows:

1. Since dams always have a reservoir where abundant quantity of water is stored, the blocking of flowing water causes harm to aquatic animals and their migration.
2. Dams also cause submerging of the nearby lands and all the natural areas, agricultural lands and hence requires relocating of the people who lived previously near the dam area.

In case of wind energy the windmill blades are injurious to the birds.

Q. 16. What is the cause of release of unusually large energies in nuclear fission reactions? How is the energy per fission calculated?

Answer: During the nuclear fission process a heavy nucleus splits to form particles. As we know that the subatomic particles are held together by strong nuclear forces and when the particle breaks it releases a tremendous amount of energy. The energy released during the fission reaction is calculated by using the famous relation:

$$E = mc^2$$

Where:

E = Energy released

m = mass defect = Total Mass before the reaction – Total mass after the reaction

c = speed of light

Q. 17. The solar constant at a place is 1.4 kW/m². How much will solar energy be received at this place per second over an area of 5 m²?

Answer: Given:

Solar Constant = 1.4 kW/m²

Solution:

Solar energy received at area of 1 m² = 1.4 kW/m²

So the energy received at an area of 5m² = 5 × 1.4

= 7 kW/m²

Q. 18. What is the basic cause for winds to blow? Name a part of India, where wind energy is commercially harnessed. Compare wind power and power of water flow in respect of generating mechanical and electrical energies. What is the hindrance in developing them?

Answer: As in physics we know that electric current flow from higher potential to lower potential due to potential difference.

In a similar manner in nature there exists pressure difference between two locations or areas which causes the wind to flow.

A wind is air in motion and so the wind flows from area of high pressure to area of low pressure.

Wind energy is harnessed in following states of Tamil Nadu, Gujarat, Maharashtra, Karnataka, Kerala etc. A wind farm is also located at Kanyakumari which is the farthest point of Indian mainland.

Wind Energy	Hydro Energy
1. Wind Energy is harnessed due to the moving causing the turbines to rotate.	Hydro Energy is harnessed by flowing water causing the propellers to move.

The major hindrances in development of these energy sources are as follows:

1. Environmental degradation of the area.
2. Availability of areas where the moving wind or flowing water is available.
3. Transportation of equipment to the selected area.
4. Heavy initial investment.

Q. 19. A certain form of energy is available due to the difference in the temperature of water at the surface of the ocean and its deeper levels.

(i) Name the form of energy.

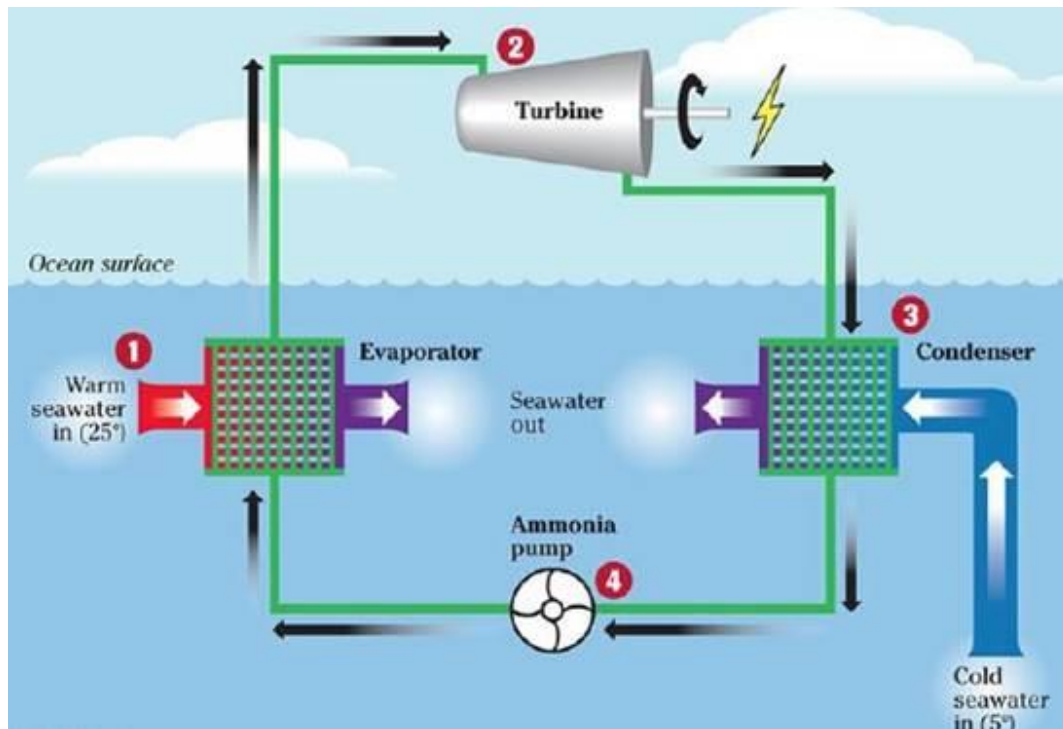
(ii) Is this energy ultimately derived from the sun or not?

(iii) Explain, how this form of energy can be converted into electricity?

Answer: (i) Ocean thermal energy due to difference in water's temperature at surface and deep inside the water.

(ii) This form of energy is ultimately derived from sun because it is the sun rays which are causing the upper surface of the ocean to heat up and cause the temperature difference.

(iii) The warm water of the surface is used to boil a volatile liquid like ammonia and the vapors of the liquid cause the turbine to rotate and the cold water the lower levels are used to condense this gas to turn it to liquid and the process continues.



Q. 20. Nikhil and Neha went to a remote village in Kerala to meet their grandmother. They were surprised to see bio-gas plant in Mr. Nair's house in the neighborhood. There was plenty of livestock and the house hold use cooking gas from the plant. Also, their farm had rich vegetation. They contacted sarpanch of the village and convinced him to set up a bio-gas plant for village community.

(i) Mention the values displayed by Mr. Nair, Nikhil and Neha.

(ii) Explain the possible arguments given by Nikhil and Neha to the sarpanch to convince him to set up a bio-gas plant.

Answer: (i) The values displayed by Mr. Nair, Nikhil and Neha are as follows:

1. Energy from renewable source of energy
2. Energy production does not contribute to pollution.

They all possess high degree of general awareness, helping nature and at the same they are nature conserver.

(ii) The possible arguments are as follows:

1. Economic and cheaper way to generate fuel
2. Use of your own organic and agricultural waste to generate fuel.

3. Efficient burning of biogas as compared to other fuels.
4. The slurry from biogas plant can be used as fertilizer for the fields.
5. Burning biogas does not pollute environment and also leaves no ash.

Q. 21. Hemant visited his neighboring village, where a bio-gas plant has been installed recently. He was surprised to see the working of the bio-gas plant. He told his village elders about the advantages of setting up a bio-gas plant in their village. Now. Answer the following question:

- (i) What are the advantages of a biogas plant?
- (ii) Why is a bio-gas plant commonly called as gobar gas plant?
- (iii) Why were the villagers are very much impressed with Hemant?

Answer: (i) Biogas is an excellent fuel for cooking purposes and it also contains 75% of methane because of which biogas burns without giving any kind of smoke and also do not leave any residue after being heated.

Since biogas also uses wastewater, it removes the oxygen-demanding pathogens present in the waste thereby preventing the pollution of water bodies.

Biogas plants contain the residue after all the organic matter is converted to gas. This residue is rich in phosphorous and nitrogen which are the two main nutrients for plants. Hence this residue can be used as an organic fertilizer for plants.

Biogas is a cheaper and economic way for villagers to obtain cooking fuel.

(ii) Bio gas is the gas formed in the biogas plant due to anaerobic oxidation of organic material. But the majority or the starting material for the biogas plant in India is the cow dung which is known as “gobar” in Hindi Language and hence the gas formed in the biogas plant is termed as the “gobar gas”

(iii) The villagers were very much impressed because of following reasons:

1. For generation of biogas the raw material is all the organic and agricultural waste which is readily available in their homes.
2. The slurry from biogas plant can be used as fertilizer for the fields as it is rich in phosphorous and nitrogen.
3. Efficient burning of biogas as compared to other fuels.

Challengers

Q. 1. When the material P mined from the earth is heated strongly in an insufficient supply of air, it produces a solid fuel Q which mainly consist of carbon. When another material R obtained from trees is heated in an insufficient supply of air, it produces another solid fuel S which also consists mainly of carbon. Then, which of the following is true?

- A. P-coke**
- B. Q-coal**
- C. R-charcoal**
- D. None of the above**

Answer: The material mined from earth and when heated strongly in an insufficient supply of air gives a solid fuel which is rich in carbon indicates that the material P is also very rich in carbon and hence the material has to be coal because coal is mined from earth and on incomplete combustion it gives a solid fuel.

The solid fuel Q is coke.

R obtained from trees which signify that wood is the only tree part which when heated in insufficient supply of oxygen gives a carbon-rich compound.

S obtained on burning wood is charcoal.

But none of the options match with our answers.

So correct answer is D.

Q. 2. 100 W/m^2 of solar energy is received by the Earth. If all the energy was to be absorbed by a bucket of water (mass 30 kg) in 30 minutes, then the rise in temperature of water will be

- A. 18°C**
- B. 15°C**
- C. 1.43°C**
- D. 12.3°C**

Answer: Given:

Power = 100 W/m^2

Mass of water = 30 kg

Time = 30 minutes

Specific Heat of Water = $4200 \text{ J/kg } ^\circ\text{C}$

Solution:

Heat Generated = Mass $\times$ Specific Heat $\times$ Temperature Rise.

Heat Generated = Power $\times$ time

Mass $\times$ Specific Heat $\times$ Temperature Rise = Power $\times$ time

$$\text{Temperature Rise} = \frac{\text{Power} \times \text{time}}{\text{Mass} \times \text{Specific Heat}}$$

$$\text{Temperature Rise} = \frac{100 \times 30 \times 60}{30 \times 4200}$$

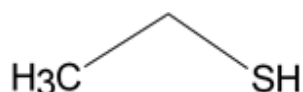
Temperature Rise = 1.43 °C

So correct answer is C.

Q. 3. While filling LPG in cylinders, a substance X is added to make the detection of leakage of LPG from the cylinder easy. The substance X is

- A. ethanol
- B. ethanethiol
- C. methanethiol
- D. methanol

Answer: Ethanethiol is added to LPG in cylinders so that the leak of the LPG gas from the cylinders becomes noticeable quickly as ethanethiol has very foul smell. The structure is as follows:



So the correct answer is B.

Q. 4. For a nuclear reactor, 48 kJ of energy is produced per minute. If the energy released per fission is 3.2×10^{-11} J, then the number of fission which would be taking place in a reactor per second is

- A. 5×10^{14}
- B. 2×10^{14}
- C. 52×10^{13}
- D. 2.5×10^{13}

Answer: Given:

Total energy released per minute = 48 kJ

$$= 48 \times 10^3 \text{ J}$$

$$\text{Energy produced per second} = \frac{(48 \times 10^3)}{60}$$

$$= 0.8 \times 10^3 \text{ J}$$

$$\text{Energy release per fission} = 3.2 \times 10^{-11} \text{ J}$$

$$\begin{aligned} \text{Solution} \quad \text{Number of fission per second} &= \frac{[\text{Energy produced per second}]}{[\text{energy released per fission}]} \\ &= \frac{[0.8 \times 10^3]}{[3.2 \times 10^{-11}]} \end{aligned}$$

$$= 2.5 \times 10^{13}$$

Therefore number of fission per second is 2.5×10^{13} .

So the correct answer is D.

Q. 5. The mass number of four different elements A, B, C and D are 2, 35, 135 and 239, respectively. Which of them would provide the most suitable the most suitable for nuclear fission?

- A. A
- B. B
- C. C
- D. D

Answer: Elements with greater mass number indicate that their nucleus is highly unstable and when such nucleus is bombarded with a moving particle, it splits the nucleus easily.

So the correct answer is D.

Our Environment

Check Point 01

Q. 1. When do we consider a given substance as waste?

Answer: Waste is something unwanted or unusable material. It is any material which is no longer useful as it has served its purpose or at the end of the process has no further use and it is generally discarded. For example, Garbage that we daily produce in our home. Food that we eat goes into our body. It is then acted upon by various specific enzymes which are needed for the breakdown of these large food molecules into simpler small molecules which provide energy. Materials like plastic which cannot be broken down by bacteria's or enzymes are non-biodegradable (cause threat to human health). Hence these products are also called waste. For example polythene bags, metal scarps.

Q. 2. In what way can biodegradable substances be used by farmers?

Answer: Biodegradable wastes are those substances that can be broken down by biological processes (like by enzyme or bacterial action). For Examples: cattle dung, cotton, jute, paper, fruit and vegetable peels, leaves etc.

They can be used by farmers in various ways:

- a) Cattle dung is used as natural fertilizers for crops and plants. It is also cost-free.
- b) Jute can be used to prepare bags for storing grains.
- c) Vegetable peels can be used as food for cattle's. Etc.

Q. 3. Besides natural degradation by microbes, what are the other ways to dispose of biodegradable wastes?

Answer: These biodegradable wastes are animal or plant matter that breaks down naturally with exposure to microorganisms, heat, and oxygen. There are other ways also for their decomposition:

- a) Collect all the material and burn it in a pit.
- b) React it with some strong acid. But both these ways are not good for nature.
- c) Recycling them into a usable material which is called composting. It is done in a sealed container (no presence of air). It will get converted into humus-like material which is a good fertilizer for plants. This step is eco-friendly.

Q. 4. Why is plastic bag called non-biodegradable while the paper is not?

Answer: Plastic bag cannot be broken down by microorganisms. It will remain in the environment for many years. Paper is a biodegradable material is made from other natural products like fruits, plants etc. Hence paper can be degraded naturally by the action of microorganisms in a few months.

Q. 5. What is the most characteristic feature of non-biodegradable wastes?

Answer: The most important characteristic features of these indecomposable products is that they are formed from non-organic matter.

It is the material not derived from living matter. And hence will pose a threat to eco-system.

Q. 6. Write any one effect of non-biodegradable substances.

Answer: These non-organic matters can prolong exist in the environment without getting broken down by biological processes and will cause harm to the environment.

For example Various plastic bags, if any of them is eaten by an animal then it can choke its digestive system. These materials can only be digested by specific enzymes, but they are not present in the animal's body. Hence it will lead to the death of that animal.

Check Point 02

Q. 1. From the list given below, choose an artificial ecosystem. Pond, crop field, lake, forest.

Answer: A community made up of both living and nonliving organisms forms an ecosystem. The type of ecosystem which is made by human beings is called as artificial ecosystem. Among the above mentioned - Pond and crop fields are manmade ecosystem.

Q. 2. In what way, the biotic components of an ecosystem are different from abiotic components?

Answer:

	Biotic components	Abiotic Components
Are they living things?	YES	NO
Examples	Animals, plants, fungi, bacteria – all living things	Forest fires, water, climate, habitat, soil, minerals
Main categories	Producers, consumers, decomposers	Atmosphere, chemical elements, sunlight/ temperature, wind and water
Main types	Living things	Chemical and physical things

Q. 3. Producers are also referred to as the autotrophs. Why?

Answer: Organisms which can produce their own food like sugar and starch from inorganic substances using photosynthesis in the presence of chlorophyll are called producers. And an autotroph is also an organism that can produce its own food using light, water, carbon dioxide, or other chemicals.

Green plants, algae, and certain bacteria are example of autotrophs that are producers.

Q. 4. Why herbivores also known as first order consumers?

Answer: Organisms which take their food prepared by plants and plants products are called herbivores. These are the organisms that cannot make their own food. So they depend directly on green plants for food and then are referred to as first or primary order consumers. Herbivorous animals like elephant, camel, cow, buffalo, deer, sheep, goat, rabbit etc. are the first order consumers.

Q. 5. Zebra, jackals, lions, goat, horse, wolves and sheep. Identify the first order consumers from those given above. Give a reason to support your answer.

Answer: Zebra, goat, horses and sheep are all those organisms which eat producers (green plants) for energy and hence are herbivores. They all cannot make food by themselves hence; they feed on plants which can make food for themselves.

Q. 6. Based on their feeding habits, differentiate parasites from decomposers.

Answer: Parasites have heterotrophic mode of nutrition where a parasitic organism lives on the body surface or inside the body of another type of organism (a host) and gets nutrition directly from the body of the host. For Example: Plasmodium, Lice, tape worm, round worm etc. And decomposers are organisms that get energy by decaying or breaking down chemically the remains of dead organisms. When an organism dies,

decomposers decay the body extracting the last bit of energy from it. For example: fungi and bacteria.

Check Point 03

Q. 1. In three words, describe the relationship of organisms working in a food chain.

Answer: The relationship of organisms working in a food chain can be described as “FLOW OF ENERGY”. It is from producers to consumers to decomposers. Each group depends on each other for food and energy.

They will not be able to survive if one group were removed. In general, the flow of energy in an ecosystem starts with sunlight (the ultimate source of all energy on Earth) which is absorbed by the producers, goes to the consumers, then to the decomposers, and back to the producers to start all over again.

Q. 2. Identify the members present at the bottom and top of a terrestrial food chain.

Answer: Terrestrial food chain shows a relationship between plants and animals found on deserts, grasslands, and forests.

The energy pyramid has a large base and becomes smaller at the top.

At the bottom or the first level are the producers. Here, the energy and the number of organisms are very high. For each level or feeding stage, the energy and number of organisms decrease so the pyramid becomes smaller at the top. And at the top are carnivores like a tiger, eagle, etc.

Q. 3. Consider a food chain of the following: Fish, crab, phytoplankton, shark. Arrange the above chain in the proper order of trophic level.

Answer:

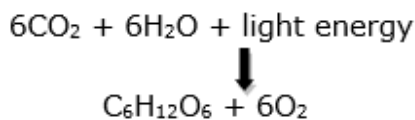


This trophic level is a depiction of the pond ecosystem.

- The first level is represented by the producers or the autotrophs; for example, phytoplankton and plants. They prepare their own food with the help of energy from sunlight through the process of photosynthesis.
- The second trophic level is characterized by the presence of primary consumers such as crabs inhabiting the pond. Organisms in this level consume the phytoplanktons or producers.
- The third level comprises of the omnivores, especially the fish species, which can feed on both plants.
- The fourth and the top most level is for carnivores or tertiary consumers which are flesh eaters.

Q. 4. What percentage of solar radiation is absorbed by green plants for photosynthesis?

Answer: Between 98 and 99 percent of solar energy reaching the Earth is reflected from leaves and other surfaces and absorbed by other molecules, which convert it to heat. Green plants capture about 1 % of the solar energy using chlorophyll in their leaves. Photosynthesis is the chemical process by which producers capture light energy from the sun and use it to combine water with air to form sugar or food. The chemical equation is:



[carbon dioxide + water + sunlight yields sugar (food) and oxygen]

Q. 5. In which form is the 10% energy available for transfer?

Answer: It is transferred in the form of chemical energy. The producers capture the energy present in sunlight and convert it into chemical energy which is passed into onto other trophic levels. This means that when primary consumers eat plants they are able to turn up only 10% of food for their own body and the rest is lost in the form of heat. And this 10% of nutrients only are available for the next level of consumers.

Q. 6. Fertilizers and other chemicals used in agriculture are harmful to us. Give reason.

Answer: Farmers use various fertilizers and pesticides (chemicals) to protect their crops and plants from diseases. These chemicals are absorbed by the plants along with water and minerals from the soil and are taken by aquatic plants and animals as well.

And since these chemicals are non-biodegradable, they will remain in the food chain. Humans are the final consumers of every food chain hence, all of this chemical gets in their body when they feed on organisms or plants of the lower trophic level. In this way, these fertilizers can cause harm to us.

Q. 7. Identify the organisms from the following food chain which will respectively have a maximum and minimum concentration of chemicals in its body? Peacock, frog, snake, grasshopper.

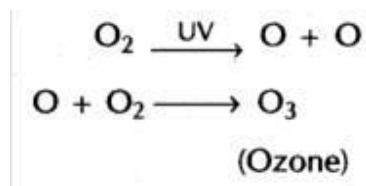
Answer: Grasshopper will have the minimum and peacock will have the maximum concentration of chemicals in their body.

Explanation: Among all the animals mentioned here, the grasshopper is the primary consumer which will eat plants having chemicals so they are the first one to feed on them. The chemicals inside the grasshoppers will start damaging his whole body and as the food chain proceeds grasshopper will be eaten by frog, which will be eaten by a snake. And by this time the snake's body will also get damaged from inside with chemicals as they cannot be degraded. Hence when peacock will feed on the snake, he will have the maximum concentration of chemicals inside its body.

Check Point 04

Q. 1. Ozone present in the atmosphere is very important for sustenance of life on earth. Justify.

Answer: When UV radiations from the sun reach the earth's atmosphere which is heavily rich in oxygen. Then these UV rays split molecular oxygen (O_2) into free oxygen (O). Afterward, this free oxygen reacts with molecular oxygen; it forms ozone (O_3).



This ozone now protects the earth from harmful UV radiations of the sun, by allowing only some percent of rays to fall on the earth's surface. Ozone acts as a filter of sun rays. These rays can cause skin cancer in human and can also affect other living organisms.

Q. 2. The ultraviolet radiations are damaging to living components of the environment. Give a reason.

Answer: When UV (ultraviolet) radiations from the sun reach earth's atmosphere which is heavily rich in oxygen. These high energy UV rays split molecular oxygen (O_2) into free oxygen (O). Afterward, this free oxygen reacts with molecular oxygen; it forms ozone (O_3).

These harmful UV radiations of the sun, can cause skin cancer in human and can cause many health hazards like skin cancer, cataract, destruction of plants, etc.

Q. 3. Efforts are being made for substituting the chemicals like CFCs. Why?

Answer: CFCs are chlorofluorocarbons are the synthetic chemicals which are made by humans artificially, that means they are not the natural products. Excessive use of these CFCs in refrigerators, ACs, fire-extinguishers, etc. causes the depletion of ozone layer. Because then UV radiations will reach the earth's surface destructing the survival of plants and organisms.

Q. 4. Name the process in which wastes are burned at high temperature.

Answer: Waste Combustion is the process of burning waste at very high temperatures. It is the simplest and earliest form of waste disposal. But this method leads to the release of highly toxic chemicals in the environment which is harmful to the organisms.

Q. 5. Untreated sewage being disposed of in waste bodies to lead to water pollution. Suggest the practices that can be included for better disposal of sewage waste.

Answer: All this untreated sewage can be processed in Sewage treatment plants. In this, undesirable substances are removed from waste water by various physical, chemical and biological pathways. It produces semisolid waste which is nothing but manure. This product is more eco-friendly and biodegradable. This won't cause any problem with live organisms.

Q. 6. What can best method be used for the safe disposal of hospital wastes?

Answer: Hospital waste comprises of those biological substances that pose a threat to living organisms. They can spread infections to the living if left untreated or just thrown in normal dustbins. Hence the best method for their complete removal will be combustion. Burning at a very high temperature kills all the bacteria and microorganisms which can spread the disease.

Chapter Exercise

Q. 1. Can biodegradable wastes be harmful?

Answer: Yes, sometimes biodegradable waste can be harmful also.

Because when these materials are decomposed with the help of microorganisms, then there is a release of powerful green house gases. These greenhouse gases when reacting with high energy UV radiations in the atmosphere leads to the depletion of the ozone layer. This will harm the various members of the eco-system.

Q. 2. Which biological factor is responsible for poor vegetation in deserts?

Answer: In deserts, there is little water available for plants and other organisms. Because of which desert soils are dry, and tend to have poor vegetation (plants found in a particular area). Hence lack of water/water scarcity due to low rainfall is responsible for poor vegetation in deserts (less growth of plants in the desert).

Q. 3. Which group of organisms converts organic materials into inorganic forms?

Answer: The breakdown of organic matter and their conversion into basic inorganic forms is called mineralization.

Decomposers are the organisms (e.g., bacteria, fungi, crabs) that breakdown organic constituents (e.g., plant material) to release carbon and other nutrients such as nitrogen (N) and phosphorus (P) as inorganic form.

When an organism dies, decomposers decay or breakdown his body chemically and extract the last bit of energy from it.

Q. 4. Are plants actually producers of energy?

Answer: Yes, plants are the producers of energy. This is the energy absorbed by the plant from sunlight for photosynthesis. Afterwards this energy is transferred to other organisms by the food chain.

For example: Plant → Goat → Lion.

Energy cannot be transferred back to producers because plants cannot eat animals like goat, insects, etc and without eating the energy cannot be transferred.

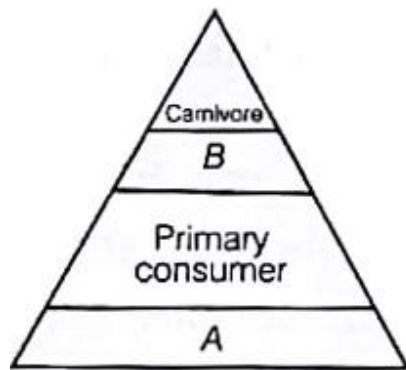
Q. 5. What do we call the various steps involved in the food chain?

Answer: A food chain is a series of organisms which eat one another. And in this food chain at each level specific type of organisms occupy the same level. Hence, the trophic level is the position of a group of organisms in a food chain. It refers to the mode of nutrition at every different trophic level.

For example Plants (producers) get their nutrition from sunlight and prepare their own food. Then comes the consumers (herbivores) they cannot prepare their own food hence get their nutrition by feeding on plants. Then comes the secondary or tertiary

consumers (carnivores) they get energy by eating other animals. They all get the nutrition from the organisms of lower trophic levels.

Q. 6. Identify A and B in the given figure.



Answer: A are the producers called plants and B are the secondary consumers which are called omnivores.

Plants make their own food with the help of sunlight through the process of photosynthesis and hence are called the producers. They are placed at first trophic level. Secondary consumers are the organisms that can feed both on plants and animals. They come in between primary consumers (herbivores-the plant feeders) and the tertiary consumers (carnivores-the flesh eaters.)

Q. 7. A food chain represents a unidirectional flow of X. What is X?

Answer: A food chain always represents a unidirectional flow of energy from one trophic level to another. As a food chain proceeds from autotrophs to heterotrophs to decomposers energy gets transferred. The flow of energy in an ecosystem starts with sunlight (the ultimate source of all energy on Earth) which is absorbed by the producers, goes to the consumers, then to the decomposers, and back to the producers to start all over again.

Q. 8. Why is straight line food chain not common in the natural ecosystem?

Answer: It is not common in a natural ecosystem, because during energy transfer from one trophic level to another most of the energy is lost in the form of heat. Hence in a natural ecosystem, we cannot see any energy transfer without a loss.

(This will be observed $1000 \rightarrow 100 \rightarrow 10$, instead of $1000 \rightarrow 1000 \rightarrow 1000$)

Q. 9. How many trophic levels does a food chain normally have?

Answer: A food chain normally has three trophic levels. The primary producer, plants who will obtain nutrition from sunlight and prepare food for itself and for the

second trophic level organism. The secondary consumers, herbivores that will eat plants, and at last will be the tertiary consumers called carnivores, the flesh eaters. They will feed on secondary consumers.

Q. 10. Which trophic level has a maximum number of organisms?

Answer: The bottom most trophic level has the maximum number of organisms because there have to be more food producers than consumers, to sustain life on earth. Suppose if 10 producers (plants) are there and 15 animals then 5 animals will be left hungry and will die and the eaten plants will also be not able to produce food so the remaining 10 animals will die.

Q. 11. How is being a vegetarian advantageous in terms of energy?

Answer: Being a vegetarian will increase the amount of energy taken up by your body. As we know that energy decreases at each successive trophic level. It is least available for the last trophic level. Humans are the final (tertiary) consumers of any food chain; hence if they skip the primary and secondary consumers and directly feed on plants, then they can have the more amount of energy comparative to the energy if they don't skip.

Q. 12. State one reason to justify the position of a man at the apex of most food chains.

Answer: The position of the man is at the apex of most of the food chain because in a food chain the top position is mostly taken by carnivorous animals and in a normal food chain herbivores are the producers, some small organisms are the second consumers and some much larger animals are the third consumers but we come at the last. Humans can consume almost all the animals, also they are the most intelligent organisms so they can change their position by manipulation.

Q. 13. What term is given to the phenomenon where a harmful chemical enters a food chain and starts accumulating?

Answer: The increase in the concentration of harmful chemicals (pesticides) in the body of a living organism at each trophic level of a food chain is called biological magnification. Its level will increase as we move from bottom to top of a food chain. For example, when pesticides are sprayed they enter the food chain through producers while they are absorbing nutrients from the soil. Since herbivores eat many types of plants, therefore their body will accumulate more amounts of pesticides. Similarly, carnivores will feed on more than one herbivore; hence it will have much more amount of pesticide in it.

Q. 14. Name the radiations absorbed by the ozone layer?

Answer: Ozone layer absorbs the harmful Ultraviolet (UV) radiations from sunlight. Then these UV rays split molecular oxygen (O₂) into free oxygen (O), thus keeping the UV radiation from reaching the surface of the Earth.

Q. 15. Does change in lifestyle add waste to the environment?

Answer: No, change in lifestyle does not add waste to the environment. It helps to reduce the amount of waste. The use of eco-friendly products and recyclable materials will lessen the waste produced. Less use of chemical producing products, as people are becoming more aware of the consequences of disturbing the balance of nature.

Q. 16. Name the process by which volume of solid wastes can be reduced.

Answer: The best way to reduce the volume of solid waste is by burning waste at very high temperatures. It is the simplest and earliest form of waste disposal. But this method leads to the release of highly toxic chemicals in the environment which is harmful for the organisms.

Q. 17. Give the difference between paper and glass as a waste product.

Answer:

PAPER	GLASS
It is a biodegradable product.	It is non-biodegradable.
It can be recycled in very less time.	It is hard to recycle.
It does not harm the environment.	It can cause harm to the environment.

Q. 18. List a few practices that lead to the production of non-biodegradable waste.

Answer: When we dispose of them in a garbage pile, the air, moisture, climate, or soil cannot break them down naturally to be dissolved with the surrounding land. They are not biodegradable.

Some practices are:

- Throwing of plastic water bottles and plastic bags.
- Metal scraps improper disposal.
- Construction waste, rubber tires, man-made fibers like nylon etc.

- Useless computer hardware like glass, CDs, DVDs, cellophane, processed woods, cable wires, etc.

Q. 19. What -are the functions of an ecosystem?

Answer: Ecosystem is the interaction of living things with themselves and with the surrounding environment. It's functions in 4 main aspects:

1. Productivity- there should be a balance between the amount of food produced and consumed.
2. Decomposition- The dead and decay matter has to be decomposed successfully to replenish the environment with nutrients.
3. Energy flow- the transfer of energy from one trophic level to another has to follow 10% rule to sustain life.
4. The nutrient cycling-the connection of various components of the ecosystem should be proper to get back the depleted nutrients in the environment.

Q. 20. Why do all food chains start with plants?

Answer: Plants are the only living organism that can consume energy from sunlight to prepare food with the help of a process called photosynthesis. They are the primary producers of every ecosystem. And they are always the largest in number because there have to be more food producers than consumers, to sustain life on earth.

Q. 21. What do you call the organism which feeds on both plants and animals? What is the most likely position of this organism in the food chain?

Answer: The organisms that feed on both plants, as well as animals, are called omnivores. For example pigs, bears, mice, etc. Humans and chimpanzees are also omnivores.

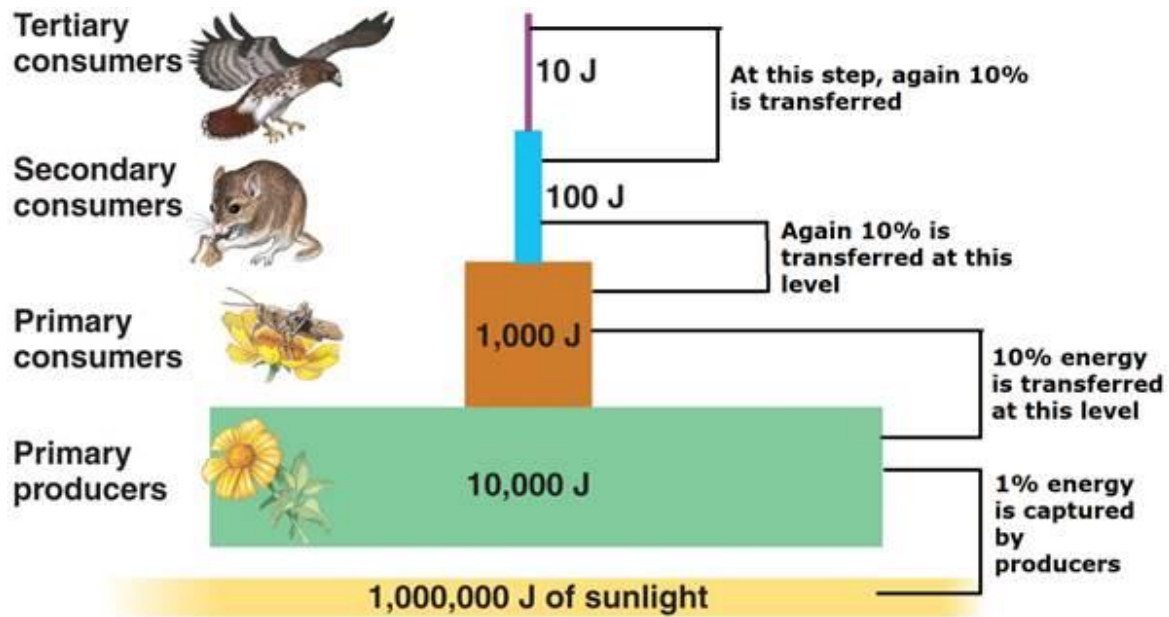
They will come to the third trophic level as they are secondary consumers. This means they will come above herbivores (primary consumers) that can eat only plants. And below carnivores (tertiary consumers) which feed only on flesh.

Q. 22. Explain the difference between the energy captured by producers and energy transferred to consumers.

Answer: A producer is an organism that captures energy and stores it in food as chemical energy. The producers of an ecosystem make energy available to all the other living parts of an ecosystem.

They capture 1% of energy from sunlight and use it to produce food. Then when consumers feed on plants the 10% rule of energy transfer is followed. In that, at each trophic level, about 10% of the energy of previous trophic level is passed to the next trophic level of food chain.

The diagram is shown below:



This is how energy transfer varies between sun to plants and then plants to various consumer levels.

Q. 23. Can an organism occupy position in more than one food chain? If so, give an example.

Answer: Yes, an organism can occupy position in more than one food chain. For example: If we consider plants which are the primary producers, their presence is necessary in all the food chains because they are the only organisms which can make their own food by photosynthesis. Because of plants only ecosystem is able to exist. If we compare forest food chain, grassland food chain, pond food chain, we will observe that plants occupy the first trophic level of all the three food chains.

Q. 24. Mention the effects of ozone layer depletion on human beings.

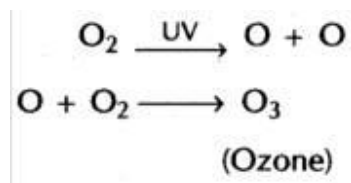
Answer: Ozone layer depletion increases the amount of UV rays that reaches the Earth's surface.

- Skin Cancer- it is estimated that skin cancer rates increased due to the decrease in stratospheric ozone (ozone layer). The most common type of skin cancer is the cause of exposures to UV radiation from sun.

- UV rays have been linked to the development of cataracts, a clouding of the eye's lens.

Q. 25.A. Ultraviolet radiation from sunlight causes a reaction involving O₂ as reactant. What does that produce?

Answer: When UV radiations from the sun reaches earth's atmosphere which is heavily rich in oxygen. Then these UV rays split molecular oxygen (O₂-reactant) into free oxygen (O-Product). Afterwards, this free oxygen reacts with molecular oxygen; it forms ozone (O₃-Finalproduct).



Q. 25.B. What does release of phosphates and nitrates in water bodies lead to?

Answer: Phosphates and nitrates are useful nutrients but when they become too concentrated in our water environments they can cause problems. The main sources of phosphates coming into water bodies are drainage from farmland (fertilizers, runoff from manure, etc.) and sewage effluent (which contains dishwasher detergents, food and drink additives). Nitrates are used in fertilizer, which help farmers to produce more crops which can mean lower food prices.

However, high phosphate and nitrate levels can cause eutrophication – an issue when there is too much nutrient in a water body (e.g. rivers and lakes). This can cause excessive growth of algae and other plants, which then affects water quality, damages plants and animals and stops us using the water. It can cause severe illness in infants and domestic animals.

Q. 26. Give two probable damages that are caused due to ozone layer depletion.

Answer: Effects of the depletion of the ozone layer:

1.1 On human health- Skin Cancer

Today, it is estimated that skin cancer rates increased due to the decrease in stratospheric ozone (ozone layer). The most common type of skin cancer is the cause of exposures to UV radiation from sun.

2. Effects on aquatic ecosystems

The loss of phytoplankton, the basis of the marine food chain, has been observed as the cause of the increase in ultraviolet radiation. For example: Under the ozone hole in

the Antarctic phytoplankton productivity decreased between 6 and 12 percent. That disturbs the ecosystem.

Q. 27. How do CFCs affect ozone layer?

Answer: CFCs are manmade chemicals called chlorofluorocarbons. These substances are found in refrigerators, ACs. Etc. Due to long life and their ability that they do not wash in the rain, so they rise up into the ozone layer above the earth, where they eventually breakdown by heavy exposure to ultraviolet (UV) radiations. When CFC is broken down, it releases chlorine and bromine atoms which can destroy various ozone molecules at once. They cause the ozone layer to breakdown faster than it can replace itself.

Q. 28. Disposal of waste should be done properly. Justify the statement.

Answer: It is because waste has to be disposed in such a manner that it doesn't cause any type of pollution. For example: When wastes are dumped into water bodies they pollute it and also affect the marine life. If it is buried in soil, it will cause depletion of the fertility of the soil and makes the land a waste land. Hence proper disposal of waste is important because:

- a) Garbage can be a source of diseases.
- b) It can be processed to recycle useful components. So, garbage should also be disposed at proper places.
- c) Some garbage contains plastic which can harm our environment. So they should be disposed after taking proper care.

Q. 29. (i) Why is use of disposable paper cups convenient over the use of disposable plastic cups?

(ii) How do biodegradable wastes not cause pollution?

Answer: (i) Disposable paper cups are more convenient over disposable plastic cups because:

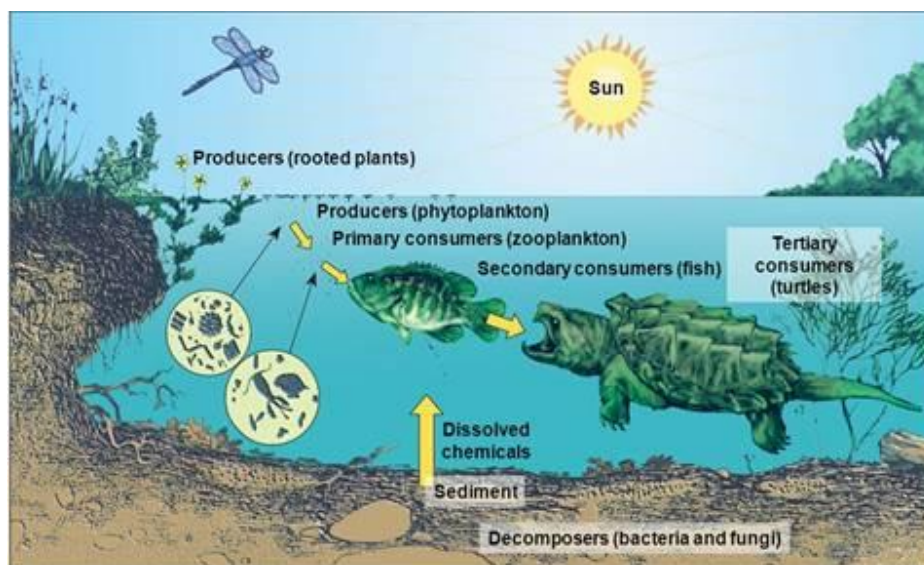
- a) Paper cups can decay naturally with the help of decomposers and become harmless after sometime, but plastic cups do not.
- b) They do not pollute the environment as they decay fast but plastic cups do pollute the environment because they are non-biodegradable.
- c) Plastic cups can cause health effect to the living organisms if consumed by chance. But paper cups are made from organic products, like plants.

(ii) Biodegradable wastes are decomposed by the micro-organisms. By the process of decomposition, mineral elements like C, N, O and P are cycled back into the biosphere. This is done in the form of manure, etc.

Q. 30. Draw a pond ecosystem showing its different components.

Answer: A pond ecosystem refers to fresh water ecosystem where there are communities of organism dependent on each other with the prevailing water environment for their nutrients and survival. Usually, ponds are shallow water bodies with a depth of 12-15 feet in which the sun rays can penetrate to the bottom promoting the growth of plants there. It is a natural ecosystem.

The following diagram shows a pond ecosystem.



There are two components in the pond ecosystem:

(a) Abiotic – It consists of water, dissolved minerals, oxygen and carbon dioxide. Sunlight is the main source of energy.

(b) Biotic – It includes phytoplanktons, aquatic insects, fishes, and microbes. These organisms are classified as producers, consumers, and decomposers. The energy flows from producer to consumers.

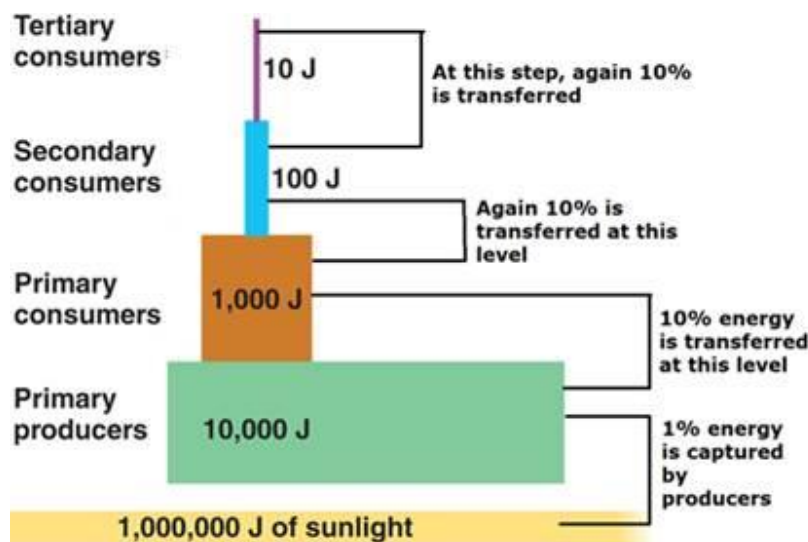
Q. 31. 'Man is only a consumer'. Justify the statement.

Answer: Man is an omnivore, that is, he can feed on both plants and animals. Thus, a man can be a primary consumer when he consumes plant products such as cereals, fruits and vegetables and he can be a secondary consumer when he consumes herbivores such as goat and sheep (in the form of their meat). Thus, a man can be placed at the second as well as the third trophic level of the food chain. Man cannot be

a producer because he cannot convert energy from sunlight, which is chemical energy conversion to food. Only plants have that function to prepare food through photosynthesis. Therefore man can only consume food and is known as a consumer.

Q. 32. How much energy will be available to hawks in the food chain comprising hawk, snake, paddy, and mice if 10,000 J of energy is available to paddy from the Sun?

Answer: Paddy (rice plants) represents the producer level. Paddy plants trap only 1% of the Sun's energy of 10,000J falling on them.



So, the energy available in paddy will be 1% of 10,000 J which will be 100 J. From plants (paddy), the amount of energy passed to the next trophic level is 10%. As we know paddy will be the producers, mice will be the primary consumer, and then the snake will be the secondary consumer and at last will be a hawk, the tertiary consumer. We can now write the food chain and apply ten percent law to it.

(Paddy 100 J) → (Mice 10 J) → (Snake 1 J) → (Hawk 0.1 J)

Thus, the energy available to the hawk in the food chain will be 0.1 J.

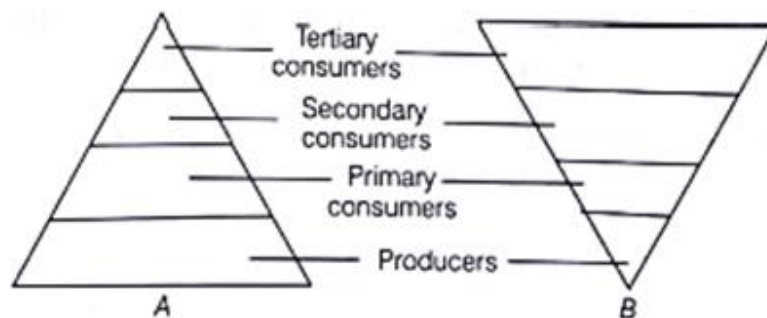
Q. 33. The number of trophic levels is limited to 3-4 in a food chain. Give reason.

Answer: The number of trophic levels in an ecosystem is limited and is not more than 3-4. Because the amount of energy flow decreases with successive trophic level, as only 10% of energy is transferred from one trophic level to the next trophic level.

Explanation: At each trophic level in a food chain, a large portion of the energy is utilized for the maintenance of organisms which occur at that trophic level and lost as heat. As a result of this, organisms in each trophic level pass on less and less energy to

the next trophic levels, than they receive. The longer the food chain, the less is the energy available to the final member of the food chain. Food chains generally consist of three or four steps (three or four organisms) because after that the energy available for the next organism will be so small that it will be insufficient to sustain the life of that organism. There are, however, some food chains containing five steps (or five organisms) but there are rarely more than five steps (or five organisms) in a food chain.

Q. 34. Look at the following figures. Choose the correct one and give a reason for your choice.



Answer: Correct representation of trophic levels in a food chain is shown in figure A.

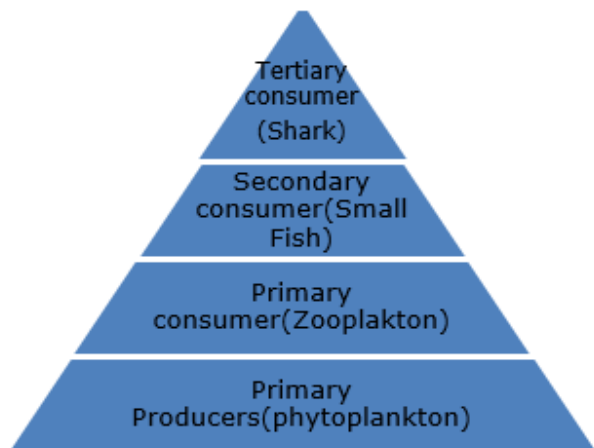
The population will decrease as we move from bottom to top of a food chain. The producers will be the highest in number in a food chain because there have to be more food producers than consumers, to sustain life on earth. The top position is mostly taken by carnivorous animals (tertiary consumers), omnivores being the secondary consumers and herbivores being the primary consumers.

A food chain always represents a unidirectional flow of energy from one trophic level to another. Each level in the pyramid represents our level in the food chain. Each level of consumers above the producers has fewer individuals because there is less energy available.

Q. 35. Make an aquatic food chain up to the tertiary consumer level. State the trophic level at which concentration of pesticide is maximum and why?

Answer: An aquatic food chain can go as

Phytoplankton (primary producers) $\Rightarrow$ Zooplankton (primary consumer) $\Rightarrow$ Small fish (secondary consumer) $\Rightarrow$ Large fish (sharks etc, tertiary consumer)



Pesticides are not degradable and progressively accumulated at each trophic level.

Pesticides are used by farmers to protect their crops. These chemicals are absorbed by the plants along with water and minerals from the soil and are taken by aquatic plants and animals as well.

And since these chemicals are non-biodegradable, they will remain in the food chain. Tertiary are the final consumers of this food chain hence, all of this chemical gets in their body when they feed on organisms or plants of the lower trophic level. Its level will increase as we move from bottom to top of a food chain. In this way, these pesticides can cause harm to us. Hence they will be maximum in a tertiary aquatic organism like large fishes.

Q. 36. Why are bacteria and fungi called decomposers? List advantages of decomposers to the environment.

Answer: Bacteria and fungi are called decomposers because they decompose complex molecules into soluble organic molecules which are absorbed in the soil which will be later used by the plants again to fulfill its nutrient requirement. OR

Because bacteria and fungi break down the dead and decaying organic matter into simpler substances and provide the nutrients back to the soil. When an organism dies, decomposers decay the body extracting the last bit of energy from it. The common left over materials such as water, carbon dioxide, and minerals can then be reused by producers to make sugar through photosynthesis.

The advantages of decomposers are

1. They keep the environment clean by decomposing the dead animals.
2. It prevents the spread of diseases caused by dead bodies of plants and animals like bird flu.

3. They help in making humus.
4. They act as natural scavengers.
5. They help in the recycling of nutrients.

Q. 37. How is Earth kept warm by nature? Describe in detail.

Answer: First, sunlight shines onto the Earth's surface, where it is absorbed and then radiates back into the atmosphere as heat. In the atmosphere, "greenhouse" gases trap some of this heat, and the rest escapes into space. The more greenhouse gases are in the atmosphere, the more heat gets trapped.

Explanation: A greenhouse is a house made of glass. It has glass walls and a glass roof. People grow tomatoes and flowers and other plants in them. A greenhouse stays warm inside, even during winter. Sunlight shines in and warms the plants and air inside. But the heat is trapped by the glass and can't escape. So during the daylight hours, it gets warmer and warmer inside a greenhouse and stays pretty warm at night too.

Similarly, Earth's atmosphere does the same thing as the greenhouse. Gases in the atmosphere such as carbon dioxide do what the roof of a greenhouse does. During the day, the Sun shines through the atmosphere. Earth's surface warms up in the sunlight. At night, Earth's surface cools, releasing the heat back into the air. But some of the heat is trapped by the greenhouse gases in the atmosphere. That's what keeps our Earth warm.

Q. 38. How do human activities affect the environment?

Answer: Human activities affect the environment in the following ways:

a) Over population- Due to good medical facilities fewer people are dying and the birth is also continuous. This leads to an increase in population. So they will damage the ecosystem more. Without enough trees to filter the air, CO₂ levels increase which carries the potential to damage every single organism on Earth.

b) Pollution- Pesticides, herbicides, large landfills, waste from food processing industries, and nuclear waste generated from nuclear reactors and weapons deplete our soil of its nutrients and make it virtually lifeless. The burning of fossil fuels and toxic gases produced in factories causes air pollution. Effluence from industries, fertilizers run off into nearby water reservoirs, leading to water pollution and damage to the ecosystem.

c) Global Warming and Ozone Layer Depletion- Greenhouse gases like CO₂ and methane are believed to lead to global warming. Chlorofluorocarbons (CFCs), used in refrigeration, and aerosols destroy the ozone layer that shields the earth from UV rays.

d) Deforestation- As the population is increasing more food, materials, and shelters are being manufactured at stupendous rates, mostly stemming from forestry. Because of which there is depletion of oxygen as well in the eco-system.

Q. 39.A. Which part of the waste is changed into an agricultural resource?

Answer: Biodegradable waste products are changes in agricultural resources like fertilizers. These biodegradable substances can be broken down by biological processes (like by enzyme or bacterial action). For Examples: cattle dung, cotton, jute, paper, fruit and vegetable peels, leaves etc.

They can be used as various agricultural resources, for example:

- a) Cattle dung is used as natural fertilizers for crops and plants. It is also cost-free.
- b) Jute can be used to prepare bags for storing grains.
- c) Vegetable peels can be used as food for cattle's. Etc.

Q. 39.B. How can pesticides be allowed in beverages?

Answer: Because of lack of regulation, some amount of highly toxic pesticides got in the beverages consumed by people day to day. If ingested over long periods, these chemicals could lead to cancer and failure of the immune system.

Q. 39C. On recycling, waste paper is converted into which product?

Answer: Paper is made from trees, and every single part of the tree is either chopped up to make products or burned to create energy. Although paper waste is biodegradable it's recycling adds more advantage because decomposition takes time(some months or years) but recycling can be done in just some hours.

Paper recycling is a simple process which leads to the recovery of waste paper and converting it into new paper products. Recycling old paper products uses 60% less energy than manufacturing it from new materials, as it would save a lot of trees from being cut down.

Q. 40. Why do harmful chemicals concentrate as we go up in a food chain?

Answer: Harmful chemicals such as pesticides get accumulated in the soil and the water gets polluted and this, in turn, is consumed by the plants to take up nutrients. Those chemicals get accumulated in the plants and go to the next trophic level. This process is also known as biomagnifications. For example, when pesticides are sprayed they enter the food chain through producers while they are absorbing nutrients from the soil. Since herbivores eat many types of plants, therefore their body will accumulate

more amounts of pesticides. Similarly, carnivores will feed on more than one herbivore; hence it will have much more amount of pesticide in it.

Q. 41. State any three environmental problems caused by man.

Answer: The three environmental problems caused by human are:

1) Human activity like the building of industry, like sugar mill, chemical industry, emitted certain harmful effluent that pollutes air and water and soil as well. Improper waste management leads to persistence of non-biodegradable products in the environment which causes health issues to animals and plants.

2) Deforestation- cutting of trees led to the migration of certain animals and cause the extinction of the species. It also results in floods and droughts. The primitive agricultural practice caused soil erosion.

3) The burning of fossil fuels leads to the depletion of ozone layer and may cause several health problems.

Q. 42. Divide the wastes generated from your house into biodegradable and non-biodegradable categories. Suggest methods for their disposal.

Answer: Materials having properties that do not breakdown or decay are called Non-biodegradable.

Examples include:

- Glass
- Metals
- Plastics
- Electronic devices
- Medical waste

Biodegradable materials are composed of waste from living organisms and the actual plant, animal or another organism when its life ends.

Examples of Biodegradable materials often referred to as “bio-waste”, include the following:

- Human and animal waste

- Plant products, wood, unwanted paper, unused food waste, leaves, grass clippings, clothes

- Remains from the death of living creatures

Dustbins aren't the only method to throw waste away. There are various methods to Dispose Waste:

a. Burial Pits/Landfills:

Throwing daily wastes in burial pits or what is also known as landfills is an alternative for dustbins and is the popular waste disposal method. It looks after burying waste in the ground and eliminating foul smell coming from the wastes.

b. Incineration:

Burning of waste at high temperatures and converting them into residue or gaseous products is known as 'Incineration'. It's a better alternative to dustbins since the volume of waste here decreases by 20-30%.

c. Recycling:

The process of reusing the discarded materials and converting them into something new is known as 'Recycling'. It's the third main element in the process of 'Reduce, Reuse and Recycle'. Recycling reduces the harmful effect of greenhouse gases and helps in conservation of resources for future.

d. Composting:

When organic wastes are kept in a pit for a long period of time the microbes start decomposing the waste. If the compost is nutrient rich then it becomes better manure for plants.

Q. 43. What is the environment? What type of substances are the major pollutants of the environment?

Answer: The environment is something you are very familiar with. It consists of the air, water, land, and all the conditions that surround living organisms. It can be living or non-living things. It is the sum total of everything around us.

The pollutants (substances that damage the environment) can be classified into two basic groups:

(a) Non-degradable Pollutants:

These are not broken down by the natural processes like the action of microbes. Most of these Mutants get accumulated in the environment and also get biologically magnified as these move along the food chains in an under the composed state. These may also react with other compounds in the environment to produce toxins.

These can be further subdivided into two more classes:

(i) Waste:

E.g. glass, plastic, phenolic, aluminum cans etc.

(ii) Poisons:

E.g. radioactive substances, pesticides, smog gases, heavy metals like mercury, etc.

(b) Degradable pollutants or Biodegradable Pollutants:

These are natural organic substances which can be decomposed, removed or consumed either by natural processes like biological or microbial action or by some artificial systems, like sewage treatment plants.

The degradable pollutants can be further subdivided into two categories:

(i) Rapidly degradable or non-persistent pollutant:

The degradation of these pollutants is a very faster process. For example, the decomposition of sewage and wastes of animals and plants is a faster process. The domestic sewage can be rapidly decomposed by natural processes. However, the problems become complicated when the input into environment get exceeded of the decomposition or dispersal capacity.

(ii) Slowly degradable or persistent pollutant:

The degradation of these pollutants is a very slower process. It seems as if the amount of pollutant remains unchanged with time. For example, degradation of synthetic compounds and radioactive elements like Iodine 137, takes a longer period of time.

Q. 44. Make two food chains and a food web from the following set of living organisms: Grass, vulture, deer, insect, and snake. Identify the tertiary consumers in both the food chains.

Answer: Food chain is a series of organism feeding on one another. And food web consists of a number of interlinked food chains. There are trophic levels in both which determine the sequence of organisms according to their mode of nutrition.

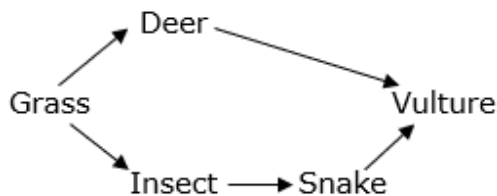
Plants (producers) get their nutrition from sunlight and prepare their own food. Then comes the primary consumers (herbivores) they cannot prepare their own food hence get their nutrition by feeding on plants. Then comes the secondary (omnivores) and then tertiary consumers (carnivores) they get energy by eating other animals. They all get the nutrition from the organisms of lower trophic levels.

Hence the food chains will be as follows:

(1) Grass->Deer ->Vulture

(2) Grass->Insect->Snake->Vulture

And the food web will be as follows:



So producer is grass, primary consumers are insect and deer, secondary consumers is a snake and at the apex is vulture the tertiary consumer of both food chain and food web.

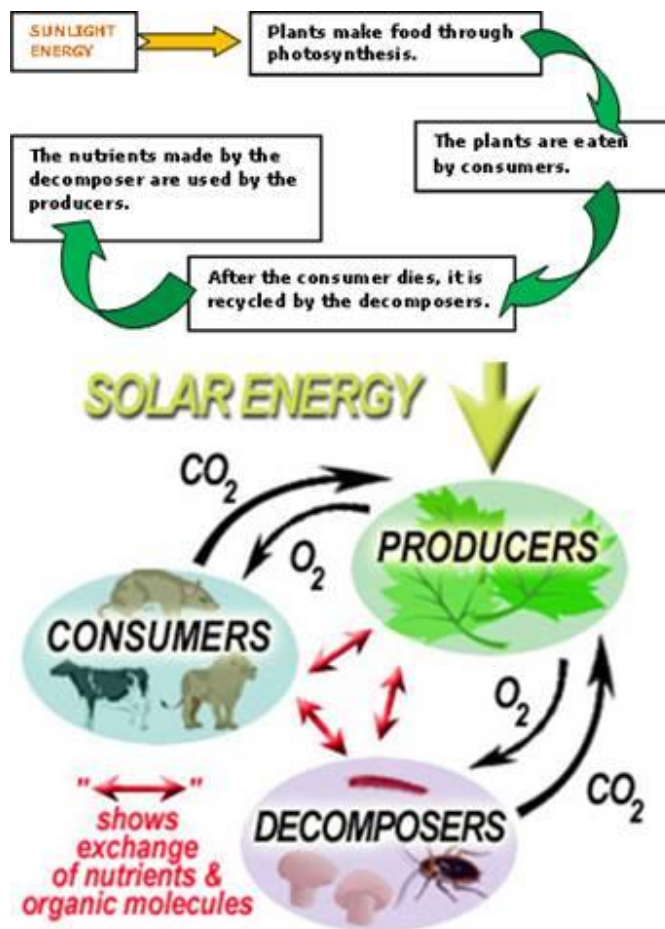
Q. 45. What happens once the Sun's energy reaches the Earth? Explain with the help of a diagram.

Answer: Energy from the sun consists of various wavelengths of light. Out of all the rays, only UV (ultraviolet rays) radiations fall on earth. The UV (ultraviolet) radiations from the sun reach the earth's atmosphere which is heavily rich in oxygen. These high energy UV rays split molecular oxygen (O_2) into free oxygen (O). Afterward, this free oxygen reacts with molecular oxygen; it forms ozone (O_3). This ozone layer filters the UV rays and allows only some part of it to fall on earth.

These harmful UV radiations of the sun can cause skin cancer in human and can cause many health hazards like skin cancer, cataract, destruction of plants, etc.

Plants capture sun energy by chlorophyll pigment found on the leaves of the plants.

Then they prepare their food in the form of carbohydrates through the process of photosynthesis. Then when energy flows from one trophic level to another in a food chain and finally gets released into the atmosphere after the decomposition of the organisms carrying it.



Q. 46.A. If the primary consumer has 400 J of energy. What was the energy trapped by the producer and also write the energy present at the quaternary consumer level?

Answer: According to the 10% law, at each trophic level about 10% of the energy of previous trophic level is passed to the next trophic level of the food chain.

So, if the primary consumers have 400J of energy then producers (first trophic level) will have 10% more of 400J

$$\Rightarrow 400 + 400 \times \frac{10}{100}$$

$$= 400 + 40$$

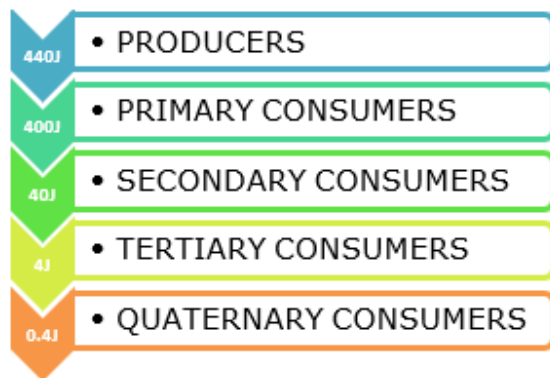
$$= 440\text{J}$$

So, 440J will be available for the producer.

Now, the energy transferred to the secondary consumer will be $= 400 \times 10\% = 40\text{J}$

Similarly only 10% of the energy entering the secondary consumers is available for the tertiary consumers. So tertiary consumers will have 4J of energy ($40 \times 10\%$).

Hence the energy available for quaternary consumers $= 4 \times 10\% = 0.4\text{J}$



Q. 46.B. State the 10 % law, associated with the flow of energy in trophic levels of organisms.

Answer: 10% rule: The law was given by Lindeman. An average of only 10% of the energy in one trophic level is passed to the next trophic level.

As energy flows in an ecosystem from producers to consumers to decomposers, about 90% of the total energy is lost at each feeding level in the chain because most of the energy is either used by the organism or is given off as heat. The loss of energy at each level can be represented by an energy pyramid. Because of the energy loss, the amount of energy levels in an ecosystem is limited to about 3-5. The transfer of energy is never 100%.

Q. 47. An industry is being established near a town. How can the wastes generated from this industry affect the local environment?

Answer: Industrial waste is the waste produced by industrial activity. It includes any material that is made useless during a manufacturing process. Some examples of industrial wastes are chemical solvents, sludge, metals, ash, paints, paper products, industrial by-products, metals, and various others.

Industries are important for the economic growth and development of a society, but it can also be harmful to the environment. Industrial process can cause pollution to air, water and soil, health issues, extinction of species, and more. Disposing of waste has huge environmental impacts and can cause serious problems like:

Air-Emissions

Industry is a major cause of air pollution, as it results in the emission of pollutants, including organic solvents, respirable particles, sulfur dioxide (SO₂) and nitrogen oxides (NOX). These pollutants can both harm public health and damage the environment in ways like the greenhouse effect, ozone hole.

Wastewater

The sources of effluent- treated or untreated wastewater that is discharged into surface waters - are many and varied. Untreated wastewater can cause environmental problems including: pollution of groundwater reservoirs, damage of transport and wastewater treatment systems, and degradation of treated wastewater and sludge such that it would disqualify them from being used for agricultural purposes.

Land-Pollution

Leakage from the fuel and energy industries, as well as industries involving hazardous materials, is the main causes of land contamination. Soil contamination is caused by direct exposure to the pollutant, leakage of toxic gases into buildings, and groundwater pollution. The properties of soil result in pollutants remaining in the soil long after the pollution incident. It is taken up by various plants and then it is consumed by humans, causing various health effects.

Hazardous-Materials

Hazardous materials are widely used by almost all the industries. If not properly treated, stored, or dealt with, hazardous materials can cause damage to human health, environment and property.

Radiation

Human and the environment are at-risk from exposure to both ionizing radiation (sources include radioactive materials, x-ray machines, and accelerators) and non-ionizing radiation (from electrical installations, mobile broadcasting centers and lasers).

These harmful radiations can cause many health hazards like skin cancer, cataract, destruction of plants, etc.

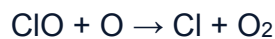
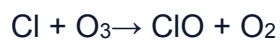
Q. 48. Give a detailed account of ozone layer depletion and the harm ozone layer depletion has caused to the ecosystem.

Answer: An ozone molecule (O₃) is composed of three atoms of oxygen. Ozone layer protects life on Earth by absorbing most of the ultraviolet (UV) radiation emitted by the sun. Exposure to too much UV radiation is linked to skin cancer, cataracts, and depression of the immune system, and may reduce the productivity of certain crops.

The ozone layer is reduced when man-made CFC molecules (comprised of chlorine, fluorine, and carbon) reach the stratosphere and are broken apart by short-wave energy from the sun.

These substances that lower the ozone layer do not directly destroy ozone. First they undergo photolysis, forming hydrogen chloride (HCl) or chlorine nitrate (ClONO₂), molecules that do not react with ozone directly, but slowly decompose, giving, among other things, a small number of chlorine atoms (Cl) and Of chlorine monoxide (ClO) molecules that catalyze the destruction of ozone.

The reactions involved in the processes of destruction are more than 100, but can be simplified in the following:



The chlorine atom acts as a catalyst, ie it is not consumed in the reaction, so it destroys thousands of ozone molecules before disappearing.

Effects of Ozone Layers

1. Effects of the depletion of the ozone layer on human health

1.1 Skin Cancer

Today, it is estimated that skin cancer rates increased due to the decrease in stratospheric ozone (ozone layer). The most common type of skin cancer is the cause of exposures to UV radiation from sun.

2. Effects on aquatic ecosystems

The loss of phytoplankton, the basis of the marine food chain, has been observed as the cause of the increase in ultraviolet radiation. For example: Under the ozone hole in the Antarctic phytoplankton productivity decreased between 6 and 12 percent. That disturbs the ecosystem.

3. Effects on terrestrial ecosystems

3.1 Animals

For some species, an increase in UV radiation implies the formation of skin cancer. This has been studied in goats, cows, cats, dogs, sheep and laboratory animals and is

probably pointing out that this is a common feature of several species. Infections in cattle can be aggravated by an increase in UV-B radiation.

3.2 Plants

In many plants UV radiation can have the following adverse effects: alter its shape and damage plant growth; Reduce tree growth; Change flowering times; Make plants more vulnerable to disease and produce toxic substances. There could even be losses of biodiversity and species.

Q. 49. Identify a deadly poisonous gas X found at the higher levels of atmosphere. Write its chemical formula and equation of its formation. Why is damage to X layer a cause of concern?

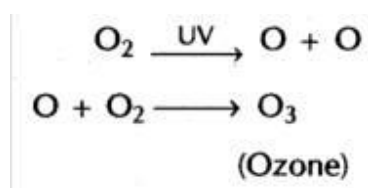
Answer: Ozone is a simple chemical compound that contains only oxygen atoms, and its effects depend on where in the atmosphere it occurs. In the upper stratosphere, it forms a protective shield against solar ultraviolet radiation, but near the ground, it's a pollutant that can cause respiratory ailments in humans and animals. The creation and destruction of stratospheric ozone depend primarily on natural processes, but near the ground, industrial processes are mostly responsible for its creation.

Hence ozone is the gas found at higher level of atmosphere (stratosphere).

Chemical Composition

An ozone molecule consists of three oxygen atoms (O_3), whereas the stable form of oxygen that normally exists in the atmosphere consists of only two. When certain chemical processes make an extra oxygen atom available, the highly reactive atom binds readily with an oxygen molecule.

Then these UV rays split molecular oxygen (O_2) into free oxygen (O). Afterwards, this free oxygen reacts with molecular oxygen; it forms ozone (O_3).



Damage to this layer is of great concern as this ozone protects the earth from harmful UV radiations of sun, by allowing only some percent of rays to fall on the earth's surface. Ozone acts as a filter of sun rays. These rays can cause skin cancer in human and can also affect other living organisms.

Q. 50. Categorize some of the activities performed by you as an eco-friendly person. Suggest some more eco-friendly activities which we should adopt in day-to-day life.

Answer: 1. 3 R's of Waste Hierarchy: The 3 R's of waste hierarchy can reduce the amount of waste generated and improve the waste management processes. Reducing what is produced and what is consumed can reduce the amount of waste that is generated. Reuse items for different purposes instead of disposing them off. Recycle items like aluminum cans, plastic, paper, glass that can be shaped into a new item.

2. Conserve Water and Electricity: It takes energy to produce fresh water and electricity. Few simple ways like turning off lights when not in use, fixing leakages, proper insulation, using maximum daylight, installing energy efficient windows, purchasing energy efficient gadgets can reduce your daily energy consumption.

3. Plant More Trees: We all know why we need more trees on this planet. They give us oxygen, fruits, timber, prevent soil erosion, control floods, and provide shelter to wildlife. Massive scale deforestation in last couple of decades has reduced forest area by significant percentage.

4. Protect Local Water Sources: Hazardous waste materials like paint, oil, ammonia and other strong chemical solutions should never be disposed on the ground as they'll seep into the groundwater. Join local water conservation groups and fight against water polluters who dump their industrial waste in rivers.

5. Drive Less, Walk More: A simple and yet more effective way to live eco-friendly life is to either take public transportation for your daily commuting needs or try pooling in with your office colleagues to save fuel and reduce your carbon footprint. If your office is couple of miles away from home, you can either start half an hour early and walk on foot or ride a bicycle.

6. Buy Energy Efficient Products: Energy efficient products with 5 star energy rating consume less energy and prove to be eco-friendly. For instance, CFL bulbs consume 40% less energy and last 10 times longer than traditional bulbs.

7. Buy locally Grown Products: When you buy or produce locally grown products, you are actually reducing your carbon footprint in the form of using less plastic bags, saving fuel to get vegetables from the market, using less packaged material..... Apart from this, you can also sell surplus to your friends or relatives.

8. Prevent Littering: Litter can originate from construction and demolition sites, households, industries, uncovered trucks, pedestrians, and moving vehicles. Littering can have big impact on environment, wildlife and local tourism industry. Being a responsible citizen, it's our responsibility to make our cities clean and impart same education to our kids.

9. Buy Recycled Products: Always look out for recycling symbol when you visit grocery shop to buy items for your home. That will make you environmentally responsible and eco-friendly. Also, try to carry grocery bag with you to avoid buying items in plastic bags that will later end up in landfills.

10. Join Environmental Groups to Combat Pollution: Protecting mother Earth is everyone's responsibility including you. The best you can do is to join different environmental groups in your city and provide helping hand to make this planet environmentally friendly.

Q. 51.A. Plastic production is increasing day-by-day in spite of the fact that plastic is harmful for the environment. Read the given passage and answer the following questions:

What are the harmful effects of plastic usage?

Answer: ● It Upsets the Food Chain

Because it comes in sizes large and small, polluting plastics even affect the world's tiniest organisms such as plankton. When these organisms become poisoned due to plastic ingestion, this causes problems for the larger animals that depend on them for food. This can cause a lot of problems, each step further along the food chain. Plus, it means that plastic are present in the fish that many people eat every day.

● Land Pollution

When plastic is dumped in landfills, it interacts with water and form hazardous chemicals. When these chemicals seep underground, they degrade the water quality. Wind carries and deposits plastic from one place to another, increasing the land litter. It can also get stuck on poles, traffic lights, trees, fences, tower etc. and animals that may come in the vicinity and might suffocate them to death.

● Air Pollution

Burning of plastic in the open air, leads to environmental pollution due to the release of poisonous chemicals. The polluted air when inhaled by humans and animals affect their health and can cause respiratory problems.

● It is Poisonous

Man artificially makes plastic by using a number of toxic chemicals. Therefore, use of and exposure to plastics has been linked to a number of health concerns affecting people around the world. The processes of making, storing, disposing of, and just being around plastics can be extremely harmful to living things.

● It is Expensive

It costs millions of dollars each year to clean affected areas after exposure, not to mention the loss of life to plants, animals, and people. As land becomes more valuable, just finding a place to put garbage is becoming a problem in many parts of the world.

Q. 51.B. Plastic production is increasing day-by-day in spite of the fact that plastic is harmful for the environment. Read the given passage and answer the following questions

In our day-to-day situation, what is the alternative that we can use instead of plastics?

Answer: We can adopt these methods to lessen the use of plastic:

- Shop Friendly

Plastic bags were once a modern convenience but can be efficiently replaced by reusable bags, many of which fold up compactly in order to be portable. Just think about how many bags you typically carry out of a grocery store, and multiply that by the number of times you grocery shop. That's a lot of plastic! Carry a bag and always reuse plastic bags as much as possible if you have them.

- Get Rid of Bottled Water

People are meant to drink lots of water each day, and plastic water bottles have become a great way to stay hydrated throughout the day. However, most of these are only recommended for single use, and that means that every time someone finishes a bottle it goes into the trash. Many companies now sell reusable water bottles as a substitute, reducing plastic waste and exposure to leaking bottles.

- Recycle Everything

Try and select items that come in non-plastic recycled and recyclable packaging, to do your best to properly handle items that can't be reused. Check everything before you put it in the trash, as more and more items are able to be recycled these days.

Remember that because plastic doesn't break down easily (if ever), recycling plastic means that it is still plastic, just being used for a different purpose. Therefore, you're not actually reducing plastic amounts or exposure, even in the recycling process.

Q. 51.C. Plastic production is increasing day-by-day in spite of the fact that plastic is harmful for the environment. Read the given passage and answer the following questions

What can be learnt as a good citizen in concern for this issue?

Answer: As a good citizen we should take steps for the betterment of the society, state, country we live in. We should learn to:

- Educate Businesses

Speak to local restaurants and businesses about options that they can switch to for packaging, storing, and bagging items. Many companies are starting to come up with excellent low-cost replacements, such as bamboo utensils in place of plastic ones.

- Get Involved

Speak to lawmakers and get involved with government on any level. Encourage development of items, and propose alternatives when applicable.

Q. 52.A. On a visit to his hometown in Gujarat, Aman went to the famous beach in the city. He was shocked to see plastic, paper, waste food, water bottle being thrown away on the beach and also floating on the beach water. On seeing this, Aman asked his father to talk to the care taker of that area to do something regarding this.

What can be the consequence of this situation on the environment?

Answer: Spread of all these non-biodegradable wastes on the beach will go in the oceans with the waves. This will cause ocean pollution or marine pollution. This will lead severe consequences like:

1. Effect of Toxic Wastes on Marine Animals

Oil spill is dangerous to marine life in several ways. The oil spilled in the ocean could get on to the gills and feathers of marine animals, which makes it difficult for them to move or fly properly or feed their children. The long term effect on marine life can include cancer, failure in the reproductive system, behavioral changes, and even death.

2. Disruption to the Cycle of Coral Reefs

Oil spill floats on the surface of water and prevents sunlight from reaching to marine plants and affects in the process of photosynthesis. Skin irritation, eye irritation, lung and liver problems can impact marine life over long period of time.

3. Depletes Oxygen Content in Water

Most of the debris in the ocean does not decompose and remain in the ocean for years. It uses oxygen as it degrades. As a result of this, oxygen levels go down. When oxygen levels go down, the chances of survival of marine animals like whales, turtles, sharks, dolphins, penguins for long time also go down.

4. Effect on Food Chain

Chemicals used in industries and agriculture get washed into the rivers and from there are carried into the oceans. These chemicals do not get dissolved and sink at the bottom of the ocean. Small animals ingest these chemicals and are later eaten by large animals, which then affect the whole food chain.

5. Affects Human Health

Animals from impacted food chain are then eaten by humans which affects their health as toxins from these contaminated animals gets deposited in the tissues of people and can lead to cancer, birth defects or long term health problems.

Q. 52.B. On a visit to his hometown in Gujarat, Aman went to the famous beach in the city. He was shocked to see plastic, paper, waste food, water bottle being thrown away on the beach and also floating on the beach water. On seeing this, Aman asked his father to talk to the care taker of that area to do something regarding this.

What measures you can take as an individual to keep the beach clean?

Answer: LEAVE PLASTIC BEHIND

Stay away from those evil plastic bags! The best you can do is bringing your snacks in reusable bags or containers.

THROW EVERYTHING AWAY

Bring your own bags with you, this will ensure you throw everything away! Trash doesn't just disappear and we all know it, so take everything you brought back with you and that will make the ocean smile.

IF YOU SPOT TRASH

Pick up everything you spot on the beach, but picking up a couple of leftovers will do good to keep the beach clean.

MAKE SMALL CHANGES

Details matter a lot here, for example you could bring a reusable water bottle to your beach day instead of disposable water bottles!.

CAREFUL WITH THAT BONFIRE

Don't you just love roasting some marshmallows on a cozy beach night? We do too! However, try not to burn your debris on the bonfire, it'll go straight to the sand and into the ocean once time goes by. Don't forget to put your fire out properly too.

TAKE CARE OF PETS

If you've brought your puppy to the beach, that's great, nothing beats a puppy trying to swim! However, remember to pick up their poops.

Q. 52.C. On a visit to his hometown in Gujarat, Aman went to the famous beach in the city. He was shocked to see plastic, paper, waste food, water bottle being thrown away on the beach and also floating on the beach water. On seeing this, Aman asked his father to talk to the care taker of that area to do something regarding this.

How can government help in keeping the beach clean?

Answer: There are various departments under government for the cleanliness and hygiene of the environment. Hence Marine department is the main department under government responsible for taking action for marine pollution.

Marine Department

The Marine Department (MD) is responsible for the sea surface cleanliness. The services provided by the department include scavenging floating refuse from sea and foreshore areas, and free of charge domestic refuse collecting service for local vessels inside typhoon shelters and sea-going ships moored in anchorages and government mooring buoys.

Besides regular scavenging services, MD's contractor will also assist green groups to dispose of the refuse collected at beaches after their cleanup operations. The foreshore cleansing force of MD's contractor may also work together with green group volunteers to clean up marine refuse accumulated at foreshore areas which are inaccessible by land.

The Department has deployed wardens to patrol marine beaches and marine reserve on a daily basis by both land and sea, giving advice to visitors and taking law enforcement action when necessary.

Education/publicity programs are being conducted to promote public awareness in clean shorelines through:

- conveying message of keeping a clean and healthy environment through a wide range of education programs including seminars, school talks, field studies and exhibition;
- producing posters, leaflets and other publications to enhance public understanding on the importance of keeping the cleanliness in beaches;
- Erecting different sign and information boards along the coast of oceans to remind the beach visitors of keeping the shoreline clean.

Q. 52.D. On a visit to his hometown in Gujarat, Aman went to the famous beach in the city. He was shocked to see plastic, paper, waste food, water bottle being thrown away on the beach and also floating on the beach water. On seeing this, Aman asked his father to talk to the care taker of that area to do something regarding this.

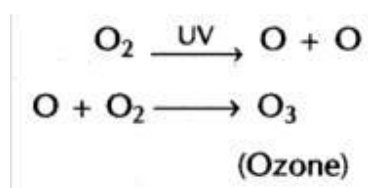
What values are shown by Aman?

Answer: Aman is concerned for the environment. He got himself involved in taking steps for the betterment of the ecosystem. He asked his father to talk to the caretaker and encourage development of items, and propose alternatives which can be applied.

Q. 53.A. While explaining the recent developing ozone hole on Antarctica, teacher makes a remark that 'without ozone layer, organisms cannot survive on Earth'. Kalpana gets curious about the various aspects of ozone layer and asks some questions to her teacher.

How is ozone layer formed?

Answer: When UV radiations from the sun reach earth's atmosphere which is heavily rich in oxygen. Then these UV rays split molecular oxygen (O_2) into free oxygen (O). Afterwards, this free oxygen reacts with molecular oxygen; it forms ozone (O_3).



This ozone now protects the earth from harmful UV radiations of sun, by allowing only some percent of rays to fall on the earth's surface. Ozone acts as a filter of sun rays. These rays can cause skin cancer in human and can also affect other living organisms.

Q. 53.B. While explaining the recent developing ozone hole on Antarctica, teacher makes a remark that 'without ozone layer, organisms cannot survive on Earth'.

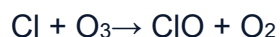
Kalpna gets curious about the various aspects of ozone layer and asks some questions to her teacher.

What has led to its depletion?

Answer: The ozone layer is reduced when man-made CFC molecules (comprised of chlorine, fluorine, and carbon) reach the stratosphere and are broken apart by UV energy from the sun.

These substances that lower the ozone layer do not directly destroy ozone. First they undergo photolysis, forming hydrogen chloride (HCl) or chlorine nitrate (ClONO₂), molecules that do not react with ozone directly, but slowly decompose, giving, among other things, a small number of chlorine atoms (Cl) and Of chlorine monoxide (ClO) molecules that catalyze the destruction of ozone.

The reactions involved in the processes of destruction are more than 100, but can be simplified in the following:



The chlorine atom acts as a catalyst, ie it is not consumed in the reaction, so it destroys thousands of ozone molecules before disappearing.

Q. 53.C. While explaining the recent developing ozone hole on Antarctica, teacher makes a remark that 'without ozone layer, organisms cannot survive on Earth'. Kalpna gets curious about the various aspects of ozone layer and asks some questions to her teacher.

What measures can an individual take to protect ozone layer?

Answer: Measures that can be taken are:

1. Limit private vehicle driving

This is because vehicular emissions eventually result in the release of smog. This in turn also damages the ozone layer causing it to deteriorate. You can choose to take the public transport or use a bicycle. Another great way to restrict the use of car is by opting for Car Pooling. If you do want to use a vehicle, then it is recommended to switch to an electric or hybrid vehicle.

2. Use eco-friendly household cleaning products

Usage of Eco-friendly and natural cleaning products for household chores is a great way to prevent ozone depletion. This is because many of these cleaning agents contain toxic chemicals that interfere with the ozone layer. A lot of supermarkets and health stores sell cleaning products that are toxic-free and made out of natural ingredients.

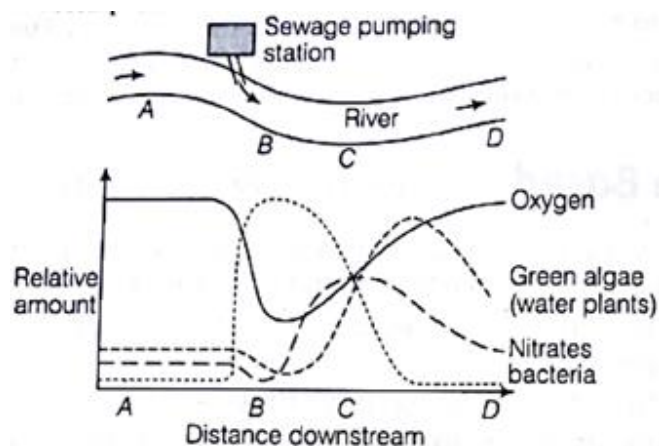
3. Avoid using pesticides and prevent ozone depletion

Pesticides may be an easy solution for getting rid of weed, but are harmful for the ozone layer. The best solution for this would be to try using natural remedies, rather than heading out for pesticides.

4. Buy air-conditioning and refrigeration equipment that do not use HCFCs as refrigerant.

Challengers

Q. 1. The diagram shows part of a river into which sewage is being pumped. Some of the effects of adding sewage to the river are shown in the graph. At which point in the river are decomposers most active?

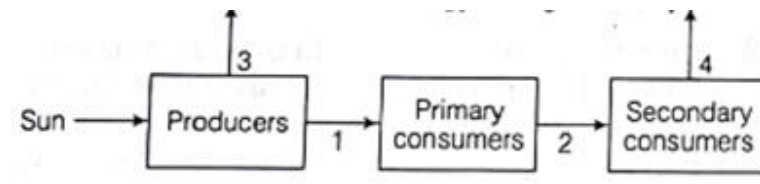


- A. D
- B. C
- C. B
- D. A

Answer: At B the concentration of blue green algae is high, they take up the atmospheric oxygen and then the nitrated bacteria convert it into ammonia, so that it can be used by aquatic environment. In this way they release nutrients back into the environment for other organisms to use.

Also because of high concentration of Oxygen at B point, helps them to use oxygen to gain energy and drive their own life processes. They will again make the water fresh and clear.

Q. 2. The diagram shows the flow of energy through an ecosystem.



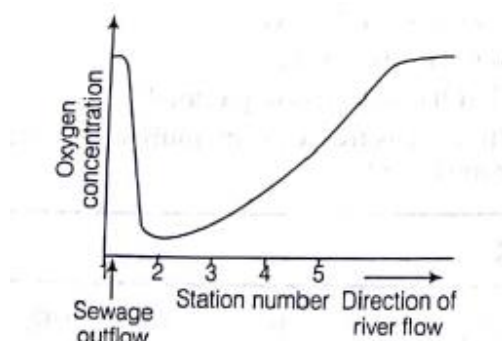
The smallest amount of energy transferred between organisms and the largest amount of energy lost to the ecosystem is represented by which arrows?

	Smallest energy transfer	Largest energy loss
(a)	4	3
(b)	2	1
(c)	2	3
(d)	1	4

- A. (a)
- B. (b)
- C. (c)
- D. (d)

Answer: The smallest amount of energy transferred between organisms is shown by arrow number 4. Because as we go up in a food chain the amount of energy transferred is reduced by 10%. And the largest amount of energy loss to the ecosystem is in the form of heat. It is shown by arrow number 3. This is because producers (plants) take energy from sunlight and only 1% of it is used to prepare food rest other is lost in the form of heat.

Q. 3. The following graph shows the concentration of oxygen in a river, measured at stations 1.5, each 100 m apart. A sewage outflow is observed just after station 1. At which stations will the concentration of organic matter be lowest?



- A. 1 and 5
- B. 2 and 3

- C. 3 and 4
- D. 4 and 5

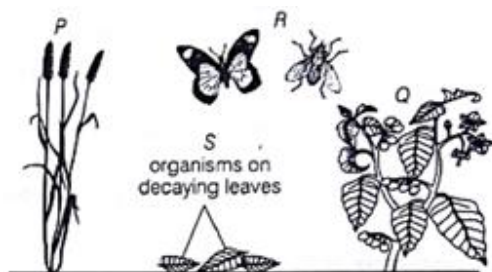
Answer: At 1 and 5 the concentration of organic matter will be lowest because there were no decomposers. Whereas in 2,3 and 4 the decomposers were using the high amount of oxygen to decompose the organic material from sewage.

Q. 4. Fertilizers are used on farmlands to increase the nutritive quality of soil and thus, the crop productivity. However, they greatly impact our environment in negative ways. A fertilizer Industry is planning to release nitrate free or reduced nitrate containing fertilizer to make it more environment friendly. This control of nitrate rich fertilizers is necessary because

- A. Nitrates cause acid rain, killing trees and fishes when released in the environment.
- B. They decrease the natural fertility of the soil.
- C. Nitrates may lead to excessive growth of water plants.
- D. It poisons different crop plants.

Answer: As nitrogen is an essential element for plant growth and development; however, due to environmental pollution, high nitrate concentrations accumulate in the edible parts of these leafy vegetables, particularly if excessive nitrogen fertilizer has been applied. Consuming these crops can harm human health.

Q. 5. The diagram shows the organisms in a habitat.



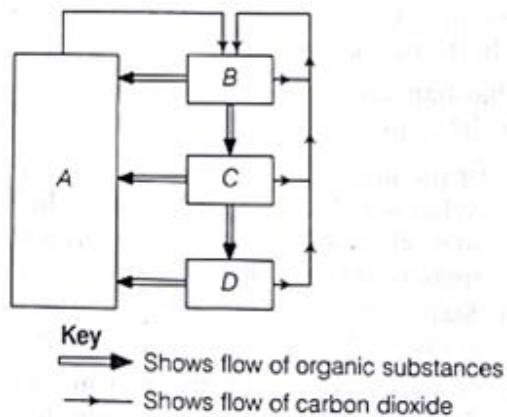
Which of the following indicates the feeding relationships of these organisms?



- A. (a)
- B. (b)
- C. (c)
- D. (d)

Answer: R are the primary consumers which feed on plant Q. Decomposers are the organisms which feed on dead and decaying matter S. Then these decaying matters help in the growth of plants by providing nutrients to feed then from soil.

Q. 6. The diagram represents the flow of substances within a balanced ecosystem. The boxes are various trophic levels. Which box represents the producers?



- A. B
- B. D
- C. A
- D. C

Answer: A box represents the primary trophic level which is producer in an ecosystem. Because of two reasons:

- 1) They are highest in number.
- 2) They provide energy for the beginning of a food chain.

Management of Natural Resources

Check Point 01

Q. 1. On what basis do we classify a substance as exhaustible or inexhaustible?

Answer: On the basis of renewable or nonrenewable the substances (resources) are classified.

The substances which can be reproduced in nature over a period of time physical, chemical or mechanical changes are renewable. For examples solar energy, wind energy, hydraulic energy, water resources, forests, and wildlife. Whereas, resources which are get exhausted and cannot be renewed are non-renewable resources. Examples are minerals and fossil fuels.

Q. 2. Why should we use the exhaustible natural resources judiciously?

Answer: Coal and petroleum are exhaustible natural resources and were formed millions of years ago. The stock of these resources are limited and may be exhaust after say 40 -50 years and they cannot be renewed. These resources should be used judiciously so that these can also be used by a future generation. Secondly, excessive use of a natural resource such as coal, petrol causes pollution and global warming. Therefore, we must use coal and petroleum with care.

Q. 3. Name the 3 Rs' that will help us to conserve natural resources for long-term use.

Answer: The three R's are Reduce, Reuse and Recycle. All these all help to cut down on the amount of waste we throw away. They conserve natural resources, landfill space, and energy.



Q. 4. The strategy of 3 Rs' has become profound in environment management programme. Give reason.

Answer: Advancement of modern civilization and urbanization had a great impact on our natural resources. Still, we have not realized the value of our natural resources.

Conserving the natural resources such as coal petroleum soil and water is very essential. We can conserve natural resources by adopting the concept of Three R's namely Reduce, Reuse and Recycle. The activity BEST OUT OF WASTE focused on minimizing the usage of available resources and recycling the commonly accessible waste material enabling them to use the resources judiciously and developing the habit of conserving our natural resources.

Q. 5. The concept of sustainable development has been adopted to limit the damage being incurred to the environment. Justify.

Answer: • The idea of 'sustainable development' became popular with the publication of a paper by the World Commission on Environment and Development, in 1987.

- Sustainable development is defined as development which meets the needs of the present without compromising the ability of future generations to meet their own needs".
- The sustainable development can be done by reducing pollution by using eco-friendly technology.
- Use of natural resources in such a way to ensure availability for the future generations, social equality in accessing resources.
- Therefore, sustainable development is a need of an hour.

Q. 6. Suggest any two measures that can be adopted by anyone to conserve our natural resources.

Answer: There are innumerable practices which can be done by anyone to conserve natural resources. Some of the activities are listed below:

- Close water taps when not in use.
- Switch off lights which are not necessary
- Plant more trees.
- Use public transport as far as possible.
- Carry your own bags when heading out for shopping.

Check Point 02

Q. 1. Why the name 'biodiversity hotspots' has been given to forests?

Answer: Forest is a house of diverse (different) species of plants, animals and all other sorts of living organisms. A biodiversity hotspot is given to the specific forests consisting

of a richest diversity of species including most rare, vulnerable species of plants and animals and other organisms.

Q. 2. Why government established Amrita Devi Bishnoi award?

Answer: This award has been instituted by the government of India as to remember the contribution of Amrita Devi and her other conservativators for the Conservation of Khejri tree from being cut.

Q. 3. Mention the name of movement which arose due to conflict of interest between local people in forests and industrialists?

Answer: The Chipko Movement began from a small village; Reni in Garhwal district. The women of the village hugged the trees to prevent them from cutting by the contractors of an industry.



Chipko Andolan

Q. 4. Name the forest department officer, who had initiated people's participation in the management of forests?

Answer: The forest officer, A.K. Banerjee involved villagers in the protection of 1,272 hectares of badly degraded sal (*Shorea robusta*) in Arabari forest range of Midnapore district in Bengal.

Q. 5. In our country, vast tracts of forests are cleared and a single species of plant is cultivated. What does this practice promote?

Answer: Vast tracts of forests have been converted into monoculture (planting single species) on cleared land and plants such as pine, teak or eucalyptus were planted. Such plantations are useful for the industries to access specific products and are an important source of revenue for the Forest Department.

Q. 6. Write any two measures for the conservation of wildlife.

Answer: To conserve wildlife of the country, **wildlife sanctuaries** and national park are established. Wildlife sanctuaries refer to an area that provides protection and natural living conditions to the wildlife. **National parks** provide protection to the entire plants, animals and, the landscape of that region.

Check Point 03

Q. 1. State purposes for constructing rules.

Answer: Over four hundred years ago, in the parts of Himachal Pradesh had developed a local system of canal irrigation called kulhs. The water flowing in the streams was diverted into man-made channels. Canals carried the water to numerous villages down the hillside to irrigate crops.

Q. 2. For what purpose (any one) were the dams constructed? Do you think dams are serving their purpose completely?

Answer: Large dams can ensure the storage of adequate water not just for irrigation, but also for generating electricity, as discussed in the previous chapter. Canal systems leading from these dams can transfer large amounts of water over great distances. For example, the Indira Gandhi Canal has brought greenery to considerable areas of Rajasthan.

Q. 3. What is the aim behind Narmada Bachao Andolan?

Answer: The main aim behind the Narmada Bachao Andolan ('Save the Narmada Movement') is to oppose the raising the height of the Sardar Sarovar Dam on the river Narmada. By raising the height a large number of peasants and tribal will be displaced without adequate compensation or rehabilitation,

Q. 4. Underground water is very essential component of water conservation programme. Mention an advantage of conserving underground water.

Answer: Advantages of conserving ground water: Use of ground water for drinking purpose has various advantages:

Ground water generally does not get polluted, it remains pure and clean. Conserving ground water can help in increasing the water table level in the ground which will also increase the amount of fresh water for human use that is for drinking etc. It could also be used for other industrial uses.

Q. 5. Despite nature's bounty, why is there a failure in sustaining the underground water sources?

Answer: Despite nature's bounty, we are unable to sustain water availability underground. This happened due to the loss of vegetation cover, diversion for high

water demanding crops, and pollution from urban and industrial wastes. Lack of proper planning and infrastructure to conserve water. Large-scale irrigation methods and dams led to mismanagement of water.

Check Point 04

Q. 1. Coal and petroleum are which type of resources? Give reason.

Answer: Coal and petroleum are exhaustible and non-renewable resources because once they are getting exhausted and cannot be renewed by the natural process.

Q. 2. What is the ultimate source of energy for the fossil fuels?

Answer: Plants trap solar energy during photosynthesis and convert it into food and animals get energy when they eat them. Fossil fuels are made from fossilized plants and animals. Therefore, we can say that the sun is the ultimate source of energy of fossil fuels.

Q. 3. It is said that the burning of fossil fuel causes pollution. Is it a true or false statement? How?

Answer: It is a true statement. Burning fossil fuels emits a number of harmful gases which are harmful to both the environment and human health. They release carbon dioxide, a greenhouse gas, into the atmosphere. Greenhouse gases trap heat from the sun in the Earth's atmosphere, causing temperatures to rise which results in global warming. Sulfur dioxide (SO₂) results from the result of burning coal, contribute to acid rain and the formation of harmful particulate matter.

Q. 4. Which gases are released from the combustion of petroleum and coal?

Answer: When coal and petroleum are burnt completely, carbon dioxide, water, oxides of nitrogen and oxides of sulfur are released but when combustion takes place in the insufficient air (oxygen), then carbon monoxide is formed instead of carbon dioxide.

Q. 5. Suggest a general practice which will help in the reduction of coal and petroleum use.

Answer: Some simple choices can help in reduction coal and petroleum use:

Chapter Exercise

Q. 1. Name the prominent ecologist, who is responsible for Chipko Andolan and the lady behind the success of the movement.

Answer: Sunder Lal Bahuguna was started the Chipko Andolan and Gaura Devi was the lady behind the success of the movement.

- (a) Use of solar energy instead of electricity.
- (b) Use public transport, avoid using personal vehicle
- (C) Using LED bulbs or fluorescent tubes in your homes.

Q. 2. In which region of India, Bundhis are used for water harvesting?

Answer: In Madhya Pradesh Bundhis are used for water harvesting.

Q. 3. What is the main purpose of rainwater harvesting?

Answer: Rainwater harvesting is a process of collecting, filtering, storing and using rainwater for irrigation and for various other purposes.

Q. 4. Name the most common practice of recharging groundwater.

Answer: The crescent-shaped earthen embankments or low, straight concrete-and rubble “check dams” are built across seasonally flooded gullies for the recharging ground water.

Q. 5. Which country has the world's strictest standards for the control of water and air pollution?

Answer: Iceland has the world's strictest standards for the control of water and air pollution.

Q. 6. How can we prevent floods?

Answer: Floods can be prevented by protecting wetlands and plant more and more trees strategically. Keeping a close eye on climate change.

Restore rivers to their natural courses and increasing water storage areas.

Q. 7. Name a clean gaseous fuel other than LPG and natural gas.

Answer: Ethanol is a clean gaseous fuel other than LPG and natural gas.

Q. 8. Name the only resource which is not obtained from the Earth.

Answer: Sunlight is the only resource which is not obtained from Earth. Sun energy is found in all things, including fossil fuels. Plants depend on the sun to make food, animals eat the plants, and both ended up becoming the key ingredients for fossil fuels. Without the sun, nothing on this planet would exist.

Ethanol, unlike petroleum, produces no net carbon dioxide emissions. That's because ethanol is made from plants that remove carbon dioxide from the air while growing.

Q. 9. Why is it necessary to conserve our environment?

Answer: Environmental conservation is important for the following reasons:

- For protecting the ozone layer, maintaining animal and human food chains, preserving potable water and making efficient use of non-renewable resources.
- Environmental conservation seeks to prevent dormant damage through measures such as proactive management and ecologically sustainable energy production.

Q. 10. Classify the following as recyclable and reusable substances. Paper bag, cloth napkin, bottles of pickles, jams, etc., newspapers, metal articles.

Answer: Paper bag, newspaper, cloth napkins, bottles of pickles can be recycled and reused.

Q. 11. What are the natural resources? Give at least two factors that work against an equitable distribution of these resources.

Answer: Anything used by humans to satisfy their needs and demands which is available in nature is known as natural resources, examples are water, soil plants, sunlight, and wildlife.

Factors working against an equitable distribution of natural resources are

- (a) Excessive use of the resources by the industrialists for short-term gains.
- (b) Access of natural raw materials only to a certain group of influential people to improper management.

Q. 12. What are the various factors to be considered while we exploit our natural resources?

Answer: While exploiting the natural resources we should consider the following factors:

- (a) The available natural resources must be managed for a long-term so that these will last for the generations to come.
- (b) Management of resources to ensure equitable distribution of resources among all the people.

(c) Sustainable management of the environment is required while we exploit or used these natural resources. For example, mining causes pollution because of a large amount of slag is produced which should be properly disposed of.

Q. 13. Why do you think there should be an equitable distribution of resources?

Answer: • Available natural resources must be distributed among the people uniformly so that each and every one gets his share of the resource.

- Human greed, corruption, and the lobby of the rich and powerful are the forces working against an equitable distribution of resources.

Q. 14. What are the ill effects of the interest of the industries in the forest as a source of raw materials?

Answer: • Industries related to timber, paper, lac and sports equipment consider the forest as merely a source of raw material for their factories.

- People who run these industries are influential people and obtain raw materials of the forest very cheap.
- These industries are not interested in the sustainability of the forest in one particular area.
- For example, after cutting down all the teak trees in one area, they move to farther away.
- They do not bother about sustainable development.

Q. 15. Forest and wildlife maintain the natural balance of our environment. Elaborate.

Answer: • Forest is a natural habitat for a large number of species of plants (flora) and animals (fauna).

- The biodiversity we have inherited should be conserved and preserved.
- Loss of diversity may lead to loss of ecological stability.
- Plants are producers, they produce food and release oxygen. The food is consumed by consumers (wildlife).
- Wildlife provides stability to different natural processes of nature and decomposers decomposes (bacteria and fungi) the dead materials into nutrients.
- Nutrients cycled back to the nutrient pool.

- Therefore, we should conserve forest and wildlife to maintain the natural balance of our environment.

Q. 16. Why is silviculture considered an advantageous practice in the management of forest resource?

Answer: ● Silviculture is the branch of forestry that deals with establishing, caring for and reproduction of trees for a variety of forest uses including wildlife habitat, timber production, and outdoor recreation.

- Silviculture requires a knowledge of how various tree species grow under particular conditions of soil, climate, and spacing.
- The focus of silviculture is to generate income from the forest by increasing recognition of forestland's use for leisure and recreation.

Q. 17. Write a short note on "Hug the Trees" movement.

Answer: ● Hug the tree was a movement aimed to protect the trees and forests from being destroyed.

- This movement is also called as Chipko Andolan and started by Sunder Lal Bahuguna.
- It was started in the 1970's to inspire eco-groups by helping to slow down the rapid deforestation, expose vested interests, increase ecological awareness, and demonstrate the viability of people power.
- The villagers used to hug the trees and protect them from the contractors from cutting them.

Q. 18. Why is there a scarcity of water in our country?

Answer: The water scarcity in India is mostly man-made. Some of the major reasons for water scarcity are:

- (a) Excessive population growth and mismanagement of water resources. Inefficient use of water for agriculture.
- (b) Traditional techniques of irrigation cause maximum water loss due to evaporation, drainage, percolation, water conveyance, and excess use of groundwater.
- (c) Reduction in traditional water recharging areas. Rapid construction is ignoring traditional water bodies that have also acted as ground water recharging mechanism. We need to urgently revive traditional aquifers while implementing new ones.

(d) Lack of efficient water management and distribution of water between urban consumers, the agriculture sector, and industry

Q. 19. How is rainwater harvesting done from open spaces around the buildings in city areas?

Answer: • Broadly rainwater can be harvested for two purposes, storing rainwater for ready use in containers above or below ground and charging into the soil for withdrawal later.

- This is called ground water recharging.
- Landscapes, open fields, parks, roads and pavements and other open areas can be effectively used to harvest the runoff.
- The main advantage in using the ground as collecting surface is that water can be collected from a larger area.
- This is particularly advantageous in areas of low rainfall.

Q. 20. Describe briefly the Khadin' system of rainwater harvesting practiced in Rajasthan.

Answer: • The khadin system is based on the principle of harvesting rainwater on farmland and subsequent use of this water-saturated land for crop production.

- A khadin is also called a dhora is traditional construction designed to harvest surface runoff water for agriculture.
- Khadin is first designed by the Paliwal Brahmins of Jaisalmer, western Rajasthan in the 15th century.
- Its main feature is a very long (100-300 m) earthen embankment built across the lower hill slopes lying below gravelly uplands.

Q. 21. Excessive irrigation and the chemical application have impacted agriculture and environment in what ways?

Answer: (a) Excess of water in soil results in water logging condition which adversely affects soil aeration. It inhibits the process of germination of seeds. Roots do not grow properly in a standing water field and destroy standing crops

(b) Chemicals are applied to the crops in the form of fertilizers and pesticides. Excessive use pollutes water causing damage to aquatic life.

Q. 22. Why is the dependence of man on nature greater than that of any other organisms?

Answer: • Humans use nature for various purposes in addition to satisfying their basic food and shelter needs.

- The development of man and his relentless pursuit of progress, comfort, luxury, and security.
- To achieve this human overexploit the existing natural resources without replenishing them.
- Whereas, other organisms use nature only to satisfy their basic needs for food and shelter.
- They do not store anything for future use.

Q. 23. List four changes you would incorporate in your lifestyle in a move towards sustainable use of available resources.

Answer: Four changes that can be incorporated in my life style as a move towards sustainable use of available resources are:

1. I shall reduce wastage of electricity by switching off unnecessary lights and fans. I will use solar lamps instead of electric bulbs and will use CFL instead of traditional bulbs.
2. I shall reduce the use of petrol by pooling my car or by using public transport where it is necessary.
3. I shall segregate non-biodegradable waste consisting of plastic, glass, and metal from other waste and send it for recycling.
4. Whenever I will go shopping I will carry my own jute bag.
5. I shall pass on my books and notes to my junior instead of disposing of as waste paper

Q. 24. How local people can be used for successful forest management?

Answer: • The people who live in villages around the forests, take firewood from the trees.

- They usually lop the branches of the trees & pluck their leaves but don't cut down the whole trees.

- On the whole, people living near the forests usually use the resources of the forests in a way that much damage is not done to the environment.
- The people living near the forests had developed practices to ensure that the forest resources were used in a sustainable manner.
- There are many examples which suggest that the involvement of local communities is necessary for any conservation effort.
- The Bishnoi community of Rajasthan is one such example: Amrita Devi Bishnoi is still remembered with reverence for the way she fought for protecting the khejri trees in Khejrali village. She; along with 363 other people; sacrificed her life for the protection of khejri trees in 1731.
- The 'Amrita Devi Bishnoi National Award for Wildlife Conservation' has been named in her honour.

Q. 25. What is water harvesting? Write any two advantages of it.

Answer: Water harvesting is a method of holding rainwater on the surface of the earth, to make it collected under the ground, so as to renew groundwater.

The two advantages of water harvesting:

- (a) Giving people control over their local water resources to ensure that overexploitation of water resources will be reduced.
- (b) The water stored in the ground provides moisture for the growth of the vegetation over a wide area and is protected from human contamination.

Q. 26. Construction of a dam on a river often results in the reduction of fish catch. Why is it so?

Answer: ● Dams are been constructed on river which holds large amount of water.

- It makes water stagnant but it provides suitable living conditions for lots of aquatic organisms which habitat in dam water.
- Since fishes breed in clean and running water it cannot sustain and breed in stagnant river water in a dam.
- Therefore, as they can't sustain in the dam their breed decrease and some eventually die.
- Hence, we can say that construction of dams on the river often results in a reduction of fish catch.

Q. 27. State the advantages of constructing dams across the rivers.

Answer: • Dams are built to control water through the placement of a blockage of earth, rock, and concrete across a stream or river.

- Dams are usually constructed to store water in a reservoir, which is then used for a variety of applications such as irrigation and municipal water supplies.
- Reservoir water can also be directed to flow through hydraulic turbines, producing electric power for use in homes and industries.
- Hydroelectric power is considered a renewable source of energy because the reservoir water that is used to generate electricity is continuously replenished.
- A dam using locks and canals, such as the series of locks on the canal, water flows through a human-made water route that must overcome elevation differences.

Q. 28. Why is water considered as the most valuable natural resource?

Answer: • Water is one of the most important substances on earth.

- All plants and animals must have water to survive.
- If there was no water there would be no life on earth. Apart from drinking it to survive, people have many other uses for water.
- Fresh water is used by all living beings except marine organisms. They use sea water.
- Fresh can be obtained from three natural sources.
- Natural sources of fresh water are rain, surface water, and groundwater.
- The body of living beings is composed of water.
- Water is required for all the chemical reactions such as digestion, excretion in the body (metabolism), similarly plants need water for growth, photosynthesis, respiration and other metabolic reactions require water.
- Therefore, water is a valuable resource.

Q. 29. What is petroleum? Which other substances are derived from crude petroleum?

Answer: • Petroleum also is known as crude oil or simply oil is a fossil fuel.

- Petroleum is mainly composed of hydrocarbons.
- It was formed by the degradation of bio-mass millions of years ago and it is a non-renewable resource which can be exhausted.
- Other substances derived from crude petroleum are:

Gasoline 46%

Diesel 20%

Kerosene 8%

Propane 7%

Petrochemical 2%

Petroleum coke 2%

Q. 30. Write a few steps to reduce consumption of coal and petroleum.

Answer: Coal is used to produce electricity. So, if we can save electricity, then the coal consumption will be automatically reduced. Similarly, the petroleum products such as kerosene and LPG are used for cooking food, and petrol and diesel are used as fuel in motor vehicles, so to reduce the consumption of petroleum we should practice some smart ways to reduce it.

Some of the steps which can be taken to conserve energy resources (like coal and petroleum) are as follows:

- (a) Switch off the electrical appliances when they are not in use. Use energy efficient electrical appliances such as Compact Fluorescent Lamps (CFL) and fluorescent tube-lights to save electricity
- (b) Use stairs instead of lift to go up at least t 3 floors. This will save electricity.
- (c) Pressure cookers should be used for cooking food to save fuels.
- (d) Solar cookers should be used to cook food whenever possible.
- (e) Use public transport as far as possible to reduce be improved so that people do not commute in their personal vehicles. This will save a lot of petrol and diesel.

Q. 31. In what ways damages are caused to the environment?

Answer: • Damage to the environment is one of the biggest threats that are being looked at in the world today.

- Environmental degradation can happen in a number of ways. When resources are exhausted, the environment is considered to be damaged or harmed.

The following factors damage the environment:

(a) Overpopulation: Rapid population growth demands more food, clothes, and shelter. This puts pressure on natural resources which damages our environment.

(b) Pollution: Air, water, land or noise pollution is harmful to the environment. Air pollution pollutes the air that we breathe which causes health issues. Water pollution degrades the quality of water that we use for drinking and other purposes.

(c) Deforestation: Rapid growth in population and industries are two of the major causes of deforestation. Deforestation contributes to global warming as decreased forest size puts carbon back into the environment.

Q. 32. Forest resources ought to be used in a manner that is both environmentally and developmentally sound. Explain this briefly.

Answer: • We need to accept that human interference has been very much a part of the forest landscape.

- What has to be managed in nature and how much to be the interference with nature.
- Forest resources need to be used in a manner that the environment is preserved, the benefits of the controlled exploitation go to the local people.
- A process needs to be developed in which decentralized economic growth and ecological conservation go hand in hand.
- The type of economic and social development we want will ultimately determine whether the environment will be conserved or further destroyed.
- The environment must not be regarded as a pristine collection of plants and animals. It is a vast and complex entity that offers a range of natural resources for our use.
- We need to use these resources with care for our economic growth as well as social growth.

Q. 33. Quote some instances where human intervention saved the forest from destruction.

Answer: ● The Chipko Andolan (Hug the Trees Movement) was the result of a grass root level effort to end the separation of people from their forests.

- The movement originated from an incident in a remote village called Reni in Garhwal during the early 1970s.

- There was a dispute between the local villagers and a contractor who had been allowed to cut trees in a forest close to the village.

- On a particular day, the contractor's workers appeared in the forest to cut the trees, seeing this the women of the village reached the forest quickly and clasped the tree trunks thus, preventing the workers from felling the trees.

- The protest spread in that area, as a result, the contractor had to withdraw its plan to cut trees.

Q. 34. Explain "industrialization is one of the main causes of deterioration of the environment."

Answer: ● To meet the needs of a growing population, new industries are being setup. To set up industry lots of natural resources are depleted.

- Emissions from the factory lead to air pollution, water pollution, and soil pollution.

- It causes acid rain that leads to the degradation of land quality. Global warming, climatic changes are the major consequences of industrialization.

- Industrial wastes including toxins enter in the food chain causes a number of undesirable effects to living beings and animals.

- Industrial effluent damages the natural biological purification mechanism of sewage treatment causing several soils and water-borne diseases.

- Radioactive industrial pollutant cause undesirable disease when food containing radio-nuclides is taken by man.

Q. 35. How can an individual contribute or make a difference to the management of (i) Forest? (ii) Fossil fuels?

Answer: An individual contributes to the management of:

(i) Forest and wildlife:

(a) We should protest against the mass cutting of trees (deforestation). Each one of us can plant as many plants can and motivate others to do that.

- (b) We should protest against the poaching of wild animals.
- (c) We can prevent hunting of wildlife by reporting on time to authorities concerned.
- (d) We should stop the acquisition of forest land for our use.

(ii) Fossil fuels:

- (a) Coal and petroleum are fossil fuels.
- (b) Coal is used to generate electricity. Therefore, to save coal we should save electricity by minimizing its wastage.
- (c) To save petrol, we should take a public transport or practice carpooling to avoid excessive use of petroleum.
- (d) We should use alternative sources of energy such as hydro-energy and solar energy instead of depending largely on coal and petroleum.

Q. 36. Why are environmentalists insisting upon sustainable natural resource management? Give reasons.

Answer: • Sustainable development refers to a balance between natural resources, ecosystems, and the requirement of natural resources, for the development and growth of humans living.

- Sustainable development also includes judicious use of our natural resources so that they are of use to the future generations.

- Environmentalists insisting on sustainable natural resource management because of following reasons:

- (a) Most of the natural resources are limited. Human population is increasing at a tremendous rate, use of natural resources is increasing at an exponential rate.

- (b) Need to conserve resources for future generations.

- (c) Equal distribution of resources for equal benefit.

- (d) Need to reduce the damage caused to the environment because of the over-exploitation and utilization of resources.

- Thus, a proper and planned usage of natural resources is essential for an overall balance with respect to the environment and also prevention of over usage of natural resources.

- Sustainable development helps in maintaining the quality of the environment by restoring the natural and economic resources of different habitats.

Q. 37. CFL is costly as compared to the incandescent electric bulb. Even, then it is advised that incandescent bulbs should be replaced by CFLs. Why so?

Answer: A compact fluorescent light (CFL) is just like the standard florescent lights that are common in use. The CFL has a smaller tube that's manufactured in a swirl shape so it fits the basic form of an incandescent bulb. The CFL work by exciting gases with electricity, due to this feature, in CFL little heat is generated, most of the electricity used goes directly into providing light. It's less wasteful, so you end up spending less on your regular electric bill by making your home more energy efficient, and the bulbs last much longer.

Advantages of CFLs:

- (a) High Efficiency: CFLs use 20% to 33% less electricity than incandescent bulbs.
- (b) Long Life: With no filament to burn out, florescent lights tend to last 8 to 15 times longer than incandescent bulbs.
- (c) Cost effective: the Up-front price of CFL is higher, but by using less electricity and helping you avoid changing bulbs, you'll end up spending less in the long run.
- (d) Safety: CFLs are even safer than incandescent bulbs since lower temperature means the risk of home fire is less.

Q. 38. Give reasons for switching over from fossil fuels to other sources of energy.

Answer: • Sun, wind, and water are alternate sources of energy.

- Energy from these sources is non-polluting, renewable and efficient.
- To produce these energies all you need is sunlight, running water and wind.
- Not only does the use of renewable energy sources help reduce global carbon dioxide emissions, but they also add some much-needed flexibility to the energy resource mix by decreasing our dependence on fossil fuels which are limited.
- These renewable energy sources create their own energy.
- The object is to capture and harness their mechanical power and convert it into electricity in the most effective and productive manner possible.

- There's more than enough renewable energy sources to supply all of the world's energy needs forever; however, the challenge is to develop the capability to effectively and economically capture, store and use the energy when needed.

Q. 39.A. Parineeta and Vivek were commenting on the increase in power rates by the Electricity Board. Parineeta said, "the Electricity Board was raising the tariffs almost every six months. Why is this happening?" Vivek said, "the consumption of power is increasing and its production is becoming costlier because of the increase in the price of fuels. We must do something to check its consumption."

Suggest some ways to limit the consumption of power.

Answer: Here are some ways to limit the consumption of power:

- (a) Make a habit of turning off all lights and electronics when not in use.
- (b) Replace your incandescent light bulbs with LED bulbs. LED light bulbs are affordable and easy to find at your local store. These light bulbs use up to 75% less energy than incandescent light bulbs
- (c) Turn off your computer and other electronic devices when they are not in use.
- (d) Recycle recyclable materials such as paper, plastic, glass, and other items can reduce your energy consumption significantly.
- (e) Use solar energy, wind energy or hydroelectric energy to reduce power consumption.

Q. 39.B. Parineeta and Vivek were commenting on the increase in power rates by the Electricity Board. Parineeta said, "the Electricity Board was raising the tariffs almost every six months. Why is this happening?" Vivek said, "the consumption of power is increasing and its production is becoming costlier because of the increase in the price of fuels. We must do something to check its consumption."

What will happen, if we do not adhere to controlled use of power?

Answer: If we do not adhere to controlled use to power, there will be continued loss of natural resources such as coal and water.

Let's try to understand:

- Coal is used to generate electricity in power plants. Coal plants are ineffective as only 35 percent of coal's energy is made into electricity in coal-based power plants. The rest is lost as heat.

- Coal burning in power plants uses huge amounts of water to create steam for turning its turbines.
- Burning coal causes smog, acid rain, global warming, and air toxics. All these pollute the air.

Q. 40.A. Meera and Radhika were on a trip to Mussoorie. They set out on a short trekking on the hills. They were closely watching the flora and fauna in the area. They felt that the area has sufficient biodiversity. This was possible because the forests had remained safe.

There was no visible sign of cutting of trees. Meera said with pride to Radhika, "do you know women have played a prominent role in the protection of forests? Without their brave acts, the situation would have been different and miserable."

Name two incidents from history when women environmentalists saved the trees from falling by greedy and powerful people.

Answer: (a) Bishnoi movement:

Amrita Devi, a female villager could not bear the destruction of both her faith and the village's sacred trees. She hugged the trees and encouraged others to do the same. 363 Bishnoi villagers were killed in this movement. The Bishnoi tree martyrs were influenced by the teachings of Guru Maharaj Jambaji, who founded the Bishnoi faith in 1485 and set forth principles forbidding harm to trees and animals.

(b) Chipko movement:

Gaura Devi, Sudesh Devi Bacchi device of Advani village of Tehri-Garhwal tied the sacred thread around trunks of trees and they hugged the trees. This movement was called 'Chipko Movement' or 'hug the tree movement'. The main demand of the people in these protests was that the benefits of the forest should go to local people.

Q. 40.B. Meera and Radhika were on a trip to Mussoorie. They set out on a short trekking on the hills. They were closely watching the flora and fauna in the area. They felt that the area has sufficient biodiversity. This was possible because the forests had remained safe.

There was no visible sign of cutting of trees. Meera said with pride to Radhika, "do you know women have played a prominent role in the protection of forests? Without their brave acts, the situation would have been different and miserable."

What is meant by biodiversity?

Answer: The variety of life exists on Earth, in all its forms and all its interactions. The existence of variety of life is called Biodiversity. The term was coined in 1985. It is the most complex feature of our Earth and it is the most vital. "Without biodiversity, there is no future for humanity. But the loss of biodiversity creating a huge problem to mankind and other life.

Challengers

Q. 1. Which of the following statements (s) is/are correct about the renewable natural resource?

- A. It gets exhausted soon**
- B. It requires millions of years to replenish**
- C. It reappears at the rate it is used**
- D. It cannot be replenished within a short period**

Answer: A natural resource which can be used repeatedly and is replaced naturally is called a renewable resource. For examples air, water, solar energy, and biomass.

Q. 2. Which of the following statements about the construction of a dam are incorrect?

- A. It provides an eco-Friendly environment**
- B. It is used to generate electricity**
- C. It displaces the largely poor tribals that do not get any benefit**
- D. It prevents the occurrence of floods in the river**

Answer: The poor tribals who have been displaced by various development projects do not get any benefits from the projects. They are and are isolated from their lands and forests without adequate compensation. For example, the oustees of the Tawa Dam built in the 1970s are still fighting for the benefits they were promised.

Q. 3. 'Narmada Bacho Andolan' has been organized under the leadership of

- A. Ravi Shankar Maharaj**
- B. Medha Patekar**
- C. Amrita Devi Bishnoi**
- D. Baba Ram Dev**

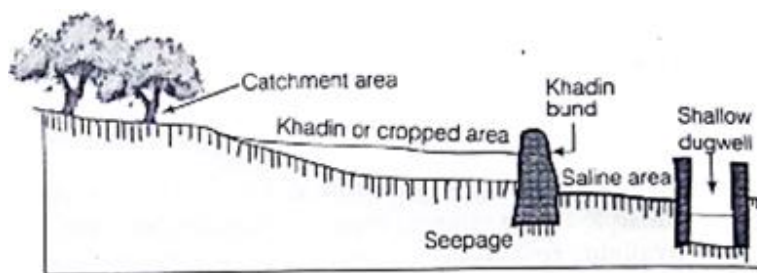
Answer: Medha Patkar initiated the Narmada Bachao Andolan. This Andolan (movement) has been in operation for the last 32 years. The Narmada Bachao Andolan (movement) fights for the rights of people, affected by the Sardar Sarovar Dam project, which aims at building dams across the Narmada River.

Q. 4. Which of the following causes an imbalance in the environment?

- A. The excess growing of green plants
- B. Using more renewable resources
- C. Biodiversity
- D. Increasing human population

Answer: Human population grows at an exponential rate (example 2,4,6,8 and so on) whereas, resources grow at an arithmetic rate (example 1,2,3,4 and so on). From this, it is evident that resources do not meet the demand of a growing population. Thus, it causes an imbalance in the environment.

Q. 5. Consider the following system of water harvesting



Which of the following systems is depicted by the given figure?

- A. Kulh system
- B. Khadin system
- C. Tals
- D. Both (b) and (c)

Answer: Khadin system is the ancient water harvesting in Rajasthan. These water storage structures still in use today. These harvesting techniques are highly locale specific and the benefits are also localized. Giving people control over their local water resources ensures that mismanagement and over-exploitation of these resources are reduced or removed.

Q. 6. Which of the following movements means 'Hug the trees movement'?

- A. Narmada Bachao Andolan
- B. Chipko Andolan
- C. Tehri Andolan
- D. Biodiversity movement

Answer: The Chipko movement was a non-violent agitation aimed at protection and conservation of trees. This movement (Andolan) is best remembered for a group of women gathered around the trees for protecting them against cutting. The movement also brought about a change in attitude regarding their own status in society. The uprising against the felling of trees.

Q. 7. Complete the following by choosing the correct option:

In 1972, the West Bengal Forest Department recognized its failures in reviving the degraded _____ forests in the south western districts of the state.

- A. Teak**
- B. Bamboo**
- C. Sal**
- D. Rosewood**

Answer: Traditional methods of surveillance and policing by forest department had led to the destruction of Sal forest in the district of Midnapore in West Bengal. Later villagers were involved in the protection of 1,272 hectares of badly degraded Sal forest. In return for help in protection, villagers were given employment in developing forest.