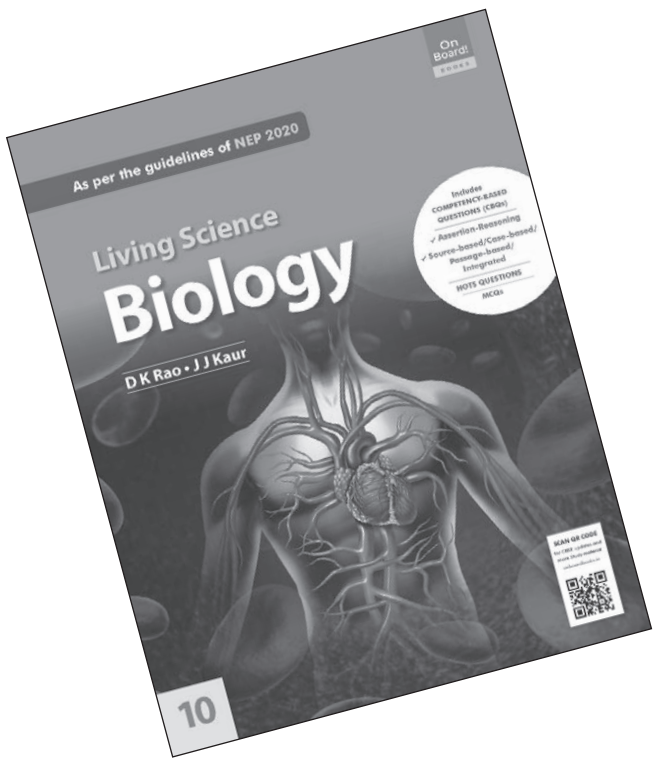
TEACHER'S HANDBOOK

CBSE Living Science
BIOLOGY
Book 10



On Board! BOOKS

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Contents

CHAPTER – 1

LIFE PROCESSES

Unit I. Nutrition

P. 18 CHECK YOUR PROGRESS 1

A. Chloroplast

Green colour is due to chlorophyll.

B. $\underset{\text{(Carbon dioxide)}}{6CO_2} + \underset{\text{(Water)}}{12\,H_2O} \xrightarrow[\text{Chlorophyll}]{\text{Light energy}} \underset{\text{(Glucose)}}{C_6H_{12}O_6} + \underset{\text{(Water)}}{6H_2O} + \underset{\text{(Oxygen)}}{6O_2}$

C. **1.** T
2. F
3. T
4. T
5. T

D. Water

P. 21 CHECK YOUR PROGRESS 2

A. Match column A with column B.

1. (e) **2.** (d) **3.** (a)
4. (b) **5.** (c)

B. Answer these questions.

1. Enzyme present in saliva of human beings is salivary amylase or ptyalin. Salivary amylase present in saliva begins the chemical digestion of carbohydrates in the mouth by breaking down starch into maltose.

2. Hydrochloric acid makes the gastric juice acidic in nature due to which inactive pepsinogen is converted to active pepsin to begin the digestion of protein present in food to smaller molecules, peptones.

3. Pepsin is secreted in the stomach and acts only under acidic condition while trypsin is secreted in pancreas and acts under alkaline condition.

P. 25 CHECK YOUR PROGRESS 3

A. **1.** mouth
2. masticate
3. saliva
4. salivary amylase
5. buccal cavity
6. oesophagus
7. stomach
8. gastric juice
9. gastric enzymes
10. hydrochloric acid
11. acidic
12. gastric enzymes
13. pepsinogen
14. pepsin

B. Complete the following enzymatic reactions:

1. Proteins $\xrightarrow[\text{Acidic Medium}]{\text{Pepsin}}$ proteoses + peptones.

2. Fat $\xrightarrow{\text{Bile}}$ emulsified fat.

3. Acidic chyme $\xrightarrow[NaHCO_3]{\text{Bile}}$ alkaline chyme.

4. Maltose $\xrightarrow{\text{Maltase}}$ glucose.

5. Sucrose $\xrightarrow[\text{Alkaline medium}]{\text{Sucrase}}$ glucose + fructose.

P. 27 EXERCISES

A. Objective Type Questions

I. Choose the most appropriate answer.

1. b. **2.** a. **3.** b. **4.** d.
5. b. **6.** d. **7.** b. **8.** d.
9. b. **10.** d. **11.** d

II. Write true or false.

1. True **2.** True **3.** True **4.** True
5. False **6.** True **7.** True **8.** True

III. Fill in the blanks.

1. Chloroplast **2.** Iodine
3. Autotrophs **4.** Chloroplasts
5. Carbon dioxide **6.** Chlorophyll

IV. Assertion-Reasoning type questions. CBQ

1. (c) **2.** (a) **3.** (b) **4.** (a)
5. (c) **6.** (d) **7.** (b)

V. Very short answer type questions.

1. Organisms which can prepare their own food are called autotrophs. For example, plants and some bacteria.

2. Heterotrophic nutrition can be defined as a type of nutrition in which energy is obtained by intake and digestion of organic substances derived from plants or animals.

3. The essential raw materials for photosynthesis are carbon dioxide, water, light energy and chlorophyll.

4. Sunlight is the source of energy used by plants in photosynthesis.

5. Holozoic nutrition is the feeding of complex organic matter by ingestion, which is subsequently digested and absorbed.

6. Food A is glucose and food B is starch.

7. Alkaline medium is required for the proper functioning of intestinal juice. It is essential for the action of pancreatic enzyme. It is essential for the action of pancreatic enzyme.
8. Pepsin
9. Proteins are absorbed in small intestine and water is absorbed in large intestine.
10. Trypsin, chymotrypsin, amylase and lipase are present in the pancreatic juice.
11. Pancreas and liver pour their secretions into duodenum.
12. Glucose
13. Caecum, colon and rectum
14. Parasites – Cuscuta and Plasmodium Saprophytes – Bacteria, fungi, yeast and mushrooms (a living organism).
15. In the colon, extra water is absorbed and the remaining material becomes a semi-solid mass to form faeces.
16. Pyloric sphincter controls the release of food from the stomach to the small intestine.
17. The length of the small intestine in herbivores is longer than that in carnivores to facilitate the digestion of cellulose.
18. Chloroplast
19. Digestive enzymes helps in digesting complex food materials into simpler molecules for absorption by the body.
20. Consumers are heterotrophs.
21. Pepsin is secreted in the stomach and acts only under acidic condition and trypsin is secreted in pancreas and acts under alkaline condition.

VI. Name the following.

1. Autotrophs
2. Saprophytic
3. Parasites
4. Parasitic
5. Herbivores
6. Chloroplast
7. Stomata
8. Glucose (sugar)
9. Oxygen

VII. Name the enzyme connected with the following.

1. Salivary amylase
2. Trypsin
3. Lipase
4. Lactase
5. Sucrase
6. Maltase
7. Peptidases
8. Rennin

B. Short Answer Type–I Questions.

1. Parasite is an organism which lives outside or inside the body of another organism called host and derives nourishment from that host. The mode of nutrition by which parasites get their food is called parasitic nutrition.
2. Parasites need a living organism on which they live whereas saprophytes feed on dead and decaying matter. Fungi show saprophytic as well as parasitic nutrition.
3. The animals which feed on both plants as well as flesh of animals are known as omnivores. For example, pig and crow.
4. Herbivores eat only plants and plant products whereas carnivores are flesh eating animals.
5. Photosynthesis is a biochemical process by which plants manufacture their own food using carbon dioxide and water as raw materials in the presence of light and chlorophyll. The overall equation of photosynthesis is

$$6CO_2 + 12H_2O \xrightarrow{\text{light, chlorophyll}} C_6H_{12}O_6 + 6H_2O + 6O_2$$

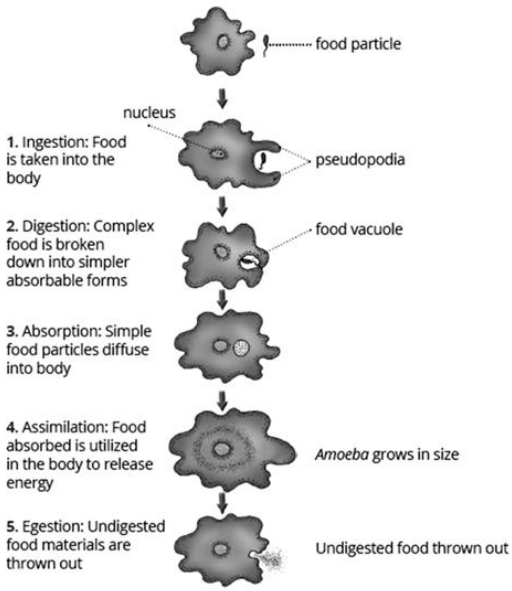
6. Gastric hydrochloric acid provides an acidic medium which is essential for the activity of gastric enzymes. It also kills the bacteria which might have come along with the food, dissolves mineral salts. It also activates pepsinogen to pepsin.
7. Pepsin is a gastric protease, an enzyme which breaks down proteins into proteoses and peptones. Lipase acts on emulsified fats and converts them to fatty acids and glycerol.
8. Deodenum, jejunum and ilium are the three parts of small intestine. The intestinal lining is provided with finger-like projections called villi. Each villus is supplied with blood capillaries and a lymph vessel or lacteal. In villi, monosaccharides, peptides and amino acids are absorbed either by diffusion or active transport into blood capillaries. Fatty acids, glycerol, water, inorganic salts and vitamins are also absorbed in the small intestine.
9. Functions of liver include the following: (i) It secretes a fluid called bile which plays an important role in emulsification of fats and creating an alkaline medium which is essential for the action of pancreatic enzymes. (ii) It regulates the blood-sugar level by retaining excess glucose and converting it into glycogen which is stored in the liver cells. (iii) It produces red blood cells in the embryo.
10. The major end products of digestion are amino acids for proteins, glucose for carbohydrates, and fatty acids and glycerol for fats.
11. The intestinal lining is provided with finger-like projections called villi. Each villus is supplied with blood capillaries and a lymph vessel or lacteal. In villi, monosaccharides, peptides and amino acids are absorbed either by diffusion

or active transport into blood capillaries. Fatty acids, glycerol, water, inorganic salts and vitamins are also absorbed in the small intestine.

12. Liver regulates blood-sugar level in the body by retaining the excess glucose and converting it to glycogen which is stored in the liver cells.

C. Short Answer Type-II Questions.

1. The process of intake of food, its digestion, absorption, and distribution to different parts of the body for utilization is known as nutrition. The different steps involved in nutrition in *Amoeba* are ingestion, digestion, absorption, assimilation and egestion.



Nutrition in *Amoeba*

2. Saprophytic nutrition: The mode of nutrition in which organisms obtain their food from dead and decaying organic matter is called saprophytic nutrition.
Parasitic nutrition: The mode of nutrition in which an organism lives inside or outside the body of an organism called host and derives nourishment from it is called parasitic nutrition.
Holozoic nutrition: Holozoic nutrition is the feeding of complex organic matter by ingestion, which is subsequently digested and absorbed.

3. The events that occur in plants during photosynthesis are: (i) Capturing light energy from the sunlight by chlorophyll. (ii) Transformation of light energy into chemical energy, and splitting of water into hydrogen and oxygen. (iii) Reduction of carbon dioxide by hydrogen ions to form glucose (a carbohydrate) by utilizing the chemical energy. Role of stomata in photosynthesis: Stomata are minute pores present either on lower or both the surfaces of leaves to facilitate exchange of gases (carbon dioxide and oxygen) between leaf and the atmosphere.

4. To show that light is necessary for photosynthesis.

Procedure

Take a potted plant and destarch its leaves by keeping it in dark for 2–3 days.

Take a black paper and cut simple 'L' shape in it making a stencil. Cover a leaf with the paper. Leave the set-up in daylight for 4–6 hours.

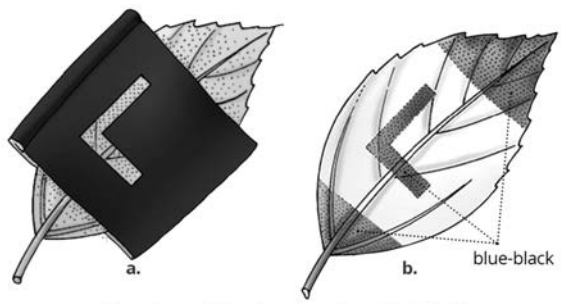
Detach the leaf and test it for presence of starch.

Observation

You will observe that only the part of the leaf that could get light through the cut out design and the other exposed parts of the leaf turn blue-black showing the presence of starch in them.

Conclusion

This shows that light is necessary for photosynthesis.



Experimental set-up to show that light is necessary for photosynthesis

5. During the day when light intensity is greater, carbon dioxide is continuously absorbed through stomata of leaves from the atmosphere as well as that produced by plants and animals during respiration.

Plants absorb water from the soil by their root hair. This water is then transported up to the stem and leaves through the xylem vessels.

Thus, carbon dioxide diffuses in from the atmosphere and water is transported into mesophyll tissue by osmosis.

6. Nitrogen is an essential raw material required by plants to make proteins and other compounds. Nitrogen is taken up in the form of inorganic nitrates or nitrites from soil or in form of organic compounds prepared by soil bacteria like *Rhizobium* from atmospheric nitrogen.

7. The digestion of food in humans starts by ingestion in the mouth. In the buccal cavity, the teeth chew and masticate the food into smaller pieces. This is called mechanical digestion. The three pairs of salivary glands in the mouth secrete saliva containing an enzyme salivary amylase which breaks starch and complex carbohydrates into maltose.

In the stomach, the food is acted upon by the gastric juice which contains hydrochloric acid and an enzyme pepsin which breaks the proteins into proteoses and peptones.

From the stomach the food passes into the intestine where food is digested and absorbed. In the small intestine food is mixed with bile juice, pancreatic juice and intestinal juice. The absorption of food takes place with the help of villi which line the surface of small intestine.

From the small intestine the food finally passes into the large intestine where practically no digestion takes place. The undigested food is stored in the rectum and excreted out through anus.

8. Gastric hydrochloric acid provides an acidic medium which is essential for the activity of gastric enzymes. It also kills the bacteria which might have come along with the food, dissolves mineral salts. It also activates pepsinogen to pepsin. Enzymes which function in the human digestive system include amylase, pepsin, trypsin, chymotrypsin, lipase, maltase, sucrase and lactase.

9. The deference between photosynthesis and cellular respiration is such that the products of one system are the reactants of the other. Photosynthesis involves the use of energy from sunlight, water and carbon dioxide to produce glucose and oxygen. Cellular respiration uses glucose and oxygen to produce carbon dioxide and water.

10. Digestion of fat takes place in the small intestine. Fat reaches the small intestine in the form of large globules. The liver releases bile juice which emulsifies the fat i.e. it breaks down the large globules into smaller globules. Lipase, in alkaline medium, acts on this emulsified fat and converts these fat molecules into fatty acids and glycerol which can be used by the body.

11. Substances such as proteins, carbohydrates, fats, minerals, etc., contained in food that support the growth of organisms and provide raw materials for the biosynthesis of body constituents are called nutrients. Nutrients are broadly divided into three groups namely, energy-yielding, body-building and growth-regulating or protective.

12. Difference between autotrophic and heterotrophic nutrition.

	Autotrophic nutrition	**Heterotrophic nutrition**
(i)	Organism prepares its own food and is not dependent on any other organism	Organism does not prepare its own food and is therefore, dependent on other organisms
(ii)	Chlorophyll is required	Chlorophyll is not required
(iii)	Green plants and some bacteria have autotrophic mode of nutrition	All the animals, fungi and most of the bacteria have heterotrophic mode of nutrition.

13. The organisms which get their food supply from dead or decaying organic matter are known as saprotrophs or saprophytes. Parasites are living organisms which live inside or outside the body of their host for their survival whereas saprophytes live on dead and decaying matter.

14. Photosynthesis is necessary for our survival because it is the ultimate source of oxygen and energy for all living organisms. It provides food for all and fixes atmospheric carbon dioxide. The raw materials essential for photosynthesis are carbon dioxide, water, light energy and chlorophyll. Chloroplast is the site of photosynthesis.

15. **a.** Salivary amylase or ptyalin

b. Peristalsis

c. Pyloric sphincter

d. Small intestine

e. Pepsinogen

f. Small intestine

16. Autotrophic nutrition in plants takes place through the process of photosynthesis. Carbon dioxide, water, chlorophyll pigment, and sunlight are the necessary conditions required for autotrophic nutrition. Carbohydrates (food) and O_2 are the by-products of photosynthesis.

D. Long Answer Type Questions

1. Organs of digestive tract include the alimentary canal and associated glands. The functions of the organs are as follows:

Teeth – mastication of food

Salivary glands – production of saliva

Tongue – mixing food with saliva and helps in swallowing

Pharynx – connects the oral cavity with oesophagus

Oesophagus – contains mucus which helps in slipping the food down

Stomach – produces gastric juice which makes food acidic and digests protein

Small intestine – site of complete digestion of carbohydrates, proteins and fats.

Duodenum – food mixes with bile, emulsification of fats and oils

Jejunum – no specific function

Ileum – secretes intestinal juice, here completely digested food is absorbed

Large intestine:

Caecum – no specific function

Colon – absorption of water

Rectum – holds undigested matter (faeces) prior to defecation

2. Oesophagus is a muscular tube-like structure extending from the pharynx to the stomach. It is 25 cm in length. Muscles in the wall of the oesophagus work in a coordinated manner to push food and liquids down into the stomach. This muscular movement is called peristalsis. Peristalsis involves a series of muscular contractions and relaxations, which propel food forward until it reaches a ring-like valve called the 'sphincter' at the junction of the oesophagus and the stomach.

3. The digestive glands associated with the alimentary canal in humans are salivary glands, pancreas and liver. Salivary glands secrete saliva which contains salivary amylase or ptyalin. It acts on carbohydrate (starch) to produce maltose. The pancreas produces pancreatic juice that aids in digestion. Liver is the largest gland in the human body. The digestive functions of liver include secretion of bile juice which emulsifies fats and creates an alkaline medium which is essential for the action of pancreatic enzyme, regulation of blood sugar level by retaining excess glucose and converting it into glycogen which is stored in the liver cells.

4. Bile is a yellowish green watery fluid produced in the liver, stored in gall bladder and transported through bile duct leading to the duodenum. Bile is devoid of enzymes but contains bile pigments and bile salts.

The bile salts help in breaking down oil droplets into small globules, forming a milky emulsion (emulsification) to facilitate further digestion of fats.

$$\textbf{Fat} \xrightarrow{\text{Bile}} \textbf{Emulsified fat}$$

$$\textbf{Acidic Chyme} \xrightarrow[NaHCO_3]{\text{Bile}} \textbf{Alkaline Chyme}$$

Since these steps facilitate digestion in human body, hence, bile juice is considered important.

5. a. Rennin – converts casein of milk into paracasein which is further digested by pepsin.

$$\textbf{Casein} \rightarrow \textbf{Paracasein}$$

b. Trypsin – acts on proteins and converts them into polypeptides.

$$\textbf{Proteins} \rightarrow \textbf{Polypeptides}$$

c. Maltase – acts on maltose to produce glucose.

$$\textbf{Maltose} \rightarrow \textbf{Glucose}$$

d. Ptyalin – acts on starch to produce maltose

$$\textbf{Starch} \rightarrow \textbf{Maltose}$$

6. Steps in digestion

Digestion in mouth:

The digestion of food in humans starts by ingestion in the mouth to the buccal cavity. In the buccal cavity the teeth chew and masticate the food into smaller pieces. This is called mechanical digestion.

The three pairs of salivary glands in the mouth secrete saliva. Saliva contains an enzyme salivary amylase which breaks starch and complex carbohydrates into maltose.

From the mouth the food is passed through the oesophagus into the stomach. The oesophagus is lined with mucous-secreting cells. Mucus helps in passing the food into the stomach.

Digestion in stomach:

In the stomach, the food is acted upon by the gastric juice which contains hydrochloric acid and gastric enzymes which breaks the proteins into proteoses and peptones. The partial digestion of food in the stomach reduces food to a paste-like form called chyme.

Digestion in the small intestine:

In the intestine, the food is digested and

absorbed completely. In the small intestine, food is mixed with bile juice, pancreatic juice and intestinal juice.

In the duodenum, the food is simultaneously acted upon by bile, pancreatic and intestinal juice. These secretions are alkaline.

Action of bile: Bile juice is produced by the liver and it contains bile pigments and bile salts. The bile salts help in emulsification of fats.

Action of pancreatic juice: Pancreatic juice contains several enzymes namely, trypsin which acts on proteins and converts them into polypeptides, chymotrypsin which acts on specific proteins and converts them into polypeptides, amylase that acts on starch and produces maltose, and lipase that converts fats to fatty acids and glycerol.

Action of intestinal juice: The intestinal juice also contains enzymes namely erepsin which acts on peptides to produce amino acids, maltase that acts on maltose to produce glucose, sucrase that acts on sucrose to produce glucose and fructose, and lactase to produce glucose and galactose from lactose.

By the action of all these enzymes the food is completely digested and converted into a liquid form called chyle which is further subjected to absorption in the small intestine.

7. The glucose molecule in the small intestine (the ileum) is absorbed with the help of villi which line the surface of small intestine. The intestinal lining is provided with finger-like projections called villi. Each villus is supplied with blood capillaries and a lymph vessel or lacteal. In villi, glucose is absorbed either by diffusion or active transport into blood capillaries. The glucose absorbed is utilized for release of energy.

8. Summary of digestion in human beings in tabular form: (see table given below)

E. Source-based/Case-based/Passage-based/ Integrated assessment questions CBQ

1. a. (iii) **b.** (iv) **c.** (ii) **d.** (i) **e.** (iii)

2. a. (iii) **b.** (i) **c.** (iii) **d.** (ii) **e.** (ii)

Table for question 8:

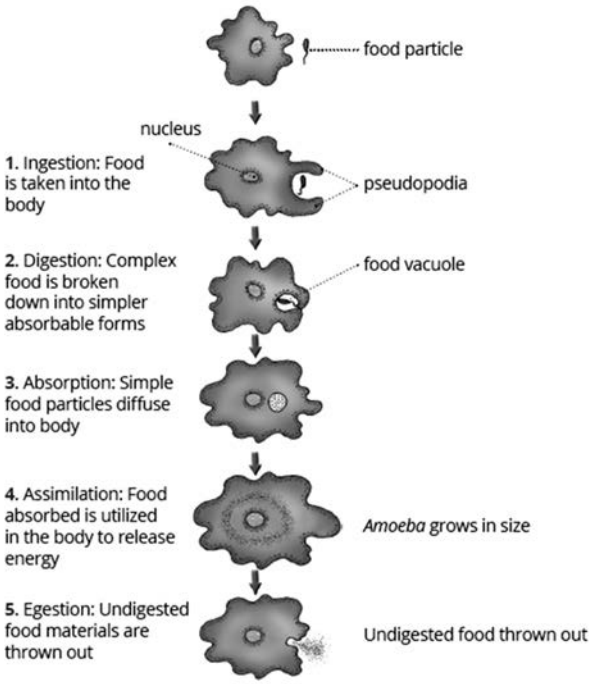
Summary of digestion in humans

Part of Alimentary Canal		Digestive Gland	Digestive Juice	Enzyme	Action
Mouth		Salivary gland	Saliva	Salivary amylase (ptyalin)	Starch → maltose
Stomach		Gastric glands (stomach wall)	Gastric juice and hydrochloric acid	Pepsin	Proteins → Proteoses + peptones
				Rennin (in infants)	Casein → Paracasein
SMALL INTESTINE	Duodenum	Liver	Bile	No enzyme	Emulsification of fats
		Pancreas	Pancreatic juice	Trypsin	proteins → polypeptides
				Amylase	starch → maltose
				Lipase	emulsified fats → fatty acids + glycerol
	Ileum	Intestinal glands	Intestinal juice	Erepsin or peptidases	peptides → amino acids
				Maltase	maltose → glucose
				Sucrase	sucrose → glucose + fructose
				Lactase	lactose → glucose + galactose
				Lipase	emulsified fats → fatty acids + glycerol

P. 31 HIGHER ORDER THINKING SKILLS (HOTS) QUESTIONS

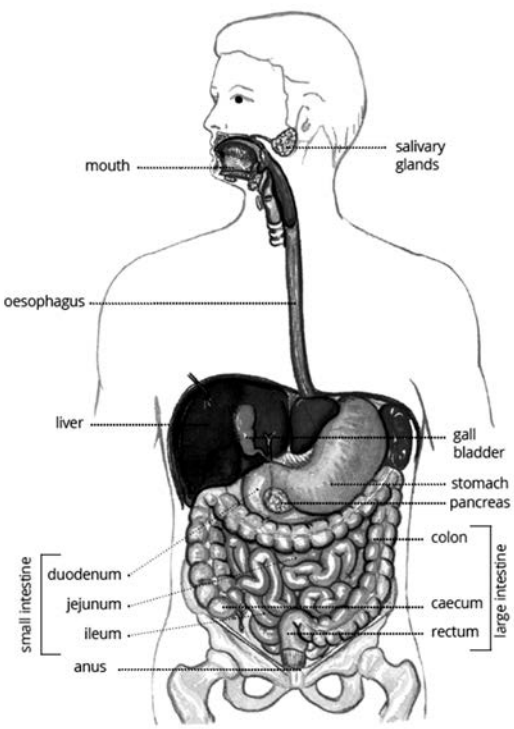
A. Make the following diagrams.

1. Diagram showing Nutrition in *Amoeba*



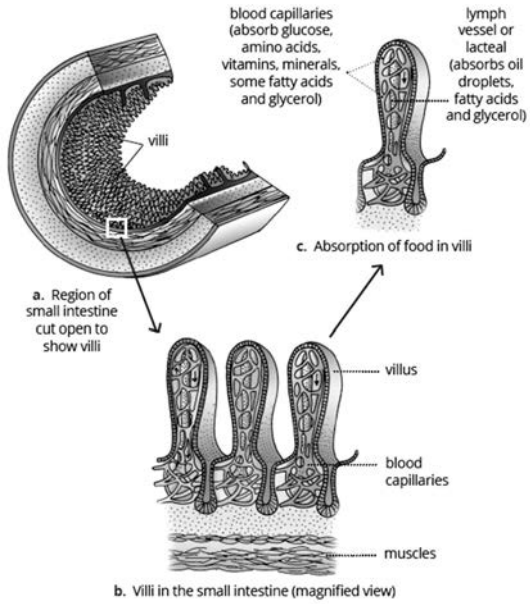
Nutrition in *Amoeba*

2. Diagram showing digestive system in human beings



Digestive system and associated digestive glands in humans

3. Structure of a villus



Internal structure of the wall of small intestine

B. The given diagram shows the internal structure of a part of alimentary canal in humans.

1. This structure is the magnified view of villi in the small intestine. These are finger-like projections each of which is supplied with blood capillaries and a lymph vessel or lacteal.

2. **a.** villus

b. blood capillaries

c. intestinal muscles

3. Part **a** is villus and it helps in absorption of food. Each villus is supplied with blood capillaries and a lymph vessel or lacteal. In villi, monosaccharides, peptides and amino acids are absorbed either by diffusion or active transport into blood capillaries. Fatty acids, glycerol, water, inorganic salts and vitamins are also absorbed in the small intestine.

C. 1. Gland **A** is salivary gland, substance **B** is saliva and enzyme **C** is salivary amylase.

2. Tube **D** is oesophagus and movement **E** is peristaltic movement.

3. Substance **F** is hydrochloric acid, **G** is gastric enzyme and **H** is mucus.

D. Given alongside is the diagram of human digestive system.

1. **a.** stomach

b. duodenum

c. small intestine

d. liver

e. large intestine

f. rectum

g. oesophagus

2. a. stomach

b. liver

c. small intestine

d. stomach

e. large intestine

3. Part **e** is the large intestine and in the large intestine practically no digestion takes place. There is absorption of water.

P. 132 VALUE-BASED QUESTIONS (OPTIONAL)

1. a. The leaves of the potted plant kept in the cupboard lost their colour and wilted as there was no sunlight. In the absence of sunlight, the rate of photosynthesis was limited and the formation of chlorophyll itself depends on the exposure of the plant to light. Since, the potted plant was kept in dark, chlorophyll was not formed and thus leaves turned yellow, lost their colour and wilted.

b. Photosynthesis is the biological process which was affected due to the shifting of the plant in the cupboard.

c. Shreya should place the potted plant back in the balcony where sufficient sunlight is available for the plant to photosynthesize and chlorophyll formation or activation.

2. During day, the leaves use some of the oxygen that is produced during photosynthesis for respiration and the rest is diffused out into the atmosphere. Also, all the carbon dioxide produced by respiration is used up during photosynthesis. Thus, during day oxygen diffuses out and carbon dioxide diffuses in.

At night, only respiration occurs and photosynthesis does not take place. So, to carry out respiration, the oxygen from the air (produced during daytime) diffuses into the leaves and carbon dioxide is diffused out into the atmosphere. Thus, the balance of oxygen and carbon dioxide remain almost constant.

3. a. The digestion of idli starts by ingestion in the mouth, to the buccal cavity. In the buccal cavity the teeth chew and masticate the food into smaller pieces. This is called mechanical digestion.

Digestion in mouth: The three pairs of salivary glands in the mouth secrete saliva. Saliva contains an enzyme salivary amylase which breaks starch and complex carbohydrates into maltose.

From mouth the food is passed through the oesophagus into stomach. The oesophagus is lined with mucous-secreting cells. Mucus helps in passing the food into the stomach.

Digestion in stomach: In the stomach the food is acted upon by the gastric juice which contains hydrochloric acid and gastric enzymes which breaks the proteins into proetoses and peptones. The partial digestion of food in the stomach reduces food to a paste-like form called chyme.

Digestion in the small intestine: In the intestine, the food is digested and absorbed completely. In the small intestine food is mixed with bile juice, pancreatic juice and intestinal juice. In the duodenum, the food is simultaneously acted upon by bile, the pancreatic and intestinal juice. These secretions are alkaline.

Action of pancreatic juice: Pancreatic juice contains several enzymes namely, trypsin which acts on proteins and converts them into polypeptides, chymotrypsin which acts on specific proteins and converts them into polypeptides, amylase that acts on starch and produces maltose, and lipase that converts fats to fatty acids and glycerol.

Action of intestinal juice: The intestinal juice also contains enzymes namely erepsin which acts on peptides to produce amino acids, maltase that acts on maltose to produce glucose, sucrase that acts on sucrose to produce glucose and fructose and lactase to produce glucose and galactose form lactose.

By the action of all these enzymes the food is completely digested and converted into a liquid form called chyle which is further subjected to absorption in the small intestine.

b. Dental caries are caused due to a bacterium *Streptococcus mutans* which acts on sugars and produces acids that soften the enamel. As a result, gradual softening of enamel and dentine takes place. Bacteria along with food particles accumulate on the teeth and form dental plaque which can lead to inflammation and infection around teeth.

c. I would have advised Dhruv to brush his teeth twice a day, that is, in the morning and after having dinner to prevent dental caries.

Unit II. Respiration

P. 38 CHECK YOUR PROGRESS 4

1. Respiration is defined as the process of the release of energy in the form of ATP from glucose molecules that are broken down to carbon dioxide and water molecules.
2. Energy released during respiration is stored in the cells of the body in the form of ATP. ATP is the energy currency for cellular processes which is used to fuel all other activities in the cell. ATP is a high energy molecule. Whenever there is energy requirement, the ATP is broken down to release a fixed amount of energy which is utilised for body functions like protein synthesis, contraction of muscles conduction of nerve impulse and many other activities taking place in the body related to functioning of cells.
3. 38 ATP molecules.
4. Cytoplasm.
5. Stomata.
6. The leaves of a plant have tiny pores called stomata. The exchange of respiratory gases in the leaves takes place by the process of diffusion through stomata. Oxygen from air diffuses into a leaf through stomata and reaches all the cells where it is used in respiration. The carbon dioxide produced during respiration diffuses out from the leaf into the air through the stomata. The direction of diffusion of these gases depends upon the requirement of the plant and the environmental conditions.
7. Body surface or skin, air tubes or tracheae, gills and lungs.

P. 43 CHECK YOUR PROGRESS 5

1. Epiglottis.
2. Cartilaginous rings keep the trachea in dilated position and prevent it from collapsing.
3. When we swallow food or drink water, the epiglottis covers the trachea to prevent food or water from entering the respiratory tract.
4. Diaphragm.
5. Haemoglobin

   Haemoglobin has a great affinity for oxygen – each haemoglobin molecule binds to four molecules of oxygen. The oxygen attached to haemoglobin is carried with the blood to various tissues. From tissues, carbon dioxide binds to haemoglobin and carried to lungs for expiration.
6. During breathing in, the air containing oxygen fills up alveoli of lungs. The concentration of oxygen is higher in alveoli than that in surrounding blood capillaries. Thus oxygen diffuses from the alveoli into the blood present in lung capillaries. The oxygen binds to haemoglobin to all parts of the body. In the tissues, oxygen is used up in various metabolic activities and hence the concentration of oxygen is lower in tissues than the blood capillaries. Therefore, oxygen is diffused from blood capillaries to tissues due to its high concentration in blood than tissues.
7. In tissues, carbon dioxide is produced due to various metabolic activities. Hence, the concentration of carbon dioxide is greater in tissues than in capillaries. Thus carbon dioxide is diffused from body cells to capillaries due to its higher concentration in body cells and tissues. Carbon dioxide being soluble in water, is transported in dissolved form in our blood. Some carbon dioxide is also transported by haemoglobin. This carbon dioxide rich blood reaches the alveoli of lungs. Since, blood present in the capillaries has high concentration of carbon dioxide it diffuses out from blood capillaries into the alveoli. Finally, the air rich in carbon dioxide is expelled out from the lungs during exhalation.
8. Diffusion.

P. 44 EXERCISES

A. Objective Type Questions.

I. Choose the most appropriate answer.

1. d.	**2.** b.	**3.** a.	**4.** a.
5. d.	**6.** c.	**7.** a.	**8.** d.
9. b.	**10.** c.	**11.** b.	**12.** c.

II. Fill in the blanks.

1. pleura	**2.** diaphragm
3. oxygen, carbon dioxide	**4.** active
5. passive	**6.** alveoli

III. Match the items in Column A with those in Column B.

1. f.	**2.** d.	**3.** c.	**4.** a.
5. b.	**6.** g.	**7.** h.	**8.** e.

IV. Assertion-Reasoning type questions. CBQ

1. (a)	**2.** (c)	**3.** (b)	**4.** (a)
5. (b)	**6.** (b)	**7.** (b)	

V. Name the following.

1. Respiration	**2.** Cytoplasm
3. Aerobic respiration	**4.** 38
5. 2	**6.** Gills

VI. Very short answer type questions.

1. Glycolysis and Krebs cycle

2. In aerobic respiration, pyruvate is the intermediate product while carbon dioxide, water and released energy are the end products.

3. Ethyl alcohol, carbon dioxide and energy in alcoholic fermentation, and lactic acid and energy in lactate fermentation.

4. Anaerobic respiration

5. Carbon dioxide

6. **(i)** Yeast derive energy through alcoholic fermentation during anaerobic respiration.

(ii) Human muscles respire anaerobically during vigorous physical exercises or hard physical work. This is called lactic acid fermentation.

7. During photosynthesis, food is prepared using carbon dioxide, water and sunlight releasing oxygen while in respiration, food is broken down using oxygen releasing carbon dioxide, water and energy.

8. In cockroach, the respiratory organ is tracheal system and in fish, the respiratory organs are gills.

9. Frog

10. Cellular respiration involves release of energy by oxidation of food and conversion of the energy released into biologically usable form, such as ATP inside cell.

11. Respiration is initiated in the cytoplasm and completed in the mitochondria.

12. Mitochondria

13. Earthworm and frog

14. In insects, gaseous exchange occurs through a system of tubes called the tracheal system. The tracheal system consists of tiny holes called spiracles and the air tubes called tracheae that further bifurcate into tracheoles. Gills are the respiratory organs in fish. During breathing, the fish takes in water through its mouth and sends it over the gills. Gaseous exchange occurs across the gill surface where the dissolved oxygen is absorbed by the blood and is transported to all the cells of the body. The carbon dioxide produced during respiration is carried back by the blood capillaries and is expelled in the surrounding water.

15. Trachea

16. Alveoli

B. Short Answer Type-I Questions.

1. Right lung has three and left lung has two lobes.

2. Oxygen enters the blood in alveoli of lungs. When we breathe in oxygen fills up alveoli of lungs. The alveoli are surrounded by very thin blood capillaries carrying rich supply of blood. The concentration of oxygen in alveoli is higher than that in the deoxygenated blood in capillaries. This difference causes oxygen to diffuse from the alveoli into the lung capillaries. This diffusion continues as long as the concerned molecules are unequally distributed.

Oxygen exits from the blood capillaries at body cells. In the tissues oxygen is used up in various activities and carbon dioxide is produced. Hence in tissues the concentration of oxygen is decreased than that in the capillaries. Therefore oxygen is diffused from blood capillaries to tissues.

3. Carbon dioxide enters the blood at body cells. In the tissues carbon dioxide is produced by various activities. Hence carbon dioxide is present in a greater concentration in tissues than in capillaries. Therefore, carbon dioxide is diffused from body cells to capillaries.

Carbon dioxide exits from the blood through alveoli of lungs. The blood present in the capillaries has high concentration of carbon dioxide which it has absorbed from body tissues. Therefore, carbon dioxide diffuses out from blood capillaries into the alveoli.

4. The full form of ATP is adenosine triphosphate. The ATP is synthesised from ADP (adenosine diphosphate), which is a low energy content. This ADP combines with an inorganic phosphate molecule (P) to form ATP as follows:

$$ADP + \textcircled{P} \xrightarrow{\text{energy}} ADP \sim \textcircled{P} = ATP$$

C. Short Answer Type-II Questions.

1. Differences between aerobic respiration and anaerobic respiration

	Aerobic Respiration	Anaerobic Respiration
(i)	Occurs in presence of oxygen.	Occurs in absence of oxygen.
(ii)	CO_2 and water are produced.	Lactic acid or alcohol is produced.
(iii)	High energy is liberated (38 ATP).	Relatively lesser energy is liberated (2ATP).

2. The opening and closing of stomata depends upon the changes in turgor pressure of guard cells. When water gets inside the guard cells, their turgor pressure increases and they expand. As a result, stomatal pores open. When guard cells lose water, the turgor pressure inside the guard cells decreases. This results in the closing of the stomatal pore.

3. The tracheal system consists of tiny holes called spiracles and the air tubes called tracheae that further bifurcate into tracheoles. Insects respire through the tracheal system that allows the oxygen in the inhaled air to diffuse directly to the tissues.

4. If the mouth of fish is kept closed, the fish will die because fish take in water through their mouth and sends it over the gills where the dissolved oxygen is taken up by blood capillaries. Closing its mouth will adversely affect respiration.

5. Fishes take in water through their mouths and sends it over the gills where the dissolved oxygen is taken up by the blood capillaries.

   Terrestrial organisms use the oxygen in the atmosphere for respiration. This oxygen is absorbed by different organs in different animals. All these organs have a structure that increases the surface area which is in contact with the oxygen-rich atmosphere. Since the exchange of oxygen and carbon dioxide has to take place across this surface, this surface is very fine and delicate. In order to protect this surface, it is usually placed within the body, so there have to be passages that will take air to this area. In addition, there is a mechanism for moving the air in and out of this area where the oxygen is absorbed.

6. Two main differences between respiration and breathing are as follows:

	Breathing	Respiration
(i)	It is a physical process.	It is a biochemical process.
(ii)	It involves exchange of gases.	It is concerned with oxidation of food.

7. The inner surface of nasal passage is lined by fine hairy ciliated epithelium and mucous-secreting cells. Both cilia and mucus check the entry of microbes and dust particles in the respiratory passage. If dust particles enter the nasal cavity, they get stuck to mucus and are thrown out by the movement of cilia.

8. The air entering our nose is generally cold and contains dust particles. The inner surface of nasal passage is lined by fine hairy ciliated epithelium and mucous-secreting cells. Both cilia and mucus check the entry of microbes and dust particles in the respiratory passage. If dust particles enter the nasal cavity, they get stuck to mucus and are thrown out by the movement of cilia. Mucus and rich blood supply inside the nasal passage make the inhaled air moist and warm.

9. Haemoglobin is the respiratory pigment which has a high affinity for oxygen and is present in the red blood corpuscles. Haemoglobin combines with oxygen to form oxyhaemoglobin and delivers oxygen to the cells in different parts of the body.

10. Blood transports oxygen from the lungs to the tissues and carbon dioxide from the tissues to the lungs. After releasing oxygen to tissues, on way back, haemoglobin combines with CO_2 and releases CO_2 into the alveoli from where it is exhaled out.

11. In the tissues, concentration of oxygen is lesser than that in blood capillaries. So oxygen diffuses from blood capillaries into the tissues. Similarly, in the tissues, concentration of carbon dioxide is higher than that in blood capillaries. So carbon dioxide leaves tissue cell and enters blood capillaries by diffusion.

12. The carbon dioxide produced in the muscles during oxidation of carbohydrates diffuses into the blood capillaries in the muscles. Red blood cells in the blood carry it to the lungs where it is released.

13. In case of complete absence of oxygen, pyruvate does not enter mitochondria but is converted into ethyl alcohol. A number of microorganisms such as yeast derive energy using alcoholic fermentation. In another situation, when sufficient oxygen is not available, pyruvate is converted into lactic acid or lactate by the process known as lactate fermentation.

14. Aerobic respiration (in presence of oxygen) in mitochondria, word equation is:

    Glucose + Oxygen = Carbon dioxide + Water + Energy (38ATP)

    Anaerobic respiration (in absence of oxygen) in yeast, word equation is:

    Glucose + enzymes = ethanol + carbon dioxide + energy (2ATP)

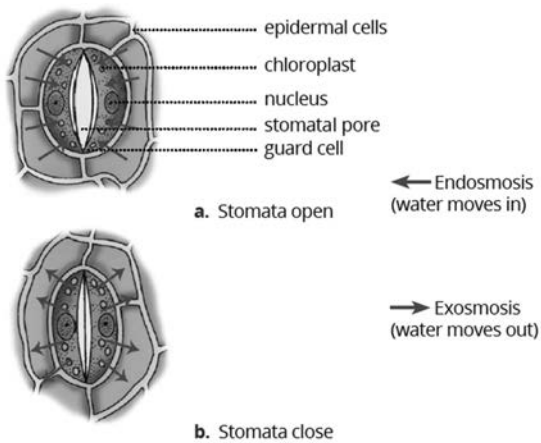
    Anaerobic respiration (in absence of oxygen) in muscle cells, word equation is:

    Glucose + enzymes = lactic acid + energy (2ATP)

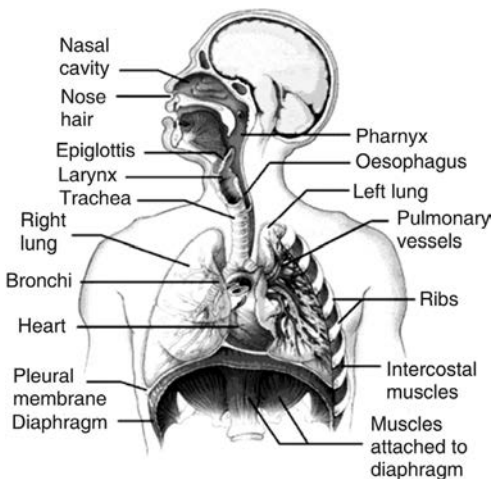
15. Terrestrial organisms breathe by using atmospheric oxygen whereas aquatic organism takes oxygen dissolved in water. As the percentage of oxygen is very low in the water, aquatic organisms have to show a much faster rate of breathing as compared to terrestrial organisms to get a sufficient amount of oxygen. Thus terrestrial organisms have an advantage over aquatic organisms.

16. Make the following diagrams.

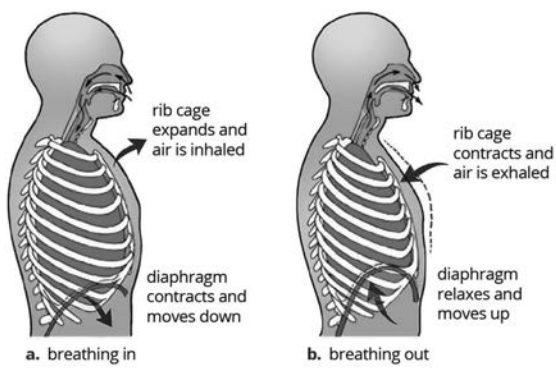
a. Opening and closing of stomata



b. Respiratory system in human beings

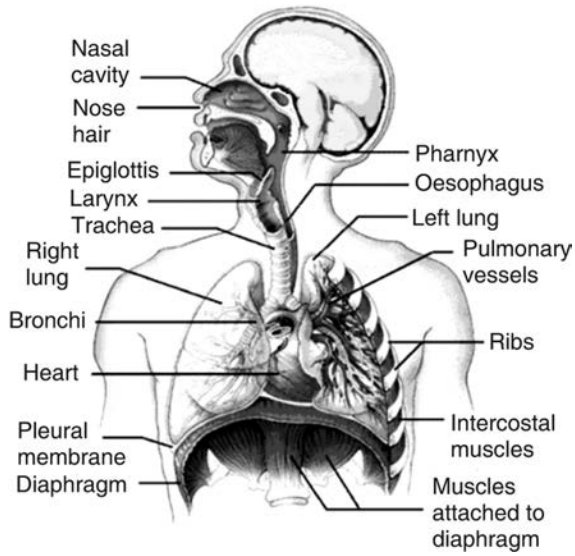


c. Inspiration and expiration in human beings showing the position of diaphragm and ribs



D. Long Answer Type Questions.

1. Gaseous exchange in lungs



The concentration of oxygen in lung alveoli is higher than that in deoxygenated blood in capillaries. This difference causes oxygen to diffuse from the alveoli into the lung capillaries. The blood contained in the capillaries has concentration of carbon dioxide which it has absorbed from body tissues. Therefore, carbon dioxide diffuses out from blood capillaries into the alveoli.

Gaseous exchange in tissues

In the tissues oxygen is used up in various activities and carbon dioxide is produced. Hence, in tissues the concentration of oxygen is decreased than that in the capillaries, whereas carbon dioxide is present in a greater concentration in tissues than in capillaries. Therefore, oxygen is diffused from blood capillaries to tissues and carbon dioxide is diffused from body cells to capillaries.

2. The respiratory system in humans include nostrils, nasal cavity, pharynx, larynx, trachea, bronchi, bronchioles, alveolar sacs or alveoli and lungs.

Nostrils and nasal cavity

The nasal passages are paired, tube-like structures. The inner surface of nasal passage is lined by fine hairy ciliated epithelium and mucous-secreting cells. Both cilia and mucus check the entry of microbes and dust particles in the respiratory passage. If dust particles enter the nasal cavity, they get stuck to mucus and are thrown out by the movement of cilia. Mucus and rich blood supply inside the nasal passage make the inhaled air moist and warm.

Pharynx

The pharynx is situated at the back of the mouth. From the nasal cavities, the air moves into the pharynx. The pharynx opens into the larynx which leads to the trachea.

Trachea

The trachea or windpipe extends into the thoracic cavity. It lies on the ventral side of the oesophagus. Its wall is provided with incomplete C-shaped cartilaginous rings. These keep the trachea in dialated position and prevent it from collapsing. The ciliated epithelial lining and the mucus help in preventing any dust particle or microbe from entering the lungs.

Bronchi and bronchioles

At its lower end, the trachea splits into primary bronchi. Within the lung each bronchus divides into several bronchioles. The smallest tubes, called respiratory bronchioles are about 0.5 mm in diameter. Each bronchiole terminates in a sac called alveolar sac. Alveoli are the actual sites of respiratory exchange. Each alveolus has a dense network of blood capillaries on its outer side.

3. Breathing has a cyclic pattern involving two steps:

(i) Inhalation or inspiration

(ii) Exhalation or expiration

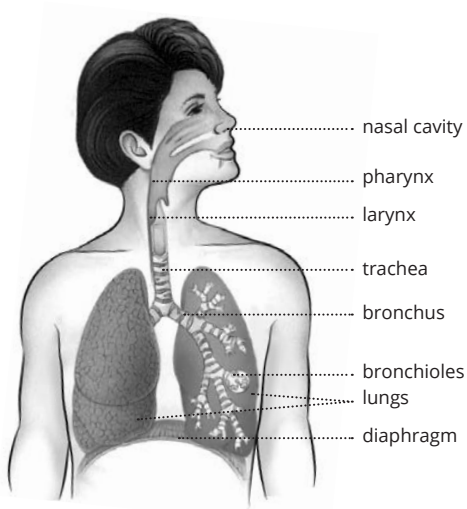
Inhalation or breathing in, is always an active, energy requiring process involving contractions mainly of the diaphragm and external intercoastal muscles. It results from an increase in the thoracic cavity volume and is brought about by simultaneous contraction of intercoastal muscles. This produces a forward and outward movement of the rib cage. This action straightens and contracts the diaphragm. This results in an increase in the volume of thoracic cavity and is followed by an automatic increase in lung volume. As lungs expand, the air pressure in them reduces and air rushes into them from the atmosphere through the air passages.

Exhalation or breathing out, is brought about by relaxation of the intercoastal and diaphragm muscles. The ribs return to their original position and the diaphragm becomes dome shaped. Both these movements reduce the thoracic cavity volume and the lungs return to their original size. The air rushes out of the lungs due to the increase in pressure above that of the atmosphere inside the lungs.

4. Alveoli are the actual sites of respiratory exchange. Hence, these are called functional units of lungs. Each alveolus has a dense network of blood capillaries on outer side. There are over 480 million alveoli present in the lungs. The larger the surface area, the greater is the gaseous exchange.

5. a. Aquatic organisms breathe faster as compared to terrestrial organisms. The amount of oxygen present in the water is very less as compared to the amount of oxygen present in the air. That is why aquatic organisms need to breath faster as compared to terrestrial organisms to get more oxygen.

b.



The human respiratory system

E. Source-based/Case-based/Passage-based/ Integrated assessment questions CBQ

1. **a.** (iv) **b.** (iii) **c.** (iv) **d.** (iv) **e.** (iv)

2. **a.** (ii) **b.** (ii) **c.** (ii) **d.** (ii) **e.** (i)

P. 48. HIGHER ORDER THINKING SKILLS (HOTS) QUESTIONS

A. Given below are two diagrams. (see book for diagram)

1. Identify the parts of the respiratory system below:

a. nostril **b.** pharynx
c. lung **d.** diaphragm
e. nasal passage **f.** trachea
g. bronchi **h.** alveoli

2. a. The concentration of oxygen in alveoli is higher than that in deoxygenated blood in capillaries. This difference causes oxygen to diffuse from the alveoli into the

lung capillaries. The blood present in the capillaries has concentration of carbon dioxide which it has absorbed from body tissues. Therefore, carbon dioxide diffuses out from blood capillaries into the alveoli.

b. In the lungs, carbon dioxide is more concentrated in the blood. This is because carbon dioxide is diffused from the body cells to capillaries due to its higher concentration in body cells and tissues.

c. Yes, exchange of carbon dioxide depends on the concentration of oxygen in the alveoli and the blood because the exchange of gases takes place by diffusion and diffusion is driven by a concentration gradient.

B. The diagram given below shows a section through an alveolus and a capillary in the lung. Match 1–4 with the labels 'a' to 'd' in the diagram.

1. blood with a high carbon dioxide content **d**

2. blood with a high oxygen content **a**

3. contains a red pigment **c**

4. where gases enter and leave the alveolus **b**

C. The graph below shows changes in the volume of air in the lungs of an athlete after a race.

1. a. air is entering the lungs.

2. c. 12000 cm^3

3. d. 60

D. Study the diagram given below.

1. d. **2.** d. **3.** d. **4.** a.

E. Given below is a table showing certain activities of the respiratory system. Match the parts given below with the activities described.

Part	Description
1	carries air from the throat to the lungs
2	flattens to make air move into the lungs
3	protects the lungs
4	where carbon dioxide leaves the blood

1. windpipe

2. diaphragm

3. ribcage

4. alveoli

F. 1. Since photosynthesis occurs during daytime only and respiration occurs for 24 hours, the concentration of carbon dioxide is expected to be more than oxygen. At night, when there is no photosynthesis occurring, CO_2 generation is the major exchange activity going on. But during the day, CO_2 generated during respiration is used up for photosynthesis, hence there is no CO_2 release. Instead, oxygen release is the major event at this time. This balances the concentration of oxygen and carbon dioxide.

2. Oxygen is the molecule in the air that we breathe. Once oxygen molecule is inhaled it travels through the nostrils, nasal cavity, pharynx, larynx, trachea, bronchi, bronchioles, alveolar sacs or alveoli and lungs.

(i) **Nostrils and nasal cavity:** Oxygen is inhaled by the nostrils and enters the nasal passages that are paired, tube-like structures. The inner surface of nasal passage is lined by ciliated epithelium and mucous-secreting cells.

(ii) **Pharynx:** The pharynx is situated at the back of the mouth. From the nasal cavities, the oxygen moves into the pharynx. The pharynx opens into the larynx which leads to the trachea.

(iii) **Trachea:** The oxygen then enters the trachea or windpipe which extends up to the thoracic cavity. It lies on the ventral side of the oesophagus. The ciliated epithelium and mucus help in preventing any dust particle or microbe from entering the lungs.

(iv) **Bronchi and bronchioles:** Within the lung, oxygen enters each bronchus which divides into several bronchioles. The smallest tubes, called respiratory bronchioles are about 0.5 mm in diameter. Each bronchiole terminates in a sac called alveolar sac. Alveoli are the actual sites of respiratory exchange. These alveoli are in close association with capillaries and provide a large surface area for gaseous exchange.

3. Ciliated epithelium helps in the prevention of entry of dust particles or microbe. If it is made of squamous epithelium, the removal of dust particles or any other foreign substance would not have been possible. Due to this the bronchioles may get blocked thereby adversely affecting the gaseous exchange.

4. Oxygenated blood reaches the brain via different arteries. Once oxygen reaches the capillary beds it diffuses through the capillary walls to the cerebrospinal fluid (CSF). CSF then supply oxygen to brain tissue.

As the concentration of carbon dioxide is higher in the brain tissue as compared to blood capillary, so the carbon dioxide diffuses from

tissues into CSF. From CSF then it diffuses to blood capillary and is taken to the lungs. In the lungs, alveoli is having higher concentration of oxygen and lower concentration of carbon dioxide. So the oxygen diffuses from alveoli to blood capillaries and carbon dioxide diffuses from blood capillaries into alveoli. Carbon dioxide from alveoli is expelled out from nose.

5. Alveoli are the actual sites of respiratory exchange. Alveoli are tiny air sacs across which gaseous exchange takes place. These alveoli are in close association with capillaries and provide a large surface area for gaseous exchange. Each alveolus has a dense network of blood capillaries on its outside. There are over 480 million alveoli present in the lungs. The total surface area of all the alveoli is about 80 square metres which is almost equal to the area of a tennis court. Hence, diffusion of gases occurs in the alveolar region only and not in the other parts of respiratory system.

P. 49 VALUE-BASED QUESTIONS (OPTIONAL)

1. The inner surface of the nasal passage is lined by fine hairy ciliated epithelium and mucous-secreting cells. Both cilia and mucus check the entry of microbes and dust particles in the respiratory passage. If dust particles enter the nasal cavity, they get stuck to mucus and are thrown out by the movement of cilia. Mucus and the rich blood supply inside the nasal passage make the inhaled air moist and warm.

2. In smokers, the walls separating alveoli break down, leading to abnormal alveoli. Thus, the area for gaseous exchange is reduced. This leads to reduction in gaseous exchange by lungs. As a result of this, the heart has to pump in more blood which may lead to heart attack.

3. a. Due to trekking, the oxygen is used up very fast in muscle cells than it is received from blood. Thus, in the absence of oxygen, anaerobic respiration takes places in muscle cells to release energy. This process is called lactate fermentation. During this process, there is a built-up of lactic acid in muscles. This sudden build-up of lactic acid in our muscles causes muscle cramps.

b. During this process, the pyruvate is converted into lactic acid in the absence of oxygen and a small amount of energy is also released. This process is called lactate fermentation.

c. Values showed by Abdul are scientific attitude and caring nature.

4. a. Mary must be suffering from anemia due to low hamoglobin level.

b. The doctor advised for a blood test to confirm the haemoglobin level as Mary appeared pale and was feeling weak and tired for the past few days.

c. The school showed readiness and sincerity for sudden health-related issues.

Unit III. Transportation

P. 53 CHECK YOUR PROGRESS 6

1. Root hair.
2. Conducting tissues – xylem and phloem. Water absorbed by the root is transported through xylem tissues while food prepared by the leaves is transported through phloem tissues.
3. The function of phloem is to transport food nutrients such as glucose and amino acids from leaves to other parts of the plant. The transport of soluble products of photosynthesis through phloem is known as translocation.
4. There are two mechanisms for transport of water from roots to other parts of the plants: (i) At the roots, cells in contact with the soil actively take up ions. This creates a difference in the concentration of these ions between the root and the soil. Water, therefore moves into the root from the soil through osmosis. There is a steady moment of water into root xylem, creating a column of water that is steadily pushed upwards. (ii) Provided that the plant has an adequate supply of water, the water which is lost through the stomata is replaced by water from the xylem vessels in the leaf. Evaporation of water molecules from the cells of a leaf creates a suction which pulls water from the xylem cells of the roots. Transpiration helps in the absorption and upward movement of water and minerals dissolved in it from roots to the leaves.
5. Water is conducted to all parts of the plant through xylem. In xylem tissue, vessels and tracheids of roots, stems and leaves are interconnected to form a continuous system of water-conducting channels reaching all parts of the plant.
6. Phloem.
7. The food prepared in the leaf is translocated to other parts of the plant through phloem. Hence, the leaves do not get fatter day by day.

P. 55 CHECK YOUR PROGRESS 7

1. Plasma is a straw-coloured aqueous component of blood. It contains water (90–92%), inorganic salts (1–2%) and organic compounds (7–8%). Plasma transports food, carbon dioxide and nitrogenous waste in dissolved form.
2. Blood is red in colour due to iron containing respiratory pigment, haemoglobin.
3. Haemoglobin present in blood carries oxygen and carbon dioxide to different parts of the body. In the absence of haemoglobin, transport of oxygen and carbon dioxide will be affected.
4. **Functions of blood:**
   (i) Blood transports oxygen from the lungs to the tissues and carbon dioxide from the tissues to the lungs.
   (ii) The digested food is absorbed by blood at small intestine and transported to different organs of the body.
   (iii) The metabolic waste substances produced in the body are transported by blood to kidneys for their removal from the body.
   (iv) Blood transports chemical substances like hormones from the site of their secretion to the target organ.
5. There are three main components of the transport system in human beings – (i) heart, (ii) circulating blood, and (iii) blood vessels.

   Functions of these components are as follows:

   (i) Heart: It is responsible for pumping the oxygenated blood throughout the human body.

   It receives deoxygenated blood back from various body parts. This impure blood is further transported to the lungs to undergo the process of oxygenation.

   (ii) Blood: Blood is a fluid connective tissue participating in the process of transferring oxygen, carbon dioxide, nutrients, and nitrogenous wastes.

   (iii) Blood **vessels:** Blood vessels are responsible for the transport of the blood throughout the human body. There are two types of blood vessels- arteries and veins.

P. 61 CHECK YOUR PROGRESS 8

1. Pericardium.
2. Haemoglobin
3. Left side of the heart.
4. Double circulation prevents the mixing of oxygenated blood with deoxygenated blood. This ensures highly efficient supply of energy necessary for warm-blooded animals.
5. **Functions of lymph:**
   (i) It transports fat from the intestine to the blood.
   (ii) It drains excess tissue fluid from the intercellular spaces back into the blood.
   (iii) It carries lymphocytes and antibodies from the lymph nodes to the blood.
   (iv) It destroys microorganisms and foreign particles in the lymph nodes.

6. Arteries

7. Pulmonary vein.

P. 63 EXERCISES

A. Objective Type Questions

I. Choose the most appropriate answer.

1. a. 2. b. 3. c. 4. a.
5. c. 6. d. 7. c. 8. b.
9. b. 10. b. 11. c.

II. Fill in the blanks.

1. RBCs 2. Platelets
3. Bicuspid valve 4. Aorta

III. Assertion-Reasoning type questions. CBQ

1. (a) 2. (b) 3. (c) 4. (c)
5. (a) 6. (b) 7. (b)

IV. Name the following.

1. Xylem and phloem 2. Transpiration
3. Guard cells 4. Phloem
5. Haemoglobin 6. Plasma
7. White blood cells 8. Arteries
9. Veins 10. Interventricular septum
11. Pericardium 12. Pulmonary circulation
13. Sphygmomanometer

V. Very short answer type questions.

1. Red blood corpuscles, white blood corpuscles and platelets
2. Arteries have comparatively thicker walls because blood flows with higher speed and under pressure in arteries.
3. The blood in arteries flows under pressure and loss of blood will be more when punctured.
4. Left side
5. The left ventricle has the thickest wall because the left ventricle has to pump blood into vessels which in turn carry the blood to the entire body.
6. Coronary artery and coronary vein
7. Auricles are the receiving chambers and ventricles are the pumping chambers.
8. The left atrium receives the oxygenated blood. The right ventricle pumps deoxygenated blood.
9. The lymphatic system is an open system which does not have a pumping organ as heart in blood circulatory system. Hence, the lymphatic circulation takes place very slowly.
10. Plasma is straw-coloured aqueous solution. As the plasma part of our blood is devoid of erythrocytes so it looks straw-coloured.
11. About 90–92 per cent of plasma is water.
12. The walls of ventricles are thicker than that of auricles because ventricles have to pump blood to the other parts of the body away from heart whereas auricles have to pump blood only into ventricles, a part of heart.
13. When the blood enters the lungs, it is deoxygenated whereas when it leaves the lungs, it becomes oxygenated after gaseous exchange.

B. Short Answer Type–I Questions.

1. The two types of transport systems in plants are xylem and phloem. Failure of any of them will adversely affect the plant. Failure of xylem in plant A prevents transport of water and minerals from the roots to other parts of the plant. Hence the plant will die. The failure of phloem in plant B will inhibit transport of food from leaves to other parts of the plant and the plant will eventually die.
2. Water and minerals are essential for survival of plants. Plants absorb water and soluble mineral salts from the soil by their root system to survive. When the gardener pours water in the pot, the plant absorbs water and minerals as the epidermis of root tips is permeable to water. The absorbed water is transported to all parts of the plant. The plant thus survives.
3. Minerals and nutrients must be regularly transported in an organism because all the cells in the organism must get the nutrition for energy production and survival. Food is transported in plants through phloem tissues.
4. The pericardial fluid protects the heart from mechanical injury.

   Four functions of blood in circulatory system include:

   (i) Transport of nutrients from the site of absorption to different organs of the body.
   (ii) Transport of respiratory gases from lungs to tissues.
   (iii) Transport of respiratory gases from tissues to lungs.
   (iv) Transport of waste substances to the organs concerned with their removal from the body.
5. The blood circulates two times in the human heart:

   (i) Systemic circulation
   (ii) Pulmonary circulation.

   The impure blood coming from various parts of the body is collected in the right atrium from where it is sent to the lungs through the

pulmonary artery. Blood is purified in the lungs. It is then sent through the pulmonary vein to the left auricle or atrium from where it comes into left ventricle and then to various parts of the body through aorta. Thus blood comes into the heart two times, and the circulation is called double circulation.

Advantage: The systemic circulation provides oxygenated blood to the rest of the body thus increasing the efficiency of gaseous exchange within the body while the pulmonary circulation provides deoxygenated blood to the lungs and pumps oxygenated blood back to the heart.

6. The pressure of blood inside the artery during ventricular systole (contraction) is called systolic pressure and pressure in artery during ventricular diastole (relaxation) is called diastolic pressure. Ram's blood pressure is 120/80 mm Hg means that the systolic pressure is 120 mm Hg and diastolic pressure is 80 mm Hg.

C. Short Answer Type-II Questions.

1. The physical forces which help in water transport in plants are root pressure and transpiration pull. Roots absorb water from the soil by osmosis or diffusion as the water is in higher concentration in the soil than in the roots. The pressure with which the water is pushed up by the xylem of the roots is called the root pressure. Most of the transpiration is from the leaves through the stomata. The cells around the stomata absorb water from the neighbouring cells. Ultimately water is drawn from the xylem in the leaves. The water moves up the plant as a result of the potential gradient. This gradient has developed due to transpiration. So, the force with which the water is pulled up the xylem is called the transpiration pull.

2. Differences between arteries and veins.

	Arteries	Veins
(i)	Carry blood away from the heart	Carry blood towards the heart
(ii)	Carry oxygenated blood except, pulmonary arteries	Carry deoxygenated blood, except pulmonary veins
(iii)	The lumen in arteries is narrow	The lumen in veins is wide

3. Heart is not fatigued even though it beats nonstop throughout the life of an individual because the heart is made up of cardiac muscles which do not tire. There is no accumulation of lactate in these muscles.

4. Circulation of blood between the heart and body organs is called systemic circulation. Systemic circulation is responsible for transporting food materials and oxygen to different parts and also bringing back wastes for excretion.

5. Circulation of blood between heart and body organs (except lungs) is called systemic circulation. The path of blood in systemic circulation is as follows:

   Left atrium → Left ventricle → Aorta → all body cells (except lungs) → Systemic veins → Right atrium → Right ventricle

6. Differences between blood and lymph.

	Blood	Lymph
(i)	Blood is red in colour due to the presence of haemoglobin in erythrocytes	Lymph is colourless, as it lacks haemoglobin containing erythrocytes
(ii)	Blood consists of plasma, erythrocytes, leucocytes and platelets	Lymph consists of plasma and leucocytes only
(iii)	Flow of blood is fairly rapid	Flow of lymph is very slow

7. The blood circulates two times in the human heart: (i) Systemic circulation (ii) Pulmonary circulation. The impure blood coming from various parts of the body is collected in the right atrium from where it is sent to the lungs through the pulmonary artery. Blood is purified in the lungs. It is then sent through the pulmonary vein to the left auricle or atrium from where it comes into left ventricle and then to various parts of the body through aorta. Thus blood comes into the heart two times, and the circulation is called double circulation.

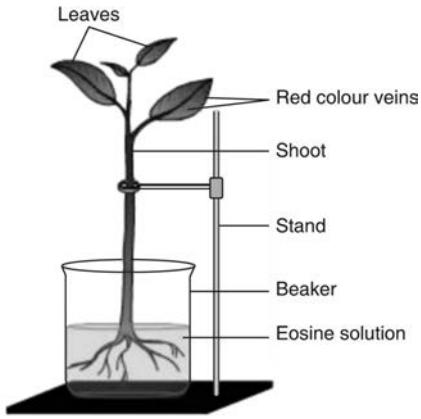
8. The blood returning to the heart from the body parts is deoxygenated. If the backflow is not prevented then the deoxygenated blood will go back to the cells and tissues. The cells need oxygen for their survival, hence the backflow must be prevented.

D. Long Answer Type Questions

1. Plants absorb water from the soil through the roots. Thus, water has to be transported upwards to the other parts of the plant. This upward movement of water is called ascent of sap. It is called the sap as it contains many dissolved minerals. Ascent of sap involves root pressure and transpiration pull.

   A young, medium sized, balsam plant is placed in the beaker containing water mixed with

eosine stain solution. The roots are completely submerged in the solution. After 3–4 hours, the plant is removed from beaker and washed in running tap water. When the transverse section passing through roots, stem and leaves is taken, it is observed that in the centre xylem vessels appear red due to conduction of eosine stain dye. This shows that water is conducted through xylem and hence xylem is the path of ascent of sap in plants.



2. The transport of soluble products of photosynthesis is called translocation.

Use a healthy potted plant. With a sharp knife cut out cleanly the outer tissues external to woody part of the stem. Allow the plant to continue growth for 1–2 weeks. The leaves and the branches will still be fresh although the portion of the stem above the ringed part becomes swollen. Water from the soil is absorbed and conducted to the leaves but manufactured food is conducted downwards only up to the ringed region. Since food accumulated at the end of the region, as a result of which the cells grow and increase in number, it means the food conducting tissues must have been interrupted.

3. Blood is a connective tissue. Blood is made up of two main components – plasma (fluid part) and cellular or formed elements or blood corpuscles (solid part).

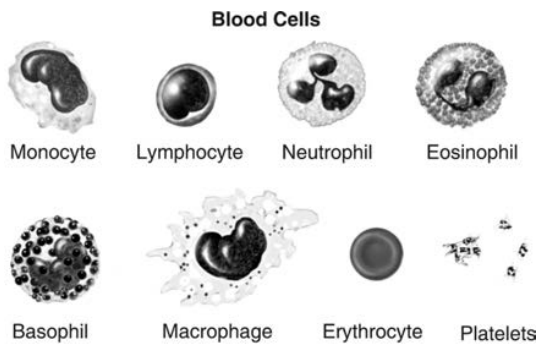
Plasma is a straw-coloured aqueous solution containing water (about 90–92 per cent), inorganic salts (about 1–2 per cent) and organic compounds (about 7–8 per cent). Plasma transports food, carbon dioxide and nitrogenous waste in dissolved form.

Three types of cellular elements are found suspended in the plasma –

(i) **Red blood corpuscles (RBCs) or erythrocytes:** Red blood corpuscles or erythrocytes are biconcave and enucleated disc-like structures, flat in the centre and thick and rounded at the periphery. Such a shape is of great advantage to these cells as it increases their surface area. The RBCs are very small in size. This small size helps in absorbing oxygen and enables them to travel in very fine blood capillaries throughout the body of a person. The RBCs contain respiratory pigment haemoglobin that transports oxygen.

(ii) **White blood corpuscles (WBCs) or leucocytes:** White blood corpuscles or leucocytes (*leucos* means white) are round or irregular-shaped cells and are capable of amoeboid movement. They lack haemoglobin and are therefore colourless. They are responsible for immunity. They fight against disease-causing germs and destroy the damaged cells by phagocytosis. They also help in the formation of antibodies which neutralize or kill the germs that enter our body.

(iii) **Platelets:** These are colourless, oval or round, cytoplasmic fragments formed in the bone marrow. These are found floating in the blood. These are enucleated (without a nucleus), bound by a membrane and contain a few organelles. They play a major role in blood clotting. They release a chemical, thromboplastin, which initiates the process of clotting of blood.



4. Functions of blood:

(i) Transport nutrients from the site of absorption (intestine) to different organs of the body.

(ii) Transport respiratory gases, that is, oxygen from the lungs to the tissues and carbon dioxide from the tissues to the lungs.

(iii) Transport of waste products produced in the body to the organs meant for their removal from the body.

(iv) Regulates the body temperature by evenly distributing the heat produced in one part of the body to different parts.

(v) Blood transports chemical secretions like hormones from the site of their secretion to the target organ.

(vi) Blood contains white blood corpuscles that are phagocytic in nature. WBCs also produce antibodies which combat the bacteria after neutralizing their toxins and thus play a protective role against infection.

5. The structure of human heart

The human heart is a four-chambered organ divided by septa into two halves – the right half and the left half. Each half consists of two chambers – the upper, small-sized auricle or atrium and the lower, large-sized ventricle.

Chambers of the heart:

(i) The auricles are thin-walled chambers and are separated from each other by an inter-auricular septum.

(ii) The ventricles are thick-walled chambers and are separated from each other by an obliquely placed interventricular septum. The wall of the left ventricle is thicker than that of the right ventricle because the left ventricle has to pump blood into vessels, which in turn carry the blood to the entire body. The right ventricle pumps blood to the pulmonary arteries which carry it to the lungs.

Great blood vessels of the heart:

The blood vessels that enter or leave the heart are called great blood vessels. These include:

(i) Superior (Anterior) vena cava: It brings deoxygenated blood from the upper part of the body.

(ii) Inferior (Posterior) vena cava: It brings deoxygenated blood from the lower part of the body.

(iii) Pulmonary artery: It carries deoxygenated blood from the right ventricle to the lungs for oxygenation.

(iv) Systemic aorta: It carries oxygenated blood from the left ventricle and provides it to all parts of the body.

Apertures and valves in the heart

There are four valves in the heart which control the flow of blood within the heart and its passage to various parts of the body through the great blood vessels. These include:

(i) The bicuspid valve guards the opening of the left auricle into the left ventricle. This valve consists of two flaps or cusps.

(ii) The tricuspid valve guards the opening of the right auricle into the right ventricle. Both the bicuspid and the tricuspid valves allow blood to pass from the auricles to the ventricles and prevent the backward flow of blood.

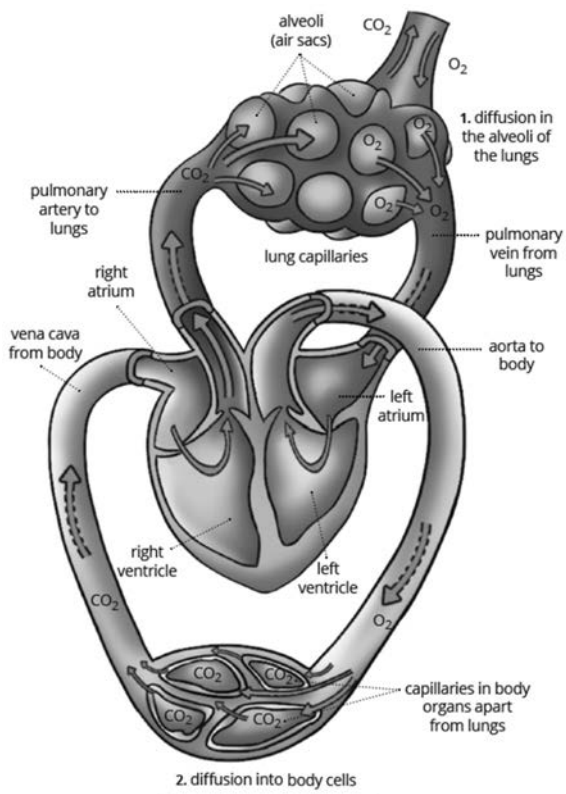
(iii) Pulmonary valves are present at the base of pulmonary artery. These valves allow blood to pass from the right ventricles to the pulmonary artery and check the return of blood into the ventricles.

(iv) Aortic semilunar valve is present at the point of origin of aorta. These valves allow blood to pass from the left ventricle to the aorta and check the return of blood into the ventricles.

6. The blood circulates two times in the human heart:

The impure blood coming from various parts of the body is collected in the right atrium from where it is sent to the lungs through the pulmonary artery. Blood is purified in the lungs. It is then sent through the pulmonary vein to the left auricle or atrium from where it comes into ventricle and then to various parts of the body through aorta. Thus blood comes into the heart two times, and the circulation is called double circulation.

7. A schematic representation of transport and exchange of oxygen and carbon dioxide during transportation of blood in human beings.



Double circulation in human heart

8. Differences between blood and lymph

	Blood	Lymph
(i)	It is red in colour due to the presence of haemoglobin in erythrocytes.	It is colourless, as it lacks haemoglobin-containing erythrocytes.
(ii)	It consists of plasma, erythrocytes, leucocytes and platelets.	It consists of plasma and leucocytes only.
(iii)	It mainly transports materials from one organ to another in the body.	It mainly conveys materials from cells and tissue into the blood.
(iv)	The path of circulation of blood is heart → arteries → capillaries → veins → heart	The path of circulation of lymph is tissue spaces → lymphatic capillaries → lymph vessels → subclavian veins

9. The lymphatic system comprises a colourless fluid - lymph, a network of fine channels - lymphatic capillaries and vessels and the lymph nodes. The lymph performs many functions:

(i) It carries carbon dioxide and nitrogenous waste materials that diffuse into the blood through the tissue fluid.

(ii) It carries lymphocytes and antibodies from lymph nodes to the blood.

(iii) It transports fats (fatty acids and glycerol) from the intestine to the blood.

(iv) It destroys microorganisms and foreign particles in the lymph nodes.

10. a. Blood has two major components-blood plasma and blood cells.

b. Circulation of blood between heart and lungs is called pulmonary circulation. Oxygenated blood moves from the lungs to the left atrium (upper chamber of the heart on the left). The blood is collected in the left atrium when the left atrium relaxes. As soon as the left atrium contracts, the left ventricle expands and blood is transferred to the left ventricle. Then, the left ventricle contracts and the blood is pumped to other parts of the body through the aorta.

c. Valves ensure that blood does not flow backwards when the ventricles contract, i.e. it ensures that the blood flows only in one direction. Valves are actually flaps that act as one-way inlets for blood coming into a ventricle and one-way outlets for blood leaving a ventricle.

d. Arteries have thick, elastic, muscular walls whereas veins have thin walls with few elastic fibres.

E. Source-based/Case-based/Passage-based/ Integrated assessment questions CBQ

1. a. (iv) **b.** (iv) **c.** (i) **d.** (iv) **e.** (ii)

2. a. (iii) **b.** (iii) **c.** (ii) **d.** (iii) **e.** (iii)

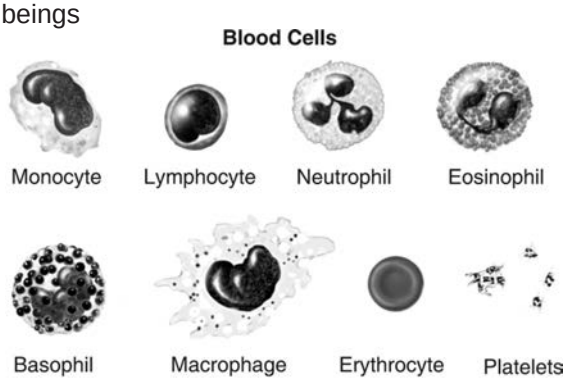
P. 66. HIGHER ORDER THINKING SKILLS (HOTS) QUESTIONS

A. 1. Moving air sweeps away the water vapour in the air outside the stomata. This speeds up diffusion of water vapour from stomata. Thus, a higher rate of transpiration is recorded on a windy day rather than on a calm day.

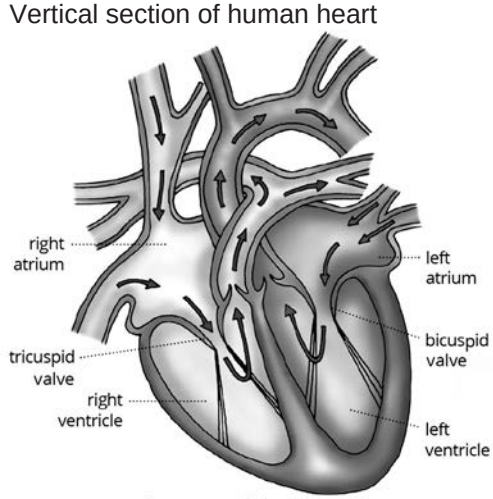
2. This is because of the high rate of vapourization of water during midday, the rate of transpiration is higher than the rate of absorption of water. Thus, the stomata becomes flaccid and close and leaves wilt. But during evening this rate of vapourization of water becomes very less and the stomata becomes turgid and the leaves again stand out erect.

B. Make the following diagrams.

1. Types of blood corpuscles present in human beings

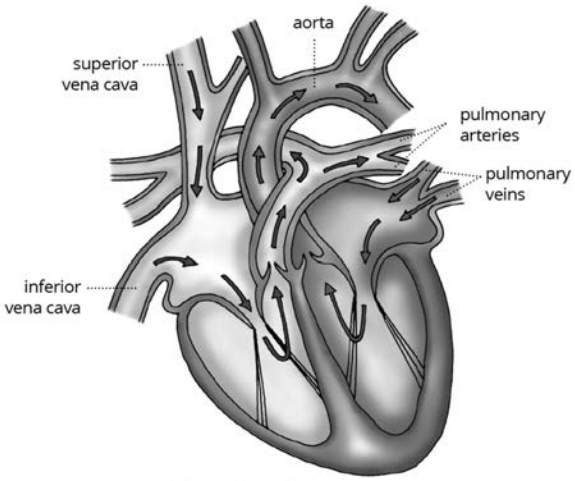


2. Vertical section of human heart



Vertical section of the human heart

3. Vertical section of human heart showing main blood vessels entering and leaving the heart.



Vertical section of the human heart

C. The figures given below are the cross sections of blood vessels.

1. **A.** artery, **B.** vein, **C.** capillary
2. In arteries, valves are absent whereas valves are present in veins.

   In arteries, lumen is narrow and the wall is thick and more elastic whereas in veins the lumen is wider and the wall is thin and less elastic.
3. Through **A** oxygenated blood flows whereas through **B** deoxygenated blood flows.

D. The given diagram represents a certain category of blood vessels showing the role of a special structure in their walls.

1. Veins
2. Semilunar valves
3. Semilunar valves prevent backward flow of blood.
4. Yes, aortic semilunar valve is present at the point of origin of aorta from the left ventricle.
5. Top

E. The given diagram shows some parts of the blood as seen through a microscope. Match words from the list with each of the labels 1–4 in the diagram.

1. Leucocyte – Ingests microorganisms
2. Plasma – Transports urea
3. Platelets – Clot blood
4. Erythrocytes – Transports oxygen

F. The given diagram shows part of the capillary bed in an organ of the mammalian body. Some of the blood arriving at the capillaries at points labelled A moves out into spaces between the tissue cells. Study the diagram and answer the questions that follow.

1. Tissue fluid
2. Erythrocytes
3. **X**: Lymphatic vessels. The fluid present in vessel **X** is lymph
4. **a.** It carries carbon dioxide and nitrogenous waste materials that diffuse into the blood through the tissue fluid.

   b. It carries lymphocytes and antibodies from the lymph nodes to the blood.

G. Blood flows through the organs of the body in blood vessels called capillaries. The given drawing shows blood in a capillary.

1. **b.** oxygen
2. **c.** sugars from the small intestine to the muscles
3. **a.** ingest microorganisms that have entered body
4. **d.** the white blood cells and capillary wall cells.
5. **d.** the platelets only

H. The diagram given below shows a section through the heart.

1. **d.** it leads from a ventricle
2. **c.** pump blood out of the heart
3. **d.** stop blood returning to the atrium when the ventricle contracts
4. **a.** bicuspid valve
5. **d.** prevent the mixing of oxygenated and deoxygenated blood.

P. 67 VALUE-BASED QUESTIONS (OPTIONAL)

1. The wall of the left ventricle is thicker than that of the right ventricle because the left ventricle has to pump blood into vessels, which in turn carry the blood to the entire body. The right ventricle pumps blood to the pulmonary arteries, which carry it to the lungs. Thus, due to developmental abnormality in infant the blood supply to the entire body will be affected.

Unit IV. Excretion – Elimination of Body Wastes

P. 73 CHECK YOUR PROGRESS 9

1. The process of removal of harmful metabolic waste products and salts from the body of an organism is called excretion.

Significance: (i) It removes waste material and toxic products of metabolism from the body of an organism. (ii) It eliminates excess material from our body, like soluble vitamins, drugs, excess salts, etc.

2. Urea and carbon dioxide.

3. Sponges – water canal system

Earthworm – nephridia

Cockroach – Malpighian tubules

4. Nephron

5. Each nephron consists of:

(i) Malpighian capsule consisting of Bowman's capsule and glomerulus.

(ii) Nephric tubule consisting of proximal convoluted tubule, loop of Henle and distal convoluted tubule.

(iii) Collecting tubule.

6. Nephrons discharge their contents into the renal pelvis.

7. If there is no reabsorption of water from the filtrate in the nephron, then our body would have lost a good amount of water and several useful metabolites like glucose, amino acids and salts.

8. Useful substances like glucose, amino acids, salts and water are selectively reabsorbed from the nephric filtrate into the blood of peritubular capillaries in proximal convoluted tubule.

9. The process of purifying blood by an artificial kidney is called haemodialysis.

P. 74 EXERCISES

A. Objective Type Questions

I. Choose the most appropriate answer.

1. d. **2.** c. **3.** a. **4.** c.

5. c. **6.** d. **7.** b. **8.** b.

9. c. **10.** c. **11.** c.

II. Fill in the blanks.

1. kidney **2.** renal artery

3. nephrons **4.** glomerulus

5. ADH **6.** renal artery

III. Match the items in column A with the items in column B.

Column A	Column B
1. Renal vein	**c.** contains more CO_2 and less urea
2. Glomerulus	**a.** Bowman's capsule
3. Renal artery	**b.** contains more urea

IV. Assertion–Reasoning type questions CBQ

1. (d) **2.** (b) **3.** (a) **4.** (c)

5. (a)

V. Name the following.

1. Nephridia **2.** CO_2 and water

3. Ammonia and urea **4.** Kidney

5. Kidney **6.** Ureter

7. Urethra

VI. Very short answer type questions.

1. The process of removal of harmful metabolic waste products and salts from the body of an organism is called excretion. The purpose of excretion is to get rid of the harmful metabolic waste products and salts from the body.

2. Urea

3. Nephron is the functional unit of kidney.

4. The three major regions of nephric tubules are, the proximal convoluted tubule, the loop of Henle and the distal convoluted tubule.

5. The liquid part of the blood containing nitrogenous wastes, glucose, amino acids, mineral ions, etc., is filtered out in the Bowman's capsule. This forms the glomerular filtrate. Since filtration is under high pressure, it is called ultrafiltration.

6. Absorption of useful substances through the walls of the renal tubules (and returning to blood flowing capillaries) from the filtrate as it flows through the nephric tubules is called tubular reabsorption. The process in which the cells of the renal tubule remove wastes from the blood and pass into the filtrate by the process of secretion is called tubular secretion.

7. The parts of the human excretory system are, kidneys (a pair), ureters (a pair), urinary bladder and urethra.

8. The right kidney is positioned slightly lower than the left kidney as the right side of the abdominal cavity is occupied by the liver.

9. Loop of Henle

10. Loop of Henle

B. Short Answer Type-I Questions.

1. Urine in a healthy person consists of water, ammonia, potassium, hydrogen, sodium, creatinine, uric acid, urea and bilirubin.
2. The glucose which enters the nephron along with the filtrate is reabsorbed by the tubular cells and sent to the capillaries surrounding the nephron.

C. Short Answer Type-II Questions.

1. a. **Nephridia:** Nephridia are excretory organs present in earthworms.

   b. **Loop of Henle:** It is a U-shaped loop formed in the middle of the nephric tubule.

   c. **Glomerular filtration:** Walls of glomerular capillaries and Bowman's capsule are very thin and semipermeable. Hence, they act as ultrafilters. The liquid part of the blood containing nitrogenous wastes, glucose, amino acids, mineral ions, etc., are filtered out in the Bowman's capsule. This forms the glomerular filtrate. Filtration under high pressure is called ultrafiltration. Since it occurs in the glomerulus, it is called glomerular filtration.

2. As the glomerular filtrate flows through the nephric tubule, several useful substances are reabsorbed through the walls of the renal tubule and returned to the blood flowing in capillaries. Water is reabsorbed by osmosis. Selective reabsorption of glucose, amino acids and salts also takes place.
3. Some people need dialysis because their kidneys are damaged. The dialysis apparatus purifies the blood by an artificial kidney. The different steps involved in haemodialysis are:

   (i) Blood of the patient is taken out from main artery and cooled to 0°C and an anticoagulant (heparin) is mixed with it.

   (ii) The blood is then pumped into the apparatus containing dialysing solution (artificial kidney).

   (iii) The dialysing solution contains salts, water and glucose in similar concentration (isotonic) in cellophane tubes with the blood plasma.

   (iv) As the blood flows through these tubes, molecules of compounds like urea, uric acid and creatinine diffuse out in the dialysing fluid.

   (v) Blood coming out from the apparatus is pure blood, it is warmed to the body temperature and mixed with antiheparin to restore to its normal state.

   (vi) This purified blood is then pumped into the body of the patient through a vein.
4. If the kidneys stop working completely, urine formation is also stopped and the body fills with extra water and waste products. This condition is called uremia.
5. Regulation of the amount of urine production depends on the amount of excess water and dissolved nitrogenous wastes present in the body. Hormones such as anti-diuretic hormone (ADH) plays a vital role in the regulation of the amount of urine produced. ADH, produced by the posterior pituitary gland, increases the amount of water reabsorbed in the distal convoluted tubule and collecting duct.
6. Methods used by plants to get rid of excretory products are:
   - Gaseous wastes (carbon dioxide) are removed through stomata.
   - Through transpiration, excess water is removed.
   - Through the removal of exudates like resins and gums
   - Wastes are deposited in the leaves which are removed upon drooping/wilting.

D. Long Answer Type Questions

1. The three different waste products formed in the human body are:

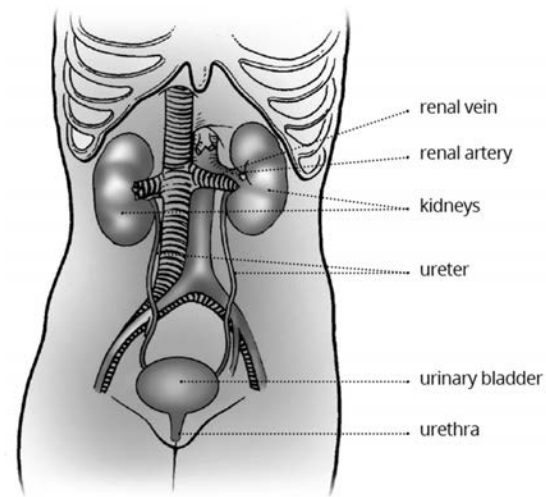
   (i) **Respiratory waste products:** They are formed as a result of oxidation of glucose (food) through cellular respiration. These mainly include carbon dioxide and water. Carbon dioxide is eliminated from the body through the lungs (during expiration), while water becomes a part of the body.

   (ii) **Nitrogenous waste products:** They are formed as a result of deamination of unwanted amino acids, body's own proteins and nucleic acids. The three main nitrogenous waste products are ammonia, urea and uric acid. Urea is a highly poisonous waste product and its accumulation beyond a certain concentration in the body may cause death. Urea is eliminated through the kidneys.

   (iii) **Excess salts (NaCl), water soluble vitamins and water:** In addition, excess salts (NaCl), water soluble vitamins and water, that we take directly through food,

are other waste materials which need to be excreted out of the body. Excess salts are mainly excreted by kidneys. The excess water is removed through kidneys as urine and some of it is excreted as sweat through sweat glands in our skin.

2.



The human excretory system

The excretory system in human beings consists of kidneys (a pair), ureters (a pair), urinary bladder and urethra.

Kidneys: The kidneys remove nitrogenous wastes and excess water from the blood.

Ureters: The ureters transport urine from the kidneys to the urinary bladder.

Urinary bladder: The urinary bladder acts as a muscular reservoir for urine. Besides functioning as a temporary reservoir of urine, the bladder also evacuates the urine at suitable intervals.

Urethra: In a human male, urethra is a common passage for urine and sperms. In females, it serves as a passage for urine only.

3. Nephron is the functional unit of a kidney. Each nephron consists of – a Malpighian capsule, a nephric or renal tubule (secretory part of uriniferous tubule) and a collecting tubule.

(i) Malpighian capsule has two parts – a Bowman's capsule and a glomerulus.

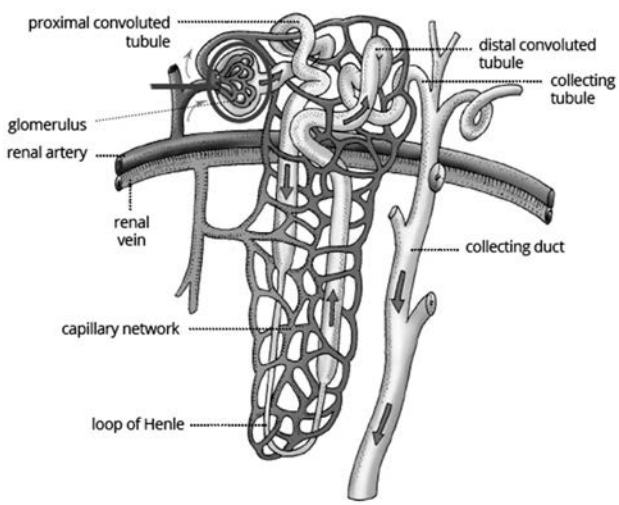
- **Bowman's capsule:** It is situated on the proximal part of the nephron. It is a double-walled cup-shaped structure. The outer concavity of Bowman's cup is filled with a knot-like bundle of blood capillaries called glomerulus.
- **Glomerulus:** An artery is attached to one end of glomerulus. This artery brings blood containing waste materials like urea into glomerulus. The other end of the glomerulus is a blood capillary that comes out of Bowman's capsule. It surrounds the nephric tubule and then joins the renal vein discharging urea-free clean blood into it. The blood capillaries in glomerulus are formed by branching of afferent (carry blood towards) and efferent arterioles (carry blood away) of renal artery.

(ii) Nephric tubule

It is a long, coiled tubule and can be divided into three major regions – the proximal convoluted tubule (PCT), the loop of Henle and the distal convoluted tubule (DCT).

- **Proximal convoluted tubule (PCT):** It is the initial (proximal) convoluted region of the nephric tubule. It is a highly coiled structure.
- **Loop of Henle:** It is a U-shaped loop formed in the middle of the nephric tubule.
- **Distal convoluted tubule (DCT):** It is a convoluted structure. It opens into the collecting tubule.
- **Collecting tubule:** Collecting tubules from many nephrons empties into a larger collecting duct. Collecting ducts drain the urine collected from the nephrons into the ureter.

4. Structure of Nephron



The filtration unit: Nephron

The function of glomerulus is to filter the blood passing through it.

5. The nephron forms urine in three main steps: ultrafiltration, tubular reabsorption and tubular secretion.

(i) **Ultrafiltration:** Walls of glomerular capillaries and Bowman's capsule are very thin and semipermeable. Hence, they act as ultrafilters. The liquid part of the blood containing nitrogenous wastes, glucose, amino acids, mineral ions, etc., is filtered out in the Bowman's capsule. This forms the glomerular filtrate. Since filtration is under high pressure, it is called ultrafiltration.

After ultrafiltration, the rest of the blood that is left behind in the glomerulus is very thick (because of the liquid part been taken out) and is carried forward by the efferent arteriole. The filtered liquid is also known as nephric filtrate.

(ii) **Tubular or selective reabsorption:** As this filtrate flows through the nephric tubule also known as renal tubule, several useful substances are reabsorbed through its walls and returned to the blood flowing in capillaries. Water is reabsorbed by osmosis. Selective reabsorption of glucose, amino acids and salts from nephric filtrate into the blood of peritubular capillaries in PCT also takes place.

(iii) **Tubular secretion:** The cells of the renal tubule also remove wastes from blood and pass into the filtrate by the process of secretion. Tubular secretion removes ammonia, urea, uric acid, creatinine, etc.

6. The path of urine begins from kidney and travels through ureter, urinary bladder, urethra and extends up to urethral orifice.

Kidneys: The kidneys are reddish-brown, bean-shaped, paired organs which lie towards the back of our body slightly higher above the waist. The right kidney is positioned slightly lower than the left kidney as the right side of the abdominal cavity is occupied by the liver. The ureter and the renal vein come out and the renal artery enters the kidney on the inner concave side of the kidney. The kidneys remove nitrogenous wastes and excess water from the blood.

Ureters: The ureters transport urine from the kidneys to the urinary bladder. Each ureter opens in the urinary bladder by a slit-like aperture.

Urinary bladder: The urinary bladder acts as a muscular reservoir for urine. It lies in the pelvic cavity of the abdomen. The neck of the urinary bladder is surrounded by sphincters which remain closed until the time of urination. Besides functioning as a temporary reservoir of urine, the bladder also evacuates the urine at suitable intervals.

Urethra: The urethra is a membranous tube that arises from the neck of bladder and extends up to the urethral orifice. In a human male, it is a common passage for urine and sperms. In females, it serves as a passage for urine only.

7. The urine is formed in three main steps: ultrafiltration, tubular reabsorption and tubular secretion.

Ultrafiltration: Walls of glomerular capillaries and Bowman's capsule are very thin and semipermeable. Hence, they act as ultrafilters. The liquid part of the blood containing nitrogenous wastes, glucose, amino acids, mineral ions, etc., is filtered out in the Bowman's capsule. This forms the glomerular filtrate. Since filtration is under high pressure, it is called ultrafiltration.

After ultrafiltration, the rest of the blood that is left behind in the glomerulus is very thick (because of the liquid part been taken out) and is carried forward by the efferent arteriole. The filtered liquid is also known as nephric filtrate.

Tubular or selective reabsorption: As this filtrate flows through the nephric tubule also known as renal tubule, several useful substances are reabsorbed through its walls and returned to the blood flowing in capillaries. Water is reabsorbed by osmosis. Selective reabsorption of glucose, amino acids and salts from nephric filtrate into the blood of peritubular capillaries in PCT also takes place.

Tubular secretion: The cells of the renal tubule also remove wastes from blood and pass into the filtrate by the process of secretion. Tubular secretion removes ammonia, urea, uric acid, creatinine, etc.

8. a. The tubing is made of selectively permeable cellophane tubes.

b. The dialysing solution contains salts, water and glucose in similar concentration (isotonic) in cellophane tubes with the blood plasma.

c. The dialysing solution contains salts, water and glucose in similar concentration (isotonic) in cellophane tubes with the blood plasma. As the blood flows through these tubes, molecules of compounds like urea,

uric acid and creatinine diffuse out in the dialysing fluid. Thus, the blood coming out from the apparatus is pure blood.

d. Dialysis is based on diffusion during which the molecules of compounds like urea, uric acid and creatinine diffuse out in the dialysing fluid. Thus, the blood coming out from the apparatus is pure blood.

9. a. The parts of the human excretory system are, kidneys (a pair), ureters (a pair), urinary bladder and urethra.

b. In human body, urine is formed in three main steps: ultrafiltration, tubular reabsorption and tubular secretion.

(i) **Ultrafiltration:** Filtration of blood for the nitrogenous wastes takes place in glomerulus. Walls of glomerular capillaries and Bowman's capsule are very thin and semipermeable. Hence, they act as ultrafilters. The liquid part of the blood containing nitrogenous wastes, glucose, amino acids, mineral ions, etc., is filtered out in the Bowman's capsule. This forms the glomerular filtrate. This filtration, under high pressure, is called ultrafiltration. After ultrafiltration, the rest of the blood that is left behind in the glomerulus is very thick (because of the liquid part been taken out) and is carried forward by the efferent arteriole. The filtered liquid is also known as nephric filtrate.

(ii) **Tubular or selective reabsorption:** As this filtrate flows through the nephric tubule, several useful substances are reabsorbed through its walls and returned to the blood flowing in capillaries. Water is reabsorbed by osmosis. Selective reabsorption of glucose, amino acids and salts from nephric filtrate into the blood of peritubular capillaries in PCT also takes place.

(iii) **Tubular secretion:** The cells of the renal tubule also remove wastes from blood and pass into the filtrate by the process of secretion. Tubular secretion removes ammonia, urea, uric acid, creatinine, etc.

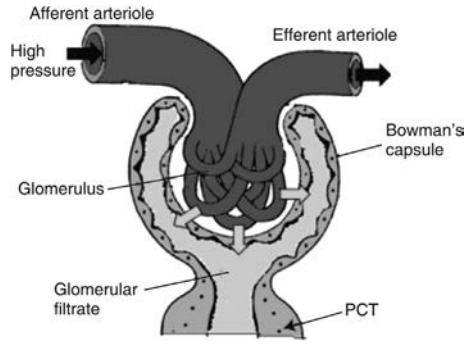
E. Source-based/Case-based/Passage-based/ Integrated assessment questions CBQ

1. a. (iv) **b.** (ii) **c.** (ii) **d.** (ii) **e.** (iii)

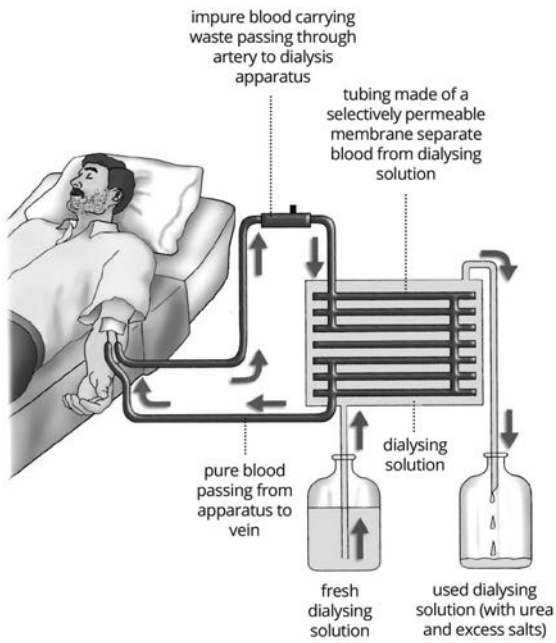
2. a. (iii) **b.** (iv) **c.** (iv) **d.** (ii) **e.** (iv)

P. 77 HIGHER ORDER THINKING SKILLS (HOTS) QUESTIONS

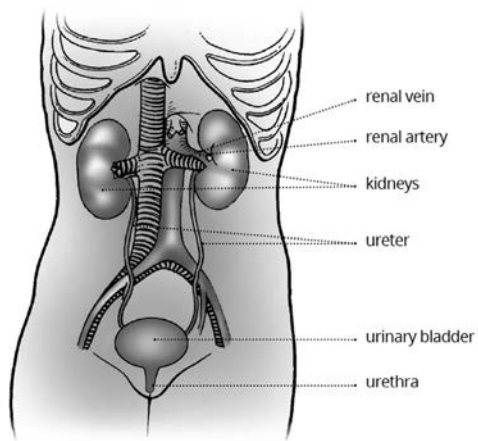
A. 1. Process of ultrafiltration



2. Diagrammatic representation of dialysis



B. 1. Excretory system in humans



Renal artery enters the kidney and renal vein leaves the kidney.

2. Malpighian capsule (Refer to figure in A. 1)

C. Following is the figure of certain organs and associated parts in the human body. Study the same and answer the questions that follow.

1. Excretory system and circulatory system
2. **1.** Kidneys, **2.** renal artery, **3.** ureter, **4.** urinary bladder, **5.** urethra
3. Nephron
4. Urea and creatinine
5. Ultrafiltration and reabsorption

D.

1. Part **3** Bowman's capsule
2. Part **6** venule to renal vein
3. Part **5** glomerulus
4. Part **8** distal convoluted tubule

E.

1. Water in the mouth → oesophagus → stomach → intestine → bloodstream → afferent arteriole (the unfiltered blood gets out by efferent arteriole) blood undergoes ultrafiltration in the glomerulus of the nephron (functional unit of kidney) → Bowman's capsule → Proximal convoluted tubule → descending limb of loop of Henle → ascending limb of loop of Henle → distal convoluted tubule → collecting ducts → renal pelvis → ureter → urinary bladder → urethra

F.

1. Organ **X** – Kidney
2. Waste material **A** – Urea, uric acid and creatinine
3. Substance **B** – Cellophane and Solution **C** – Dialysing solution
4. Substances **D** – Salt, **E** – Water and **F** – Glucose. Solution C cleans the blood by diffusion.
5. The overall process is known as haemodialysis.

G. Study the given diagram showing role of nephron in urine formation in human beings and answer the following questions.

1. Ultrafiltration is occurring in Part **2**. Walls of glomerular capillaries and Bowman's capsule are very thin and semipermeable. Hence, they act as ultrafilters. The liquid part of the blood containing nitrogenous wastes, glucose, amino acids, mineral ions, etc., is filtered out in the Bowman's capsule. This forms the glomerular filtrate. Since filtration is under high pressure, it is called ultrafiltration.
2. Part **2** is Malpighian capsule. It has two parts – Bowman's capsule and glomerulus.
3. In part **3** tubular reabsorption takes place. Several useful substances are reabsorbed through its walls and returned to the blood flowing in capillaries. Water is reabsorbed by osmosis. Selective reabsorption of glucose, amino acids and salts from nephric filtrate into the blood of peritubular capillaries in PCT also takes place. While in part 4 tubular secretion takes place. The cells of the renal tubule remove wastes from blood and pass into the filtrate by the process of secretion. Tubular secretion removes ammonia, urea, uric acid, creatinine, etc. Part 3 is Henle's descending loop and part 4 is Henle's ascending loop.
4. The primary function of the loop of Henle is the concentration of urine utilizing a principle called 'countercurrent multiplication'. If part 3 is not functioning, water from the filtrate will not be reabsorbed and a lot of water will be lost from the body.

P. 78 VALUE-BASED QUESTIONS (OPTIONAL)

1. **a.** Kidney stones are the soft stones. They are formed when calcium oxalate salts and excessive uric acid take the form of soft stones.

   b. These stones affects the functioning of the kidneys, that is, the nitrogenous waste and excess water from blood are not removed properly.

CHAPTER – 2

CONTROL AND COORDINATION

P. 83 CHECK YOUR PROGRESS 1

A. Answer the following questions.

1. Phototropism and geotroprism.

2. (i) Auxin promotes cell elongation and cell differentiation in plants.

(ii) It regulates the phototropic and geotropic behaviour of a plant.

(iii) It helps in twining of a tendril around a support.

3. a. Cytokinin

b. Abscisic acid

c. Gibberellins

d. Ethylene

4. Abscisic acid

B. Define the following terms.

1. Any change in the environment to which an organism responds and reacts is called a **stimulus**.

2. The growth and movement of a plant part in response to the light is called **phototropism**.

3. The downward movement of roots in response to gravitational force of the earth is called **geotropism**.

4. The movement of plant parts towards water or moisture is called **hydrotropism**.

C. Which of the following is a plant hormone?

Cytokinin.

D. Auxin is a growth hormone and helps the cells to grow longer. It is synthesized at the shoot and root tip. When the tip of a tendril touches a support, the auxin present in it moves away from the support. Therefore, the side of a tendril away from support grows longer and faster. It also curves or bends towards the support and as a result winds around the support.

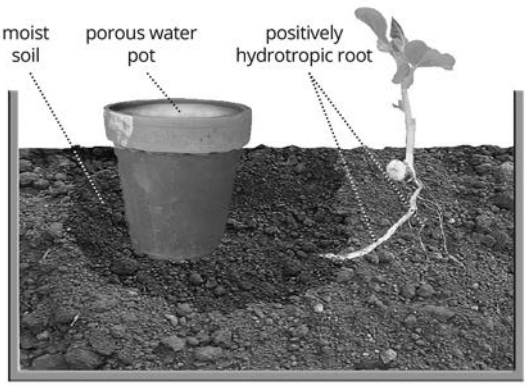
E. Hydrotropism is the process of growth or movement of roots towards the source of water. Here is an experiment that is performed to observe the growth of plants when water is present.

Procedure:

(i) Plant a seedling in a vessel containing soil.

(ii) Adjacent to the seedling put a porous pot containing water.

(iii) Leave the set up for a few days.



Positive hydrotropism

Observations:

On examining the roots of seedlings it is observed that the roots bend towards the source of water and do not grow straight.

Conclusion:

It confirms that plant shows hydrotropism as the roots bend towards the porous pot of water. Hydrotropism is a plant growth response in which the direction of growth is determined by a stimulus of the gradient in water concentration.

P. 89 CHECK YOUR PROGRESS 2

A. Answer the following questions.

1. Synapse.

2. Cerebrum part of forebrain.

3. A reflex action is a spontaneous, automatic and mechanical response to a stimulus controlled by the spinal cord without the involvement of brain. On the other hand, walking is an activity controlled by brain.

4. Watering of mouth at the sight of tasty food and immediate withdrawal of hand if one touches a hot object unknowingly are the examples of reflex action.

5. When the smell of an agarbatti or incense stick reaches to our nose then the olfactory receptors present in our nose detects it and send this information to the forebrain in the form of electrical signals.

Then, the forebrain interprets it by putting it together with the information received from other receptors and also with the information already stored in the brain.

B. Complete the following.

1. Nervous system

2. Neuron

3. Brain and spinal cord

P. 89 CHECK YOUR PROGRESS 3

1. Peripheral nervous system comprises the nerves that connect the central nervous system with different parts of body.

2. Differences between central nervous system and peripheral nervous system.

	Central nervous system	Peripheral nervous system
(i)	It is the centre of control and coordination of all body functions.	It is not the main coordinating centre of the body.
(ii)	It includes brain and spinal cord.	It includes cranial and spinal nerves that connect brain and spinal cord to different parts of the body.
(iii)	It is mainly concerned with memory, comprehension and execution of information.	It is mainly concerned with transmission of information to far away structures.

3. Autonomic nervous system regulates the working of the internal organs like heart muscles, glands, smooth muscles of blood vessels, digestive, respiratory and reproductive tracts of our body involuntarily (on its own).

P. 90 CHECK YOUR PROGRESS 4

A. Name the following.

1. Hormones

2. Endocrine glands

B. Hormones are chemical messengers secreted by endocrine glands and carried by blood and lymph to target organ elsewhere in the body to stimulate a specific activity that may be biochemical or physiological.

C. Hormones are secreted by endocrine glands into the tissue space next to them. These secretions are then carried by blood and lymph to the target organ.

P. 91 CHECK YOUR PROGRESS 5

A. Fill in the blanks.

1. Parathyroid glands

2. Thyroxine, calcitonin

3. Thyroxine

4. Insufficient secretion

B. Iodine is a trace mineral commonly found in seafood, dairy products, grains and eggs. If the quantity of iodine in food is lesser than required, then the neck will swell up due to the enlargement of the thyroid gland. This deficiency disease is known as goitre. Therefore the iodized salt is advised.

P. 92 CHECK YOUR PROGRESS 6

A. Mention any one hormone secreted by the following.

1. Adrenaline

2. Insulin

B. The exocrine part of pancreas secrete pancreatic juice containing digestive enzymes like trypsin, chymotrypsin, amylase and lipase. The endocrine part of pancreas secretes hormones like insulin and glucagon.

C. Undersecretion of hormone insulin causes diabetes mellitus which is associated with high concentration of glucose in the blood and urine.

D. During emergency or dangers, adrenal gland secretes adrenaline. It is a hormone secreted directly into the blood and is transported to different parts of the body. It speeds up the heartbeat and hence supplies more oxygen to the muscles for fight or flight.

P. 94 CHECK YOUR PROGRESS 7

A. Name the following.

1. Thyroid stimulating hormone

2. Oestrogen and progesterone

B. Pituitary gland

C. Feedback mechanism maintains homeostasis.

P. 96 EXERCISES

A. Objective Type Questions

I. Choose the most appropriate answer.

1. b.	**2.** d.	**3.** c.	**4.** c.
5. b.	**6.** b.	**7.** b.	**8.** c.
9. a.	**10.** c.	**11.** c.	**12.** d.

II. Fill in the blanks.

1. Cerebrum

2. Sensory neurons

III. Match the items in column A with the items in column B.

Column A	Column B
1. Dendrites	**d.** nerve impulse
2. Neuron	**a.** basic unit of nervous system
3. Afferent neuron	**b.** carries impulses towards the brain and the spinal cord
4. Efferent neuron	**c.** carries impulses away from the brain and spinal cord
5. Hypothalamus	**e.** thermoregulation

IV. Assertion–Reasoning type questions CBQ

1. (d) **2.** (d) **3.** (c) **4.** (a)
5. (b) **6.** (c) **7.** (a) **8.** (c)
9. (c) **10.** (d)

V. Name the following.

1. Tropism or tropic movements
2. Nasties or nastic movements
3. Auxin
4. Ethylene
5. Synapse
6. Myelin sheath
7. Cerebrospinal fluid
8. Cerebrum
9. Hypothalamus
10. Medulla oblongata
11. Cerebellum
12. Peripheral nervous system
13. Thyroxine
14. Adrenal gland
15. Insulin
16. Pituitary gland
17. Hydrotropism
18. Phototropism
19. Sensory neuron
20. Motor neuron
21. Reflex action

VI. Very short answer type questions.

1. Nervous system and endocrine system
2. The longest thread-like branch arising from the cell body of the nerve cell is called the axon.
3. a. Movement on the touch-sensitive plant
4. Cranium
5. Cerebrospinal fluid
6. Occipital lobe
7. The spinal cord is protected in the human body by vertebral column.
8. Insulin
9. Pituitary gland
10. The olfactory lobes act as a centre of smell.
11. Receptors sensitive to sound are phonoreceptors.
12. Receptors sensitive to smell are olfactoreceptors.
13. Receptors sensitive to touch are thigmoreceptors.
14. Four types of tropisms found in plant are phototropism, geotropism, hydrotropism and chemotropism.
15. Auxins and Gibberellins.
16. The system that works with the endocrine system to communicate, integrate and coordinate the functions of various organs and organ systems in the body is called the nervous system.
17. The small gap between the axon endings of one nerve cell and cyton or dendrite of the next nerve cell is called synapse.
18. The nerves that carry messages from receptors towards the brain are afferent nerves. The nerves that carry messages away from the brain towards the effector organs are called efferent nerves.
19. The system concerned with production of hormones that regulate the physiological processes, and coordinates various body activities in animals is called the endocrine system.
20. The thyroid gland is a large endocrine gland located in the neck region just in front of the trachea or windpipe. Undersecretion of thyroxine may cause simple goitre whereas oversecretion of thyroxine may cause exophthalmic goitre.
21. Adrenaline is also known as emergency hormone as it prepares body for fight or flight situation.
22. Increased thirst, weight loss and frequent urination are some of the symptoms of diabetes mellitus. Undersecretion (hyposecretion) of insulin causes diabetes mellitus or hyperglycemia.

B. Short Answer Type-I Questions.

1. The growth and movement of a plant part in response to the light is called phototropism. Auxin controls phototropism.

2. Cerebrum governs mental abilities like thinking, reasoning, learning, memorizing and intelligence. It also controls will, emotions and speech. It enables one to observe things through sense organs. This part also controls the feelings of love, admiration and hatred. Cerebellum maintains the equilibrium and controls postures.

3. a. Islets of Langerhans

b. Synapse

c. Cerebellum

d. Motor nerves or efferent nerves

4. a. Progesterone: influence ovulation and maintains pregnancy

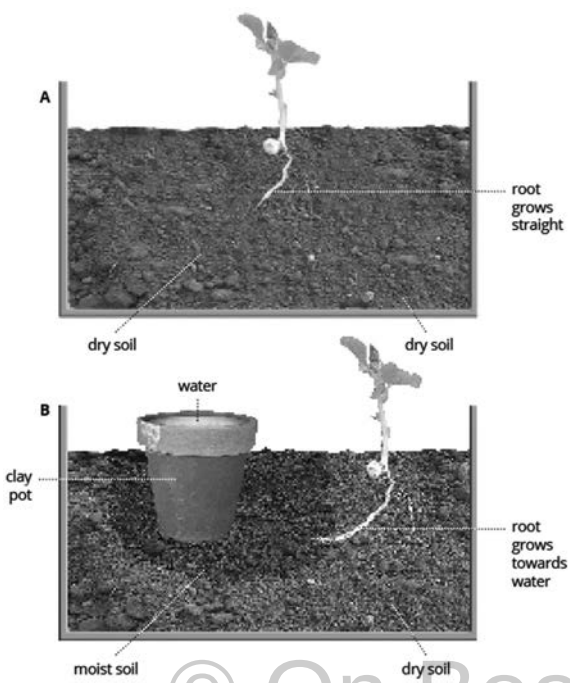
b. Testosterone: development of secondary sexual characteristics in males

C. Short Answer Type-II Questions.

1. Response of plants to water: Hydrotropism

The movement of plant parts towards water or moisture is called hydrotropism. The roots always grow towards water, therefore roots are positively hydrotropic. This can be shown through an experiment.

Take two glass troughs and fill two-third of them with soil. In both the troughs plant a tiny seedling. In the second trough place a small clay pot inside the soil. Now, water the soil in the first trough daily and put water in the clay pot placed inside the soil in second trough.



An experiment to show the response of a plant to water or hydrotropism.

After a few days, dig up the seedling from both troughs. We will notice that roots of the seedling of first trough are straight and that of the second trough in which clay pot filled with water was placed have bent towards the side at which clay pot was placed. This shows that roots of a plant grow towards water.

2. The three main divisions of human brain are – forebrain, midbrain and hindbrain.

The forebrain has olfactory lobes, the cerebrum and diencephalon. Midbrain consists of optic lobes concerned with vision. The hindbrain has three main centres – cerebellum, pons and medulla oblongata.

3. The hindbrain has three main centres – cerebellum, pons and medulla oblongata.

The cerebellum controls the body postures. Pons helps in respiration. Medulla oblongata contains vital centres for swallowing, sneezing, coughing and vomiting.

4. A reflex action may be defined as a spontaneous, automatic and mechanical response to a stimulus controlled by the spinal cord without the involvement of brain.

Stimulus received by the sensory receptors---> Impulse is generated and carried along by sensory neurons towards the spinal cord along the dorsal root---> Impulse arrives at the nerve endings of sensory neurons in the grey matter of the spinal cord.--->The impulse passes across the relay neuron to the motor neuron via synapse--->Impulse travels along motor neurons away from the spinal cord along the ventral root--->The nerve endings of motor neuron connect effector organ or muscle---> Response produced by effector organ or muscle

5. The ductless glands which produce hormones are called endocrine glands. Hormones are released directly into the tissue space next to each endocrine cell and are carried by blood or lymph to the target organ. Pancreas, thyroid, parathyroid and pituitary gland are examples of endocrine glands.

6. The secretions from endocrine glands are released directly into the tissue space next to each endocrine cell and are carried by blood or lymph to the target organ.

7. Adrenal gland secretes adrenaline and noradrenaline and thyroid gland produces thyroxine. Adrenaline controls emotions, fear, anger, etc. Thyroxine stimulates rate of cellular oxidation, basal metabolism.

8. Hormones are chemical messengers secreted by endocrine glands and carried by blood and lymph to the target organ elsewhere in the body to stimulate a specific activity that may be biochemical or physiological.

Growth hormone is secreted by pituitary gland. Growth hormone regulates overall development of the body.

9. a. In hilly regions many people are found to be iodine deficient which could cause problems in thyroid gland and may form goitre.

b. Oversecretion of growth hormone during childhood can cause the abnormal growth in children called gigantism.

c. Facial hair develop in boys around the age of 13 because of the onset of puberty.

10. The central nervous system is composed of the brain and the spinal cord. The peripheral nervous system is composed of cranial nerves, spinal nerves and the autonomous nervous system.

Brain gets protection, as it is enclosed inside the skull or cranium. Spinal cord gets protection by the vertebral column.

11. Chemical coordination occurs in plants with the help of phytohormones or plant hormones or plant growth regulators secreted by plants. Auxin, cytokinin, gibberellin, abscisic acid and ethylene are plant growth regulators. These hormones regulate the growth and development of the plants. They also regulates various metabolic activities in the plants. These hormones respond to the external stimuli like light, temperature, etc. For example, auxin is responsible for the growth of the plants and cytokinin is responsible for the cell division. Similarly, gibberellin is responsible for stem elongation, flowering etc. and ethylene is responsible for fruit ripening. Abscisic acid is responsible for the dormancy.

12. It is the nervous system which governs the way a particular organ or organ system has to work. This control is achieved by a complex network of neurons which carry signals in the form of electric impulses; to and from the brain.

The hormonal system, on the other hand, coordinates the functioning of nervous system. The hormonal system has somewhat indirect control on various functions.

Nervous and hormonal systems are complementary to each other. Thus, it can be said that nervous and hormonal system together perform the function of control and coordination in human beings.

13. The function of receptors is to detect the information from the environment. These are located in our sensory organs like eye, ear, skin, nose and tongue. For example- olfactory receptor detect the smell. If these receptors are not working properly, the external stimulus won't be able to stimulate receptors and no nerve impulse is generated. The result is that the body would not respond to changes in the surroundings.

14. Plants and animals respond to stimuli in different ways as animals have nervous system while in plants it is absent. For example, the movement of sensitive plant leaves occurs due to the sudden loss of water in pad like swelling (pulvinous leaf base) at the base of all the leaves. Leaf gets drooped and folded due to the loss of water from pulvinus.

On the other hand, the movement of our legs take place due to pull in the muscles of legs on the leg bones. It is a voluntary action. The cerebellum of the hindbrain controls it.

15. The immediate change that takes place in its body for a squirrel to either fight or run -

The hypothalamus activates the sympathetic nervous system and releases adrenaline from the adrenal gland. The adrenaline causes an increase in heart-pumping rate, breathing rate. Thus the animal body becomes ready to deal with the situation.

16. Chemical communication is always better than that of electrical impulses as a means of communication between the cells in a multi-cellular organism because

(i) Chemical communication involves communication through hormones, it does not require any specialized tissue like nervous tissues for signaling to take place.

(ii) Chemical signals are carried out by blood and thus have some delay in the response than an electrical one.

(iii) Electrical communication is limited to only those regions which are connected by nerves while chemical coordination can take place throughout the body.

(iv) The electrical impulse is very rapid and helps in quick response.

(v) Chemical communication can be done steadily and persistently.

D. Long Answer Type Questions

1. The human brain is a highly developed organ and is situated in the cranium (or bony box) of the skull. It is covered on the outside by three membranes called meninges which help to protect it. The outer tough, protective layer dura mater is formed of fibrous tissues. The cerebrospinal fluid fills the spaces between the meninges and also brain cavities or the ventricles. The fluid protect the brain from shock.

The human brain is divided into three major regions:

(i) **Forebrain:** It is the anterior region of the brain. It has three main parts – the olfactory lobes, the cerebrum and diencephalon.

The olfactory lobes are a pair of very small, club-shaped bodies which remain fully covered by the cerebrum.

Cerebrum is the largest, highly developed and most prominent part of the brain. It is divided into two cerebral hemispheres (right and left) separated in the centre by a deep median longitudinal groove. A thick band of nerve fibres called corpus callosum connects the two hemispheres.

The diencephalon mainly consists of the pineal gland, pituitary gland, thalamus and hypothalamus.

(ii) **Midbrain:** It is a thick-walled structure and constitutes a comparatively smaller portion of the brain. The midbrain connects the anterior region of the brain to the posterior region and therefore all nerve fibre tracts pass through this region. It consists of four optic lobes concerned with vision.

(iii) **Hindbrain:** The hindbrain has three main centres – cerebellum, pons and medulla oblongata.

The cerebellum is situated in the dorsal region of hindbrain.

Pons forms the part of the brain stem in the floor of hindbrain. It is a bridge of transverse nerve tracts from the cerebrum to the cerebellum. It also connects the forebrain to the spinal cord.

The medulla oblongata forms the third main component of hindbrain. It is the lowermost part of the brain. This part of the brain extends into the spinal cord.

2. A reflex action may be defined as a spontaneous, automatic and mechanical response to a stimulus controlled by the spinal cord without the involvement of brain. The pathway followed by sensory and motor nerves in a reflex action is called reflex arc. Components of a reflex arc are:

(i) **Receptor or sensory organ:** Perceives the stimulus.

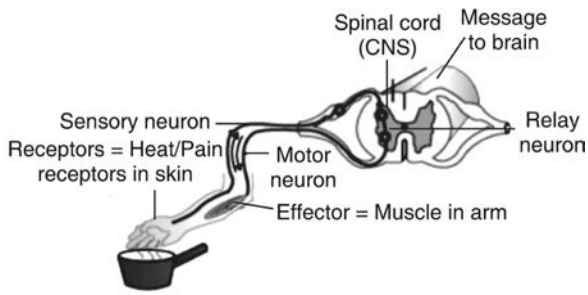
(ii) **Sensory or afferent nerve:** Carries message from receptor to spinal cord.

(iii) **Relay neurons of the spinal cord:** Transmit impulses from afferent neurons to the efferent neurons.

(iv) **Motor or efferent nerve:** Carry messages from spinal cord to the effector organs.

(v) **Effector organ:** Responds by producing movement or secretions.

For example, immediate withdrawal of hand if a person touches a hot object unknowingly.



3. a. Thyroid Gland: The thyroid gland secretes thyroxine. It regulates body temperature by energy production; It regulates growth and development of the body and mental development; It regulates activities of the nervous system. It regulates metabolism of carbohydrate, protein and fat.

b. Pancreas: Secretes insulin hormone. It regulates blood sugar level in two ways:

(i) Whenever there is increase in blood glucose, insulin is secreted which induces uptake of glucose. Glucose is utilized by the body cells or stored as glycogen. This reduces the blood glucose level.

(ii) It stimulates deposition of extra glucose as glycogen in the liver and muscles.

c. Gonads: In males, there are a pair of testes that secrete male hormone, testosterone, which in turn influences the appearance of secondary sexual characteristics like development of male sex organs and male features like deeper voice, more body hair, beard, moustache, etc. These changes are associated with puberty and occur at an age of approximately 13–14 years.

In females, there are ovaries which secrete oestrogen and progesterone, which in turn

influence the process of ovulation, formation and maintenance of corpus luteum and appearance of secondary sexual characteristics like development of female sex organs, mammary glands, feminine voice, etc. These changes are associated with puberty and occur at an age of 10–12 years.

E. Source-based/Case-based/Passage-based/ Integrated assessment questions CBQ

1. **a.** (ii) **b.** (i) **c.** (ii) **d.** (ii) **e.** (iv)

2. **a.** (ii) **b.** (iv) **c.** (ii) **d.** (ii) **e.** (iv)

P. 100 HIGHER ORDER THINKING SKILLS (HOTS) QUESTIONS

A. The given diagram is of sagittal section of brain.

1. **a.** Cerebrum, **b.** Cerebellum, **c.** Pons, **d.** Medulla oblongata, **e.** Spinal cord

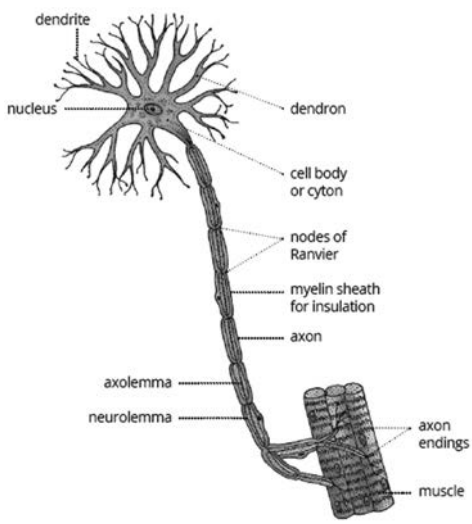
2. Part **a** is Cerebrum. Cerebrum governs mental abilities like thinking, reasoning, learning, memorizing and intelligence. It also controls will, emotions and speech. It enables one to observe things through sense organs. This part also controls the feelings of love, admiration and hatred.

Part **c** is Pons. It forms the part of the brain stem in the floor of hindbrain. It is a bridge of transverse nerve tracts from the cerebrum to cerebellum. It also connects the forebrain to the spinal cord. Pons helps in respiration.

3. The body's control over maintaining the postures will be lost if part **b** gets damaged. Damage of part **d** will hamper the reflex actions such as coughing, sneezing, swallowing, vomiting, etc.

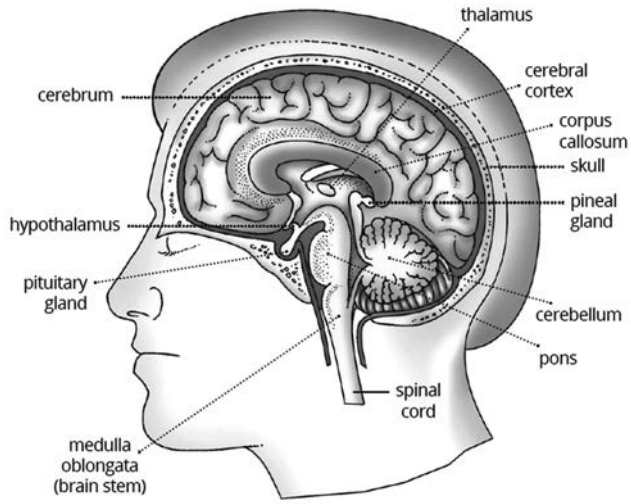
B. Make the following diagrams labelling all its parts.

1. A typical nerve cell or neuron



A nerve cell or neuron

2. Parts of the human brain

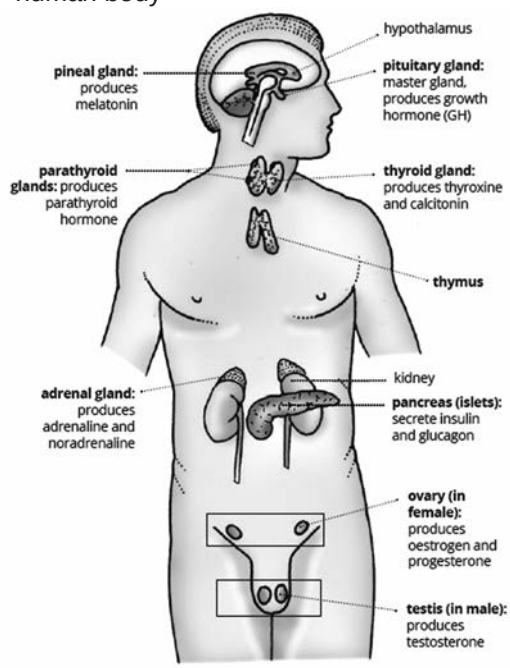


Parts of the human brain

3. Components of the reflex arc

Refer to Figure in **2.** of long answer type questions

4. Positions of various endocrine glands in the human body



Location of endocrine glands in our body

C. The given diagram represents the human brain as seen in an external view. Study the same and then answer the questions that follow.

1. **a.** Frontal lobe, **b.** cerebellum, **c.** medulla oblongata, **d.** Spinal cord.

2. Part **c** is medulla oblongata which is concerned with controlling the reflexes such as coughing, sneezing, vomiting.

Part **d** is spinal cord. It is the centre for reflex actions and conducts impulses from and towards the brain. It also mediates most of the involuntary actions.

3. Corpus callosum

D. The given diagram is that of a human brain. Label a – e indicate different parts of the brain as shown.

1. **a.** Frontal lobe of cerebrum, **b.** Auditory area of cerebrum, **c.** Occipital lobe of cerebrum, **d.** Cerebellum, **e.** Medulla oblongata.
2. **i.** may affect the vision.

   ii. will lead to loss of balance of the body and coordination of muscular activities.
3. Part **a** is concerned with the thinking.

   Part **b** is concerned with hearing.

   Part **e** controls the reflexes such as coughing, sneezing and vomiting.

E. For diagram, please refer to Figure 2.22 and 1.30 of textbook.

1. The thyroid gland secretes thyroxine. Thyroxine stimulates the rate of cellular oxidation and metabolism.
2. Hyposecretion of thyroxine in children causes cretinism.
3. Adrenal glands secrete two major hormones – adrenaline (epinephrine) and noradrenaline (nor-epinephrine). Both adrenaline and noradrenaline, together control emotions, fear, anger, blood pressure, heartbeat, respiration and relaxation of smooth muscles. These are also known as emergency hormones as they prepare body for fight or flight situation. It increases heartbeat, increases blood supply to muscles and decreases blood supply to visceral organs.

F. 1. Adrenaline is the hormone responsible for these changes. It is secreted by adrenal gland (adrenal medulla). Adrenal gland also produces noradrenaline. Noradrenaline functions together with adrenaline.

2. The increase in concentration of blood glucose activates insulin production by beta cells of islets of langerhans in pancreas. This hormone stimulates the conversion of glucose to glycogen. That brings the blood sugar level to normal.
3. Same as 2

G. 1. Drawing pin is the stimulus

2. Foot is the effector. Foot is pulled up immediately in response to the stimulus.
3. stimulus $\rightarrow$ receptor $\rightarrow$ sensory neuron $\rightarrow$ synapse $\rightarrow$ motor neuron $\rightarrow$ effector

P. 101 VALUE-BASED QUESTIONS (OPTIONAL)

1. Alcohol can affect our nervous system by affecting different parts of the brain that control movement, speech, judgment and memory. It leads to difficulty in walking, slurred speech, memory lapses, and impulsive behaviour. Consumption of alcohol is a social evil because it leads to impulsive behaviour, vandalism and violence.
2. Reflex action is the phenomenon involved in this process. Spinal cord controls such stimulus. We should wear footwear while walking in the park. At the same time we should be careful enough and take precautionary measures to avoid recurrence of such situations.
3. These changes are caused by adrenaline hormone. This hormone is secreted by adrenal gland. Ramesh should be first asked to calm down and breathe, and follow the instructions given by the rescue personal properly and also a generator can be switched on to provide electricity to the lift.

CHAPTER – 3

REPRODUCTION IN PLANTS AND ANIMALS

P. 112 CHECK YOUR PROGRESS 1

A. Reproduction is the process by which a living organism is able to produce more of its own kind. Reproduction ensures continuity of life and survival of a species on earth. Therefore it is essential for living organisms.

B. Name the following.

1. a. Asexual reproduction

b. Sexual reproduction

2. a. Budding

b. Multiple fission

3. *Rhizopus*

4. Tuber

5. Bulb

6. Rhizome

C. Fill in the blanks.

1. Binary fission, multiple fission

2. Eyes or buds

3. Layering

4. Stem cutting

D. *Bryophyllum* produces adventitious buds on the margin of their leaves. When the leaf falls on moist soil, these buds develop into small plantlets. These plantlets get separated and grow into independent plants, thus promoting vegetative propagation.

E. Name one plant that reproduces by

1. Sugarcane

2. Jasmine

3. Mango

4. Orchids

F.

	Stock	Scion
(i)	The plant whose root system is taken for grafting is called stock.	The plant whose shoot system is taken for grafting is called scion.
(ii)	Stock is selected for a deep root system, efficient in absorbing water and minerals.	Scion is a plant having desirable characteristics like large size, better yield and nutritious fruits.

G. Tissue culture or micropropagation is the technique of maintaining and growing plant cells, tissues or organs on artificial medium in suitable containers under controlled environmental condition. A small part of tissue is cut from a plant and grown in a test tube under sterile conditions in special nutrient media.

H. Spores can remain dormant till favourable conditions become available. Spores help an organism to tide over the adverse condition. Spores can be spread through water, air or animals and thus is good for the spread of an organism to more places.

P. 116 CHECK YOUR PROGRESS 2

A. 1. Male

2. Female

3. Pollen grain

4. Stigma

5. Cytoplasm of pollen grain

6. Pollen tube

7. Style

8. Ovary

9. Nucleus

10. Mitosis

11. Egg

12. Embryo sac

13. Embryo sac

14. Zygote

15. Fertilization

B.

	Pollination	Fertilisation
(i)	It is the transfer of pollen grains from anther to stigma of the carpel.	It is the fusion of male and female gametes.
(ii)	It is an external process	It is an internal process
(iii)	Pollinators are required	Pollinators are not required
(iv)	It occurs before fertilisation and leads to fertilisation	It occurs after pollination and leads to seed formation.

P. 120 CHECK YOUR PROGRESS 3

1. The embryo gets nourishment inside the mother body through a special tissue called placenta. The embryo grows inside the mother's womb and gets nourishment from mother's

blood through the tissue called placenta. The placenta is a temporary organ that develops in the uterus during pregnancy. It attaches the fetus to the uterine wall. It also provides nutrients to the fetus and also allows the fetus to transfer waste product's to the mother's blood.

2. a. Secondary sexual characters at the time of puberty in human males:

(i) Deepening of voice.

(ii) Appearance of beard and moustache.

(iii) Enlargement of external genital organs.

b. Secondary sexual characters at the time of puberty in human females:

(i) Growth of hair under arm and in pubic area.

(ii) Enlargement of breasts.

(iii) Initiation of menstrual cycle.

3. Seminiferous tubules.

4. Seminal vesicles, Prostrate glands and Cowper's glands.

5. a. A pair of testes, a pair of epididymis, a pair of vasa deferentia, urethra, penis and accessory glands.

b. A pair of ovaries, a pair of Fallopian tubes, uterus, vagina and external genitalia.

P. 120 CHECK YOUR PROGRESS 4

1. The fusion of male and female gametes to form zygote is called fertilization.

2. a. Implantation is the fixing of developing zygote called morula in the wall of the uterus.

b. Placenta is the physiological connection between the developing embryo and mother's uterine wall.

c. Amnion is the sac-like structure in which the embryo is enclosed.

3. Oxygen and food are received by the foetus from the mother through placenta.

4. Carbon dioxide and urea excreted by the foetus diffuses from the foetus blood to the mother's blood through placenta.

P. 123 CHECK YOUR PROGRESS 5

1. The contraceptive methods can be broadly classified into the following categories:

Commonly used methods of contraception in human males and females are:

(i) Natural methods like rhythm method of contraception and coitus interruptus.

(ii) Mechanical methods using condoms, diaphragm or IUD.

(iii) Chemical methods using spermicidal creams or oral contraceptive pills.

(iv) Surgical methods like vasectomy in males and tubectomy in females.

2. Intra uterine device

IUD is a very effective contraceptive device made of plastic or stainless steel. It is inserted in the uterus. Its insertion causes certain secretions which prevent the implantation of embryo in the uterine wall.

3. a. Vasectomy

b. Tubectomy

4. Medical termination of pregnanc

MTP is recommended in case of an emergency or if there is an evidence of genetic disease in the foetus and removal of foetus is necessary for the life of the mother.

5. When a cell reproduces, its DNA is copied and passed on to the offspring. DNA copying is an important step in the process of reproduction as DNA is the blue-print of the body design of the offspring.

6. Contraception is used to prevent pregnancy, and some types will also protect from sexually transmitted infections (STIs). Contraceptive methods are mainly adopted because of the following reasons:

(i) To prevent unwanted pregnancies.

(ii) To control population rise or birth rate.

(iii) To prevent the transfer of sexually transmitted diseases.

P. 124 CHECK YOUR PROGRESS 6

1. Acquired immuno deficiency syndrome.

2. Human immunodeficiency virus.

3. HIV can be transmitted through:

(i) Sexual contact with the affected person through semen or vaginal fluid or through blood in case there is any tearing of tissues during the intercourse.

(ii) Exposure to infected blood and blood products by using the same syringe already used by an infected person, and by use of infected blood during blood transfusion.

P. 126 EXERCISES

A. Objective Type Questions

I. Choose the most appropriate answer.

1. d.	**2.** a.	**3.** b.	**4.** b.
5. b.	**6.** a.	**7.** d.	**8.** b.
9. c.	**10.** c.	**11.** b.	**12.** b.
13. c.	**14.** b.	**15.** c.	**16.** d.

II. Write true or false.

1. False	**2.** False	**3.** True	**4.** True
5. False	**6.** False	**7.** False	

III. Match the items in column A with the items in Column B

Column A	Column B
1. Fertilization	**e.** Fallopian tube
2. Menopause	**f.** complete stoppage of menstrual cycle
3. Acrosome	**b.** spermatozoa
4. Ovulation	**d.** release of the ovum from the ovary
5. Foetus	**c.** an embryo with human baby features
6. Prostrate	**a.** semen

IV. Assertion–Reasoning type questions. CBQ

1. (d)	**2.** (b)	**3.** (b)	**4.** (b)
5. (a)	**6.** (c)	**7.** (b)	**8.** (b)
9. (b)	**10.** (d)		

V. Name the following.

1. Reproduction
2. Binary fission
3. Stem cuttings
4. Gynoecium
5. Pollination
6. Seminiferous tubules
7. Epididymis
8. Ovulation
9. Sexually transmitted diseases
10. Puberty
11. Fertilization
12. Menstruation
13. Ovulation
14. Implantation

VI. Very Short answer type questions.

1. *Plasmodium* reproduce by multiple fission and *Leishmania* reproduce by binary fission. In binary fission, whole parent body divides into two daughter cells whereas in multiple fission many individuals are formed from splitting of a single parent.

2. Certain lower animals form cysts in order to protect the cell from unfavourable conditions.

3. Its filament breaks up into smaller fragments or pieces, and each fragment grows into a new filament/individual.

4. **a.** embryo sac, **b.** Fallopian tube

5. The initial cell formed by the fusion of male and female gametes is called zygote. A zygote is formed by the fusion of male and female gametes.

6. The organs present in human male reproductive system include testes, epididymis, vas deferens, urethra and penis.

7. Prostate gland secretes an alkaline fluid which nourishes and protects sperms.

8. A contraceptive is a method, device or pharmaceutical drug that prevents pregnancy.

9. Process of fission (asexual reproduction) in which two individuals are formed from a single parent is called binary fission. Fission in which many individuals are formed from a single parent is called multiple fission.

10. Yeast and *Hydra* reproduce by budding.

11. The body which produces zoospores is called zoosporangium. Zoospores are formed in sporangia.

12. Spore is a reproductive structure in resting state. In this state the cell is protected by a thick wall during unfavourable conditions.

13. *Spirogyra* and flatworms

14. The undifferentiated mass of cells formed in tissue culture when the tissue utilizes nutrients from the medium and proliferates is called callus.

15. The advantages of vegetative propagation are as follows:

(i) The plants which do not produce viable seeds can be propagated by this method.

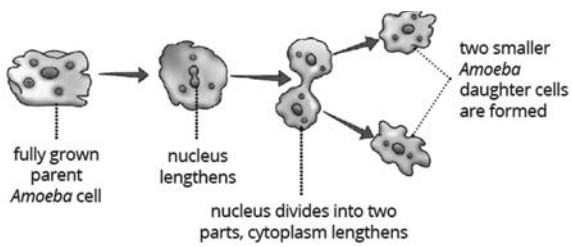
(ii) Plants propagated through vegetative propagation bear flowers and fruits earlier.

16. Pollination is the transfer of pollen grains from anther to stigma of the flower. Pollination brings the male and female gametophytes together for fertilization.

17. The fusion of male and female gametes to form a zygote is called fertilization.
18. The time when ovulation and menstruation in females stop is called menopause.
19. In humans, fertilization takes place in Fallopian tube.
20. Umbilical cord is a tough structure that serves as the blood vascular connection between the foetus and the uterine wall.
21. Use of condoms and intra uterine device
22. The testes of males are extra-abdominal because sperm production needs a cooler temperature than the inside of the body.
23. *Hibiscus*
24. Define the following:
    a. **Androecium:** Male reproductive part of a flower.
    b. **Zygote:** The initial cell formed by the fusion of male and female gametes.
    c. **Testes:** Male gonads.
    d. **Ovaries:** Ovum producing reproductive organs in females.
    e. **Graafian follicle:** Final stage in maturation of ovum inside the ovary.
    f. **Oviduct:** Passage from ovaries to uterus.
    g. **Corpus luteum:** Structure formed by the rupture of follicle.
    h. **Amnion:** Sac in which embryo is enclosed.
25. Give the major functions of the following with respect to reproduction by a flowering plant.
    a. Thalamus is the broad and bulging part of the flower attached to the stalk.
    b. Gynoecium is the female reproductive part of a flower.
    c. Androecium is the male reproductive part of a flower.
    d. The centrally located structure in the gynoecium.
    e. The area of the ovary wall where the ovules are attached in called the placenta. It is the part where ovules and spores develop.

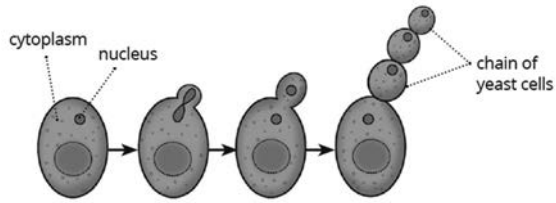
B. Short Answer Type-I Questions

1. Binary fission in *Amoeba*.



Binary fission in *Amoeba*

2. Budding



Budding in yeast

3.

	Binary fission	Multiple fission
(i)	Whole parent body divides into two daughter cells.	Many daughter cells are formed.
(ii)	Nucleus of the parent divides into two daughter nuclei.	Nucleus of the parent cell divides several times.

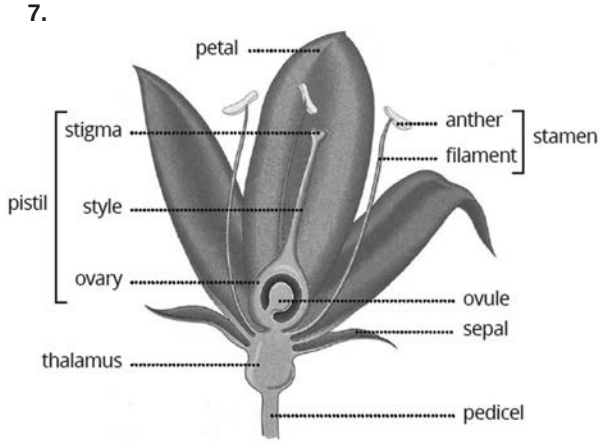
4. *Rhizopus.*

   Three conditions favourable for spores to germinate and grow are: 1. Moist, 2. Cool and 3. Dark place.

5. Advantages of vegetative propagation:
   (i) The plants which do not produce viable seeds or produce very few seeds can be propagated by this method, for example, banana, potato, sugarcane, grape, orange, rose and jasmine plants.
   (ii) The plants raised by vegetative propagation bear flowers and fruits earlier than those produced from seeds. The quality of flowers and fruits is also better.
   (iii) It is a cheaper and more rapid method of plant propagation than growing plants from seeds.
   (iv) Seedless fruits like seedless oranges and grapes, can be obtained by this method.

6. **a.** Stem – *Colocasia*
   b. Leaves – *Bryophyllum*

7.



Structure of a flower as seen in the L.S.

8. The flowers containing only one sex organ (stamen or carpel) are called unisexual flowers, for example, flowers of papaya and watermelon. The flowers containing both the sex organs are called bisexual flowers, for example, flowers of mustard and *Hibiscus*.

9. Seminal vesicles and prostate gland. Semen activates and nourishes sperms.

10. Testes are extra abdominal in human male because sperm needs temperature 2–3°C lower than body temperature to mature.

11.

	Sperm	Ovum
(i)	Sperms are motile.	Ovum are non-motile.
(ii)	Sperms are smaller in size.	Larger in size.
(iii)	Contains X or Y chromosome.	Have only X chromosomes.

12. Fallopian tubes are site of fertilization and conveys fertilized egg/embryo to the uterus.

13. **a.** The lining of uterus thickens and is richly supplied with blood to nourish the growing embryo.

    b. The lining of uterus breaks and comes out through vagina as blood and mucus.

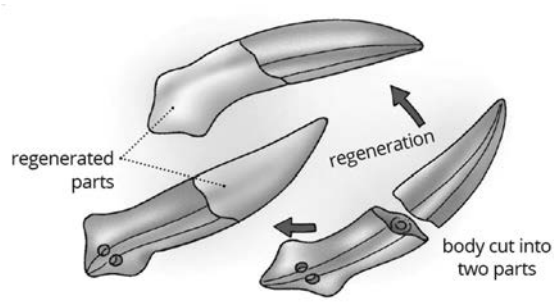
14. Preventive methods of birth control aim at avoiding conception whereas corrective methods aim at terminating pregnancy after conception.

15. Full form of IUD is intra uterine device. It is one of the mechanical methods of contraception wherein a loop that is made of plastic or stainless steel is inserted in the uterus. Its insertion causes secretions which prevent the implantation of embryo in the uterine wall.

C. Short Answer Type-II Questions

1. Reproduction can be defined as a process by which a living organism is able to produce more of its own kind.
   Reproduction is a means of self-perpetuation in which one generation produces next generation. It involves the transmission of genetic material (DNA) from the parental generation to the next generation. This ensures that characteristics not only of the species but also of the parental organisms are perpetuated.
   It is essential for the existence and continuity of a species. The continuity of life on earth, from its origin to the present day, has been possible only because of reproduction. It also plays an important role in evolution by transmitting favourable variations in the gene pool of the organism from one generation to the next.

2. The ability of an organism to replace its lost body part(s) by regrowth is known as regeneration. It is a type of asexual reproduction. If a *Planaria* is cut into small pieces, then each piece develops into a new individual.



Regeneration in *Planaria*

   Regeneration can take place from any part of the organism, example cut tail of a lizard. However, reproduction is a process in which new organism is formed through specialized cells called gametes. Also regeneration does not necessarily give rise to a new individual, whereas reproduction always produces new individuals from the parent organism.

3. A large variety of plants are grown by vegetative reproduction because these plants do not produce seeds and it is a cheaper and more rapid method of reproduction. The desirable characters once obtained can be preserved.

4. The full form of DNA is deoxyribonucleic acid. DNA is present in the nucleus of a cell and is the source for making proteins. Information from parents to offspring in next generation is transferred through deoxyribonucleic acid (DNA) molecules.

   DNA replication (creation of a DNA copy) is the most basic event in reproduction. In this process, biochemical reactions take place in a cell to prepare two copies of DNA in reproducing cells. The copying of DNA is accompanied by creation of an additional cellular apparatus having its own cell contents with genetic similarities. Subsequently, the two DNA copies separate followed by separation of cellular apparatus and hence one cell divides into two daughter cells.

5. Characteristics of sexual reproduction.
   (i) Generally two parents are involved.
   (ii) Two dissimilar gametes are formed, gamete formation involves meiosis.
   (iii) Variations are produced.

(iv) It occurs in all the higher and some of the lower organisms.

(v) Zygote is formed by fertilization or fusion of gametes.

(vi) It is a slow process.

6. The female reproductive part of a bisexual flower is known as gynoecium or carpel. Carpel is also known as a pistil. Each pistil consists of three parts – an upper, sticky flat part stigma, a medial, long, cylindrical part style and a lower, swollen part ovary.

The stigma receives pollen grains during pollination.

The style bears the stigma at a suitable position within the flower to receive the pollen grains.

The ovary contains ovules that are found attached to the placenta. Ovules are the structures in which embryo sacs or egg cells develop, and mature into seeds after fertilization.

7. DNA replication is necessary for cell division and reproduction. DNA replication may not be accurate always and as a result, variations occur. Variations are necessary for survival of the fittest and evolution of a species. Since there are more chances of occurrence of variation in sexual reproduction, therefore it is important.

Each new variation that occurs in DNA copy has already accumulated variations from many previous generations. When two DNA copies (one of each coming from male and female) combine, it creates a new combination of variants, which is novel. This can be made possible only by sexual reproduction in which two individuals are required in place of one as seen in asexual reproduction.

8. Significance of reproductive health:

(i) It prevents sexually transmitted diseases which can be transmitted from an infected person to a healthy person during a sexual intercourse.

(ii) Check the increasing population and gives advantage of small family.

(iii) Less mortality among new born.

(iv) Reduces the cases of maternal mortality.

Areas which have improved over the past 50 years are family planning and decrease in sexually transmitted diseases.

9. The four methods of contraception used by humans are:

(i) Natural methods of contraception: rhythm method of contraception and coitus interruptus

(ii) Mechanical barrier methods of contraception: Condoms or nirodh, Diaphragm or cervical cap and Intra uterine device (IUD) or loop.

(iii) Chemical methods of contraception: Spermicides. Oral contraceptives or pills

(iv) Irreversible surgical methods: Vasectomy and tubectomy.

Their use have a direct effect on the health and prosperity of a family by:

(i) Preventing fertilization and hence to avoid unwanted pregnancy.

(ii) Preventing sexually transmitted diseases which can be transmitted from an infected person to a healthy person during a sexual intercourse.

10. a. Advantages of imposing ban on prenatal sex determination are:

(i) It prevents female foeticide.

(ii) For a healthy society, it is necessary that the female and male sex ratio is maintained adequately.

b. (i) The students can educate the society about the ill-effects of indiscriminate female foeticide by explaining that it will decline the child sex ratio. Our daughters are much better and no less than boys. Also, to fight against the practice of female foeticide, our country has started a social initiative called *Save the Girl child*. *Beti Bachao*, *Beti Padhao* is a Government of India scheme launched by the Prime Minister in 2015.

(ii) A small family is a healthy and happy family. The parents can make the basic amenities or resources available to small family easily as compared to large family.

11. a. Warts and HIV-AIDS are the viral infections

b. Gonorrhoea and syphilis are the bacterial diseases.

Although there is no cure for AIDS, the HIV infection can be prevented by taking certain precautions:

(i) Responsible sexual behaviour

- Avoiding multiple sex partners.
- Using a condom or other barrier method of contraception which prevents direct contact between body fluids of two persons.

(ii) Screening of blood before transfusion

- Treatment of all blood and other products used in transfusion to destroy the HIV.

(iii) Avoiding sharing of needles

- By use of disposable syringes and needles.

(iv) Avoiding pregnancy if the mother is HIV positive.

(v) Educating people

12. AIDS is Acquired immuno deficiency syndrome. Human immunodeficiency virus (HIV) is responsible for AIDS infection.

Mode of transmission: Sexual contact with the affected person through semen or vaginal fluid or through blood in case there is any tearing of tissues during the intercourse.

Measures for the prevention of AIDS:

(i) Responsible sexual behaviour.

(ii) Avoiding multiple sex partners.

(iii) Using a condom or other barrier method of contraception which prevents direct contact between body fluids of two persons.

13. Vegetative propagation is a form of asexual reproduction in which parts of the old plant like stems, roots and leaves grow and develop into a new plant without the help of any reproductive organ.

Two advantages of vegetative propagation:

a. The plants that do not produce viable seeds or produce very few seeds can be propagated by this method, e.g. banana, potato.

b. Seedless fruits like seedless oranges and grapes can be obtained by this method.

Two disadvantages of vegetative propagation:

a. When repeatedly grown using this method, plants lose their vigour.

b. New varieties are not produced.

14. Three techniques to prevent pregnancy- a) mechanical methods, b) chemical methods, c) surgical methods

Use of chemical methods, such as contraceptive pills and spermicides, is not meant for males.

The use of contraceptive methods have direct benefit to the prosperity of the family, such as

a. Large size of families has a negative impact on the economical status of the family. Use of contraception helps in reducing the family size and thus prosperity.

b. It improves the mother's health and vitality.

c. Some contraceptive devices, such as condoms, also helps to prevent the sexually transmitted diseases.

15. Pollination is the transfer of pollen grains from the anther of a stamen to the stigma of a carpel.

Differences between self-pollination and cross-pollination

Self-pollination	Cross-pollination
Occurs within a flower or between two flowers on the same plant	Occurs between the flowers of two different plants of the same species
No external agent of pollination is required	External agents such as wind, water, insects and birds are required
Pollen grains are produced in small numbers	Pollen grains are produced in large numbers (usually)

Significance of pollination:

a. It helps in fertilisation by bringing the male gamete closer to the female gamete and allowing their fusion.

b. It, therefore, helps in the production of seeds and fruits and thereby help in reproduction.

c. Cross-pollination helps in the introduction of new variations in plants.

16. Advantages of sexual reproduction over asexual reproduction:

- In sexual reproduction, more variations are produced. Thus, it ensures survival of species in a population.
- The newly formed individual has characteristics of both the parents.
- Variations are more viable in sexual mode than in asexual one.

D. Long Answer Type Questions

1. The ability of an organism to replace its lost body part(s) by regrowth is known as regeneration.

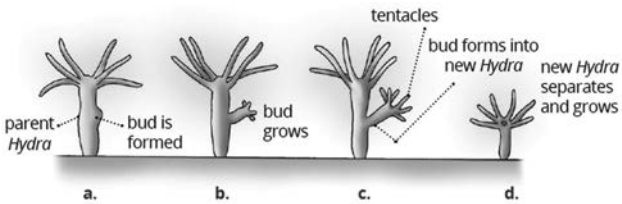
Regeneration in *Hydra*:

When the body of *Hydra* or *Spirogyra* is cut into number of pieces by any means then each piece develops into a new organism. Specialized cells are present in each piece. These cells proliferate and make large number of cells. From this mass of cells different cells undergo changes to become various cell types and tissues finally developing into a new organism.

2.

	Asexual reproduction	Sexual reproduction
(i)	Single parent	Usually two parents take part
(ii)	Offspring are identical to parents	Variation occurs in offsprings

Hydra reproduce by budding. In *Hydra*, the bud arises from one side of the body in the form of a protuberance. The protuberance grows, and develops a mouth and tentacles at its free end. Finally, it gets detached from the parent and grows independently.



Budding in *Hydra*

3. Vegetative propagation can be done by both natural and artificial methods.

(i) The natural methods involves propagation by roots, by stem, by underground stems, by subaerial stems and aerial stems, by runners and by leaves.

(ii) Artificial methods of vegetative propagation involves cutting that includes stem cutting, roots cutting and leaf cutting; layering and grafting and tissue culture.

4. A sexually reproducing organism can never produce an offspring with his own exact set of genetic material because sexual reproduction involves fusion of gametes from two different partners. Half the genetic material is contributed by one partner and the remaining half by another partner.

5. a. (Refer to Fig. 3.25 of Textbook.)

b. Pollination means transfer of the pollen grains (which contain male gametes) from anthers to the stigma.

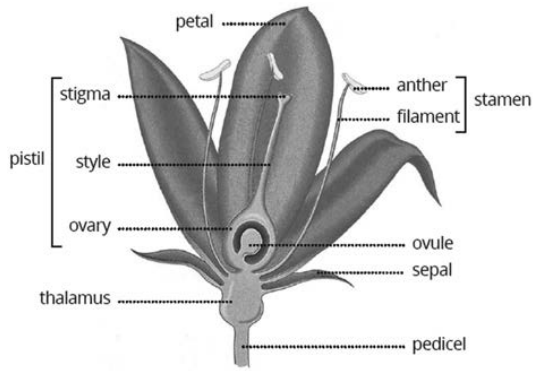
In self-pollination, the pollen grains from anther of a flower are transferred to the stigma of the flower of the same plant whereas in cross-pollination, the pollen-grains from the anther of a flower on one plant are transferred to the stigma of a flower on another plant. Cross-pollination is carried out with the help of agencies like insects, birds, wind and water.

6. Pollination is the transfer of pollen grains from the anther of a stamen to the stigma of a carpel.

The process of fusion of sperm and ovum is known as fertilization.

For figure, (Refer to Fig. 3.25 of Textbook.).

7. a.



Structure of a flower as seen in the L.S.

b. The androecium constitutes the male part of the flower. It is a collection of the male reproductive organs of the flower called stamens. Each stamen has an upper part called anther and a slender stalk called filament.

Gynoecium or carpel is the female reproductive part of a flower. Carpel is also known as a pistil. Each pistil consists of three parts – an upper, sticky flat part stigma, a medial, long, cylindrical part style and a lower, swollen part ovary.

8. a. Unisexual flower – flowers of papaya and watermelon.

Bisexual flowers – flowers of mustard and *Hibiscus*.

b. Following fertilization, the sepals, petals, style and stigma degenerate and usually fall off.

The ovule develops into a seed. After fertilization, the zygote divides many times to form an embryo within the ovule. The ovule develops a tough coat and is gradually converted into a seed. The embryo contains a tiny root (radicle), a future shoot (plumule) and cotyledons. Cotyledons contain food reserves. The endosperm cell divides to form the endosperm or nutritive tissue which supplies food to the developing embryo. As the seed matures, it hardens and dries, enabling it to survive in adverse environmental conditions. The embryo and its food supply are enclosed by a seed coat.

The whole ovary after fertilization develops into a fruit, which protects the enclosed seed. The ovary wall ripens and forms the pericarp of the fruit. This wall of the ovary may harden and become a pod as in poppy or it may

become fleshy and succulent as in plums or tomatoes. There may be one or more seeds in a fruit. The fruit after dehiscence (breaking open) releases the seeds.

c. The germ cells in a male or a female have only half the number of chromosomes and half the amount of DNA in comparison to the non-reproductive body cells. During sexual reproduction, each parent contributes half of the chromosomes which combine to form a new zygote. This re-establishes the number of chromosomes and DNA content in the next generation. For example, the male germ cell has 23 chromosomes and female germ cell also has 23 chromosomes. During fertilization, they fuse together and the zygote gets 23 + 23 = 46 chromosomes.

9. a. Testes (consists of seminiferous tubules) – manufacture sperms.

b. Seminal vesicles – store sperms and secrete seminal fluid that make the sperm active.

c. Vas deferens (sperm duct) - contractions help in the passage of sperms into urethra during ejaculation.

d. Ureter – carries urine from kidney to urinary bladder.

e. Prostate gland - secretes alkaline fluid which is discharged into the urethra.

10. a. Testis produces sperms and also secretes the hormone testosterone.

Functions of testosterone:

i. functional maturation of sperm

ii. development of secondary sexual characters.

b. i. Fallopian tube/oviduct.

ii. uterus

The developing embryo is attached to the uterus by a tissue called placenta. It is the physiological connection between the developing embryo and the mother's uterine wall. Placenta serves as a tissue through which oxygen and food are supplied from the maternal blood to the foetus. It also transports carbon dioxide and excretory waste from the foetal blood to the maternal blood.

11. Once the zygote is formed it immediately begins to divide and forms a mass of cells called morula. It passes down to the uterus and fixes itself to the wall of the uterus. This fixing of morula in the wall of the uterus is called implantation and the female is said to be pregnant or in the stage of pregnancy. Implantation takes place about a week after fertilization.

The developing embryo is attached to the uterus by a tissue called placenta. It is the physiological connection between the developing embryo and the mother's uterine wall. Umbilical cord is a tough structure that serves as the blood vascular connection between the foetus and uterine wall. From the first few weeks of development, the embryo is enclosed in a sac called amnion which is filled with amniotic fluid. This fluid acts as a shock-absorber and helps to protect the embryo from damage. Placenta serves as a tissue through which oxygen and food are supplied from the maternal blood to the foetus. It also transports carbon dioxide and excretory waste from the foetal blood to the maternal blood. After complete development, the uterus is capable of rhythmic contractions leading to the birth of the child.

If the egg is not fertilized, it starts degenerating. At the end of the 28th day, the ovum is ejected along with the uterine lining. This marks the start of a slow disintegration of the thickened lining of the uterus and the next menstrual cycle.

12. During each menstrual cycle, an ovum is matured and released once every 28 days.

The menstrual cycle starts with menstrual flow, during which the cellular lining of the uterus with blood is shed off. This process continues for 3–4 days.

From 5^{th} to 13^{th} day, growth and maturation of graafian follicle occurs. Mature graafian follicle produces the become oestrogen which stimulate the uterus to prepare itself to receive the ovum. The cell lining of the uterus grow rapidly and develop dense network of blood vessels. The graafian follicle ruptures to release the ovum. The cells of the ruptured graafian follicles secretes the hormone, progesterone, which stimulates the uterus to maintain the thickening. If the ovum does not get fertilized, the uterine wall starts to degenerate and on 28^{th} day, the ovum is ejected out along with uterine lining through vagina.

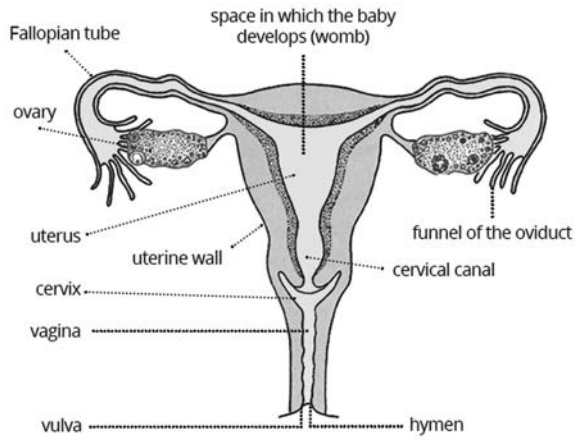
13. Placenta is the physiological connection between the developing embryo and the mother's uterine wall.

Structure – The developing embryo is attached to the uterus by a tissue called placenta. It is the physiological connection between the developing embryo and the mother's uterine

wall. Umbilical cord is a tough structure that serves as the blood vascular connection between the foetus and uterine wall.

Function – Placenta serves as a tissue through which oxygen and food are supplied from the maternal blood to the foetus. It also transports carbon dioxide and excretory waste from the foetal blood to the maternal blood.

14. a.



Female reproductive organs in human beings

(i) Ovary produces the egg

(ii) Fertilization takes place in Fallopian tube

b. Gonorrhea and syphilis

c. Contraceptive devices are involved in the prevention of fertilization and conception of baby.

Two reasons for adopting contraceptive devices:

- Contraception results in birth control and is the basis of family planning.
- Some contraceptive devices, such as condoms, also helps to prevent the sexually transmitted diseases.

15. a. (i) **Ovary:** It produces egg (ova) or female gamete and also produces female sex hormones- oestrogen and progesterone

(ii) **Uterus:** The function of the uterus is to accept the fertilized ovum which will turn into a fetus and hold it during development; it also helps support the fetus during the gestation period.

(iii) **Fallopian tube:** Fertilization takes place in Fallopian tube.

b. Placenta is the physiological connection between the developing embryo and the mother's uterine wall.

Structure: The developing embryo is attached to the uterus by a tissue called placenta. It is the physiological connection between the developing embryo and the mother's uterine wall. Umbilical cord is a tough structure that serves as the blood vascular connection between the foetus and uterine wall.

Function: Placenta serves as a tissue through which oxygen and food are supplied from the maternal blood to the foetus. It also transports carbon dioxide and excretory waste from the foetal blood to the maternal blood.

16. a. Prostate glands and seminal vesicle add their secretions so that the sperms are in a fluid and it makes their transport easier and also provides nutrition.

Testes produce sperms and also secrete testosterone which brings about changes in the appearances in the boys at the time of puberty.

b. It can be misused for foeticide after prenatal sex determination which is illegal and insensitive. For a healthy society, it is necessary that the female and male sex ratio is maintained adequately.

c. Oral contraceptives or pills: Oral contraceptives prevent ovulation in females. Birth control pills contain synthetic hormones resembling oestrogen and progesterone which prevent ovulation but allow monthly shedding of the uterine lining through menstrual bleeding.

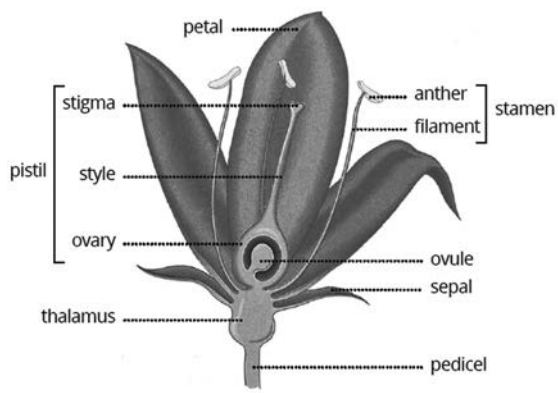
E. Source-based/Case-based/Passage-based/ Integrated assessment questions CBQ

1. a. (iii) **b.** (ii) **c.** (iv) **d.** (ii) **e.** (iv)

2. a. (ii) **b.** (iv) **c.** (iv) **d.** (i) **e.** (iv)

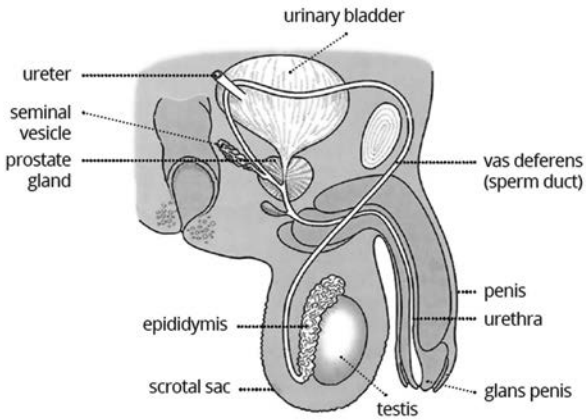
P. 131 HIGHER ORDER THINKING SKILLS (HOTS) QUESTIONS

A. 1. Parts of a flower



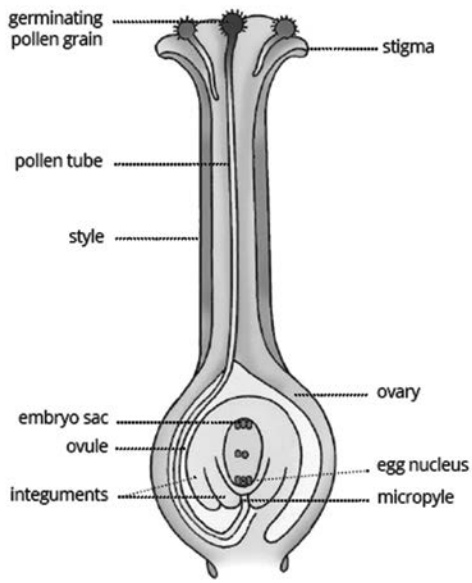
Structure of a flower

2. Male reproductive system in human beings.



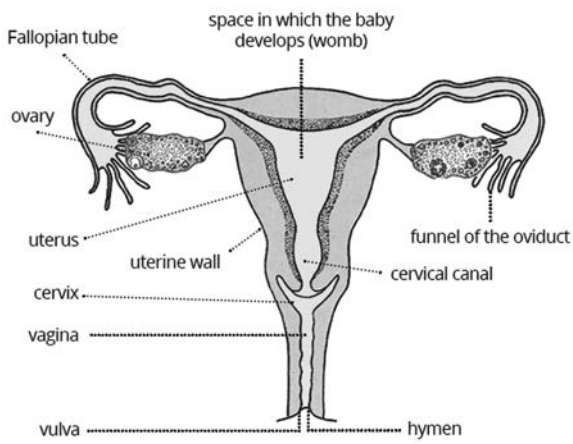
Male reproductive organs in vertical section

3. Longitudinal section of pistil



Longitudinal section of a pistil showing fertilization

4. Organs in the human female reproductive system



Female reproductive organs in human beings

B. 1. Pollen/pollen grain

2. Pollen (part **a**) reaches style (part **b**) by pollinator or agents of pollination.

3. Pollen tube (part **c**) helps male gamete to reach egg (ovule).

4. Part **d** converts into embryo

C. 1. **a.** petal, **b.** stigma, **c.** sepal, **d.** ovule, **e.** anther.

2. Part **e**

3. Part **b**

4. Part **a** degenerate and usually fall off and part **d** converts into embryo.

D. 1. Refer A.4 (HOTS)

2. Fallopian tube is the site of fertilization and also conveys fertilized egg/embryo to the uterus. Amniotic fluid acts as shock absorber and helps to protect the embryo from damage.

3. X–Fallopian tube (refer to A.4 (HOTS))

E. 1. Refer A.2. (HOTS)

2. Testosterone

3. To increase the chance of fertilization

4. The function of seminal vesicles is to store sperms and secrete seminal fluid.

F. 1. The diagram represents surgical method of contraception i.e. tubectomy. Tubectomy is performed in females.

2. **a.** Vagina, **b.** Fallopian tube, **c.** Cut portion of Fallopian tube.

3. Site of fertilization is blocked.

G. 1. **a.** **i.** umbilical cord, **ii.** placenta, **iii.** amniotic fluid, **iv.** cervix, **v.** muscular uterine wall

b. Placenta serves as a tissue through which oxygen and food are supplied from the maternal blood to the foetus. It also transports carbon dioxide and excretory waste from the foetal blood to the maternal blood.

c. Human chorionic gonadotropin hormone (HCG)

d. Amniotic fluid acts as shock absorber and helps to protect the embryo from damage.

2. Hormonal contraception refers to birth control methods that act on the endocrine system. Almost all methods are composed of steroid hormones. The oral contraceptive pills mimic the hormones estrogen and progesterone that prevent ovulation but allow monthly shedding of the uterine lining.

3. Vegetative propagation has both advantages as well as disadvantages.

The advantages are:

(i) The offsprings are genetically identical and therefore advantageous traits can be preserved.

(ii) Only one parent is required which eliminates the need for special mechanisms such as pollination, etc.

(iii) It is faster.

(iv) Many plants are able to tide over unfavourable conditions. This is because of the presence of organs of asexual reproduction like the tubers, corm, bulbs, etc.

(v) Vegetative propagation is especially beneficial to the agriculturists and horticulturists. They can raise crops like bananas, sugarcane, potato, etc., that do not produce viable seeds. The seedless varieties of fruits are also a result of vegetative propagation.

(vi) The modern technique of tissue culture can be used to grow virus-free plants.

The disadvantages are:

(i) Plants gradually lose their vigour as there is no genetic variation. They are more prone to diseases that are specific to the species. This can result in the destruction of an entire crop.

(ii) Since many plants are produced, it results in overcrowding and lack of nutrients.

4. i. Organ '**X**' is ovary and gamete '**C**' is ovum.

ii. Organ '**Y**' is testes and gamete '**E**' is sperm.

iii. Structures '**D**' and '**F**' are fallopian tube and sperm duct respectively.

iv. The cells '**G**' and '**H**' are zygote and morula respectively. Organ '**I**' is uterus.

v. '**A**' is female and '**B**' is male.

5. i. Vasectomy in males and tubectomy in females.

ii. Structure '**X**' is vas deferens and organ '**B**' is testes.

iii. The cells '**A**' and '**D**' are sperm and ovum respectively.

6. Two reasons for the appearance of variations among the progeny formed by sexual reproduction:

(i) Sexual reproduction involves two parents with different sets of chromosomes. DNA replication is necessary for cell division and reproduction. DNA replication may not be always accurate and as a result, variations occur.

(ii) Also each new variation that occurs in DNA copy has already accumulated variations from many previous generations. When two DNA copies (one of each coming from male and female) combine, it creates a new combination of variants, which is novel.

P. 133 VALUE-BASED QUESTIONS (OPTIONAL)

1. a. Vegetative propagation.

Advantages of vegetative propagation:

(i) The plants which do not produce viable seeds or produce very few seeds can be propagated by this method, for example banana, potato, sugar cane, grape, orange, rose and jasmine plants.

(ii) The plants raised by vegetative propagation bear flowers and fruits earlier than those produced from seeds. The quality of flowers and fruits is also better.

(iii) It is a cheaper and more rapid method of plant propagation than growing plants from seeds.

(iv) Seedless fruits like seedless oranges and grapes, can be obtained by this method.

b. Guava and mint

2. a. Such awareness programs are necessary to:

(i) Keep a check on increasing population.

(ii) To avoid unwanted pregnancy.

(iii) To prevent spread of sexually transmitted diseases.

b. Values exhibited by Rashid and his friends are:

(i) Scientific temper

(ii) Social cohesion

(iii) Intellectual honesty

c. Steps to be taken to prevent population explosion are:

(i) The most effective method is to impart education to the masses about various ways of fertility control.

(ii) Use of preventive methods to avoid fusion of the sperm and the egg.

(iii) Educate people about the corrective methods if the unwanted conception has taken place.

3. a. Contraceptive methods involve prevention of fertilization and conception. Contraception results in birth control and is the basis of family planning. Contraception may be natural, mechanical or chemical.

(i) Natural methods: Rhythm method of contraception and coitus interruptus

(ii) Mechanical barrier methods of contraception: In this approach, various

mechanical methods are used to prevent the passage of semen to the Fallopian tube or to prevent implantation. Condoms or nirodh, Diaphragm or cervical cap, Intra uterine device (IUD) or loop.

(iii) Chemical methods of contraception: Spermicides, Oral contraceptives or pills.

Irreversible surgical methods: Surgical methods are irreversible and provide permanent form of birth control by blocking the vas deferens (in males) or Fallopian tube (in females).

b. Education helps to make people aware about:

(i) Various ways of fertility control.

(ii) The advantages of a small family and the disadvantages of a large family.

4. a. The reason behind repeated unwanted pregnancies in women and resultant death is due the lack of education and awareness about the different ways of fertility control and the advantages and disadvantages of a large family.

b. We can make people aware about this problem by educating them about the various ways of fertility control and creating awareness about the advantages of a small family and disadvantages of a large family. We can organize an awareness program to educate illiterate women.

c. Mechanical barrier methods of contraception: Condoms or nirodh, Diaphragm or cervical cap, Intra uterine device (IUD) or loop.

5. The approach of female foeticide is absolutely wrong. Because of this the child sex ratio is declining which is wrong.

This evil can be prevented by making the society aware that our daughters are much better and no less than boys. To fight against the practice of female foeticide, our country has started a social initiative called *Save the Girl child*. *Beti Bachao, Beti Padhao* is a Government of India scheme launched by the Prime Minister in 2015.

The sex of the offspring will be determined by the type of chromosome (X or Y) inherited from father. At the time of fertilization, when the sperm and the egg unite to form a zygote, each individual inherits one of the two possible combination of sex chromosomes. A zygote (XX) with two X-chromosomes (one from father and one from mother) develops into a girl while a zygote, (XY) with one X-chromosome (from mother) and one Y-chromosome (from father) develops into a boy.

6. a. Scientific temper, social justice and helpfulness.

b. No, it is not appropriate to isolate and neglect the person suffering from HIV because HIV is not spread by mere touch or physical contact; it spreads only through body fluids.

c. Although there is no cure for AIDS, the HIV infection can be prevented by taking certain precautions:

(i) Responsible sexual behaviour

- Avoiding multiple sex partners.
- Using a condom or other barrier method of contraception which prevents direct contact between body fluids of two persons.

(ii) Screening of blood before transfusion

- Treatment of all blood and other products used in transfusion to destroy the HIV.

(iii) Avoiding sharing of needles

- By use of disposable syringes and needles.

(iv) Avoiding pregnancy if the mother is HIV positive.

(v) Educating people

7. a. No, it is not appropriate to isolate and neglect the person suffering from HIV because HIV is not spread by mere touch or physical contact; it spreads only through body fluids. We should take care and support the person suffering from HIV emotionally to combat the stress.

b. One can protect oneself from AIDS by:

(i) Avoiding multiple sex partners.

(ii) Using a condom or other barrier method of contraception which prevents direct contact between body fluids of two persons.

(iii) By use of disposable syringes and needles.

8. a. View point of social activists is correct because educating people about the use of contraceptives and HIV-AIDS is very important to control population explosion and preventing spread of deadly disease HIV-AIDS.

b. HIV spreads by:

(i) Having multiple sex partners.

(ii) Not using proper contraceptives.

(iii) Transfusion of HIV infected blood.

(iv) Sharing needles.

CHAPTER – 4

HEREDITY AND EVOLUTION

P. 137 CHECK YOUR PROGRESS 1

A. All the variations in the species do not have equal chances of survival in the environment. The survival of the variations depends upon the nature of variation. Different individuals have different chances. Selection of variants by environmental factors forms the basis for evolutionary processes. These variations may lead to increased survival advantages of the individuals due to positive adoption of traits or may merely contribute to the genetic drift.

B. Match Column A with Column B.

1. c **2.** a **3.** e **4.** b **5.** d

P. 142 CHECK YOUR PROGRESS 2

A. Mendel conducted his experiment on garden pea plant, *Pisum sativum.* He chose this plant for the following reasons:

(i) All the varieties of pea plants have sharp contrasting characteristics, such as colour and shape of seeds.

(ii) Pea plant bears bisexual flowers which ensures self-pollination to get pure lines.

(iii) It is an annual plant so it is easy to study several generations within a short span of time.

(iv) Pea plants are easy to cultivate and handle.

(v) Each pea plant produced many seeds in one generation.

B. According to Mendel's law of independent assortment, during the inheritance of two or more characters, the assortment of individual traits takes place independently during gamete formation. Thus each allele of a pair segregates independently and each gamete formed contains one allele of that trait. This law is inapplicable for linked genes.

Mendel performed the dihybrid cross from which he showed that the traits are inherited independently. For example, heterozygous round-yellow seeded pea plant were taken as F_1 generation. The genotype of both the F_1 plants is RrYy. These plants were self-crossed by Mendel. In his dihybrid cross the F_2 plants were obtained in the phenotypic ratio 9 (round yellow): 3 (round green): 3 (wrinkled yellow):1 (wrinkled green). The seed colour is inherited independently of the seed shape. Thus round green seeds, as well as yellow wrinkled seeds both were formed along with round yellow seeds and green wrinkled seeds.

C. Fill in the blanks.

1. 3 : 1

2. 9 : 3 : 3 : 1

3. Homozygous

4. Heterozygous

5. Dominance

P. 144 CHECK YOUR PROGRESS 3

A. Answer these questions.

1. Gene is a unit of inheritance forming part of a chromosome. It is a section of DNA found on chromosomes. Genes are passed from parents to the offsprings via chromosomes present in the nuclei of the parents' gametes.

2. The biological process through which the sex of an individual is determined majorly due to chromosomal or sometimes environmental factors, is called sex determination.

3. Sex chromosomes which are XX in females and XY in males.

4. Autosomes are the somatic chromosomes which control the body characters or somatic characters of an individual.

	Autosomes	Sex chromosomes
(i)	Determines somatic traits.	Determines gender of an individual.
(ii)	Males and females contain the same copy of autosomes.	Different in males and females by their size, form and behaviour.
(iii)	22 pairs of autosomes are homologous in humans.	Female sex chromosomes (XX) are homologous while male sex chromosomes (XY) are non-homologous.

P. 154 CHECK YOUR PROGRESS 4

1. Evolution is defined as a naturally occurring slow, continuous and irreversible process of change.

2. Evidences in support of organic evolution:

(i) **Morphological and anatomical evidences:** There are similarities and differences among organisms of today and those existed years ago revealing common ancestor or different ancestor:

(a) **Homologous organs:** Which includes organs similar in structure and origin but different in function.

(b) **Analogous organs:** Which includes organs similar in function but different in structure and origin.

(ii) **Vestigial Organs:** These organs are the remains of organs that were fully developed and functional in the ancestral forms in the past and have disappeared due to change in the mode of life of organisms.

(iii) **Embryological evidence:** Developmental stages of vertebrates show resemblance among their embryos indicating all vertebrates have evolved from a common ancestor.

(iv) **Palaeontological evidence:** Fossils provide direct and most reliable evidence for evolution.

(v) **Biochemical evidence:** Organisms which support common ancestry show similar biochemical reactions like nature and functions of enzymes and hormones, composition of blood and lymph etc.

3. Homologous organs are similar in structure and origin but different in functions, such as forelimbs of seal, bird, bat, horse and human being. Similarity in structures indicates that these organisms have a common ancestry but variation in their function are due to adaptation of the organisms in different habitat, feeding habits, etc.

Organs similar in function but different in structure and origin are termed analogous organs, such as wings of an insect, bat and bird. This shows that similarity in adaptation may result in the evolution of dissimilar organs to perform the same function.

4. Evidences that birds have evolved from reptiles:

(i) *Archeopteryx,* one of the most commonly known fossils is a connecting link between reptiles and birds. It possesses the features of both reptiles and birds. It has wings like that of birds, while scale, teeth and tail like that of reptiles.

(ii) Feathers developed to provide insulation in cold weathers. Some dinosaurs had feathers. Later feathers evolved so as to become useful for the purpose of flight. Birds have adopted feathers for flight. This shows that the birds have evolved from reptiles, as dinosaurs were reptiles.

5. Factors contributing to species formation:

(i) Geographical isolation of population due to any physical barrier.

(ii) Reproductive isolation due to which there is no gene flow between separated population groups.

(iii) Genetic drift leading to accumulation of changes in genetic make-up.

(iv) Variation caused due to natural selection.

6. No, these animals cannot be grouped together on the basis of eye. Eye of insects, octopus, *Planaria* and vertebrates are analogous organs which have developed bit by bit over generations in their own way as adaptation for similar function.

Eye is a very complex organ of sight in mammals. *Planaria* have very simple eyes, just eye spot to detect light. Even these rudimentary structure provide advantage to the animal to ensure its survival. From this basic design, more complex eyes later evolved in different organisms. For example, eyes in insects, octopus and all vertebrates have different structures and also have separate evolutionary origin. The complex structure of eyes in these animals have been created in stages over many generation.

7. All human beings belong to the same species as humans of different size, look and skin colour have same number and structure of chromosomes. They have similar DNA sequences and have descended from same ancestor. They are capable of breeding among themselves to produce fertile offsprings. The variation might have arisen due to environmental factors, mutation and mixing of characters during sexual reproduction.

8. Asexual reproduction is a type of reproduction that does not involve the fusion of gametes or change in the number of chromosomes. In asexulally reproducing organisms, geographical isolation cannot be a major factor in speciation because there is no need of two organisms to reproduce. Geographical isolation is a major factor in the speciation of organisms that reproduce sexually because it interrupts with gene flow.

9. Fossils are the remains or impressions of dead organisms preserved in sedimentary rocks or other substances that lived in the remote past.

Fossils provide direct and most reliable evidences for evolution. They provide the evidence that the present animals have originated from previously existing ones through the process of continuous evolution. A regular gradation from simple to complex is noted in the fossils of animals found in the rocks of successive eras. This geological succession shows that evolution has occurred.

P. 155 EXERCISES

A. Objective Type Questions

I. Choose the most appropriate answer.

1. b. **2.** b. **3.** a. **4.** d. **5.** b.
6. b. **7.** b. **8.** c. **9.** a. **10.** b.
11. a.

II. Fill in the blanks.

1. Variations
2. Dominant, recessive
3. Pea
4. Law of segregation
5. Gametes
6. Autosomes

III. Match the items in Column A with Column B.

1. d. **2.** c. **3.** e. **4.** a. **5.** b.

IV. Assertion – Reasoning Type Questions CBQ

1. c. **2.** d. **3.** c. **4.** a. **5.** d.
6. b. **7.** b. **8.** a.

V. Name the following.

1. Genotypes
2. *Pisum sativum*

VI. Very short answer type questions

1. a. Genetics
b. Speciation
2. Genetics
3. Gregor Johann Mendel
4. Factors
5. 22
6. The variations which provide survival advantage to the species will have better chances of survival as compared to other variations.
7. The resemblance among the embryos of all vertebrates indicates that they have evolved from a common ancestor.
8. W. Bateson proposed the term genetics.
9. Mendelian mohohybrid ratio was 3:1
10. Mendelian dihybrid ratio was 9:3:3:1
11. Autosomes are the chromosomes which are exactly similar and not involved in the determination of sex. Every human cell contains 23 pairs of chromosomes – 22 pairs of autosomes and 1 pair of sex chromosomes.
12. Sex chromosomes are the chromosomes that determine the sex of an individual. In humans, female cells have a pair of homologous sex chromosomes called X-chromosomes, while the male cells have two different sex chromosomes : One is an X-chromosome the other is a smaller Y-chromosome.
13. X and Y chromosomes determine the sex in humans.
14. A group of similar organisms that interbreed to produce their kind is called species. The origin of new species is called speciation.
15. Two embryological evidences that support evolution are as follows:
(i) Resemblance among vertebrate embryos indicate that all vertebrates have evolved from a common ancestor.
(ii) Temporary and non-functional teeth in birds' embryos indicate that birds have evolved from toothed reptiles as their embryos recapitulate the toothed ancestral stage.
16. Biochemical evidences that support evolution are as follows:
(i) Similar chemical nature and similar functions of enzymes and hormones of different vertebrates.
(i) Similarity in composition of blood and lymph.
17. Define these terms.
a. Heredity: The phenomenon by which living organisms transmit parental characteristics to the successive generation is called heredity.
b. Genetics: The branch of science which deals with the mechanisms responsible for similarities and dissimilarities among closely-related species is called genetics. It is the science of heredity and variation.
c. Chromosomes: Filamentous thread-like bodies present in the nucleus, composed of chromatin material are called chromosomes.
d. Variation: Different characteristic traits among individuals of a species is called variation.
e. Gene: A unit of inheritance forming a part of chromosome is called a gene.
f. Allele: Alleles are alternate forms of a gene or a pair of matching genes.
g. Dominant gene: The gene which expresses itself in a heterozygous organism is called dominant gene.
h. Recessive gene: The gene which cannot

express itself in presence of a dominant gene is called a recessive gene.

i. **Genotype:** The genetic constitution of an organism.

j. **Phenotype:** The outward visible expression of genes, which is an inherited feature in an individual's appearance.

k. **Monohybrid cross:** The cross where only one trait is focussed is called a monohybrid cross.

l. **Evolution:** The branch of biology that deals with the changes and its causes in the diversity of living organisms over the period of time is called evolution.

m. **Analogous organs:** Organs similar in function but different in structure and origin are called analogous organs.

n. **Molecular phylogeny:** Molecular Phylogeny is the use of the structure of molecules to gain information on an organism's evolutionary relationships.

B. Short Answer Type-I Questions

1. The chemical nature of the genetic material is the chemical basis of heredity; DNA is the chemical basis of heredity.

2. Mendel conducted his experiments on pea plants because pea plant has shorter life span, so a large number of generations could be studied and examined; pea has contrasting variants of features and pea plant can be easily cultivated.

3. Mendel carried out a monohybrid cross between tall and short pea plants. He observed that all plants of F_1 generation were tall. This proved that the tall character was dominant. On further planting the seeds of F_1 generation and allowing to self pollinate, the F_2 generation produced tall and short plants in the ratio 3:1(3 tall and 1 short).

4. A dihybrid cross is one in which contrasting or alternating forms of two traits or features are simultaneously considered in the hybridization experiment. The ratio of F_2 hybrid is 9:3:3:1.

5. Traits, which we define as visible aspects of an organism (known as the organism's phenotype), are coded for by an organism's DNA and are expressed through the proteins that the gene (DNA) codes for.

C. Short Answer Type-II Questions

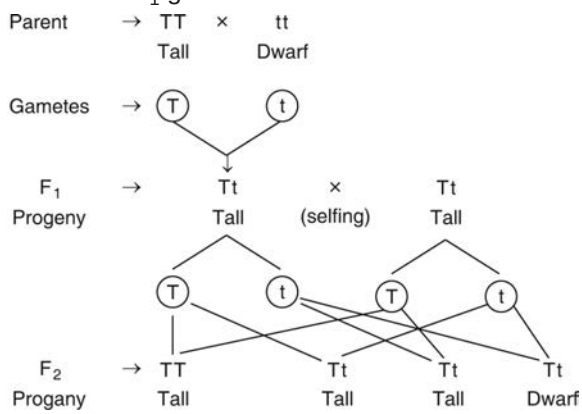
1. a. All the plants of F_1 generation are tall.

b. Tall : Dwarf :: 3 : 1

c. Dwarf plants are not found in F_1 generation but appeared in F_2 generation.

Both tallness and dwarfness genes are inherited in F_1 generation. Tallness gene being dominant over dwarfness gene in expressed in F_1 generation. When self-pollination of F_1 plants were done, both tall and dwarf plants were obtained in 3 : 1 ratio in F_2 generation. The trait of dwarfness was suppressed by the tallness trait in F_1 generation. Dwarfness trait is recessive trait. It remains hidden in the presence of a dominant trait. It can be expressed only in homozygous condition in the F_2 generation.

2. Mendel selected pure tall and pure dwarf parental plants and cross hybridized the parent plant to get the F_1 progeny. He then allowed the self-pollination of F_1 plant to obtain the F_2 progeny. All the plants in the F_1 generation were tall while in F_2 generation 75% plants were tall and 25% were dwarf. This indicates that both the traits, tallness and dwarfness, were inherited in F_1 palnts but only one of the trait i.e. tallness was expressed in F_1 plant. The trait which is expressed in F_1 generation is called dominant trait while the trait which remains hidden in F_1 generation is called recessive trait.



Phenotypic ratio → 3 Tall : 1 Dwarf

Genotypic ratio → 1 : 2 : 1

Genotypic ratio → 1 TT : 2 Tt : 1 tt

Both TT and Tt are tall plants while tt is a dwarf plant. A single copy of the dominant trait (T) is enough to make tall plant while both copies of the recessive trail (tt) have to be there for the plant to be dwarf.

3. a. Phenotype of F_1 is round and yellow seed. This is because round and yellow are dominant over wrinkled and green traits respectively.

b. Phenotype of F_2 progeny.

9 Round yellow

3 Round green

3 Wrinkled yellow (9 : 3 : 3 : 1)

1 Wrinkled green

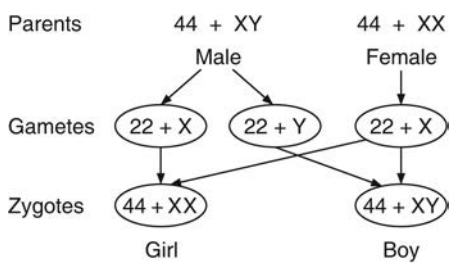
4. Mendel selected pure line variety of pea plants with two different characteristics like round yellow seeds and wrinkled green seeds. He crossed these plants and observed that all the plants in F_1 progeny having round and yellow seeds. This showed that yellow colour was dominant over green which is a recessive characteristic and round shape was dominant over wrinkled shape.

When F_1 plants were self-pollinated to raise the F_2 generation, the F_2 progeny showed four different kinds of phenotypes of seeds. It was observed that not only both the parental traits (round seeds of yellow colour and wrinkled seeds of green colour) were present but two new combination of traits (round seeds of green colour and wrinkled seeds of yellow colour) also appeared. Thus, there were round-yellow, wrinkled-yellow, round-green and wrinkled-green seeds in the ratio of 9 : 3 : 3 : 1 respectively in the F_2 generation. Therefore round and yellow trait and wrinkled and green seed trait are independently inherited giving parental as well as new combination in the F_2 generation.

5. Chromosomes are filamentous thread-like bodies present in the nucleus, composed of chromatin material.

In sexually reproducing organisms, the number of chromosomes are reduced to half by the process of meiosis at the time of gamete formation. During fertilization, the male and female gametes having half the number of chromosomes fuses to form the zygote thus restoring the original number of chromosomes.

6.



In human beings, there are 23 pairs of chromosomes, out of which one pair is the sex chromosomes. There are two types of the sex chromosomes X and Y. A female contains two X-chromosomes while a male contains one each of X and Y chromosome. Rest of the 22 pairs of chromosomes are exactly similar and are called autosomes. During gamete formation, these paired chromosomes separate. Thus male gametes are of two types, half containing X-chromosome while the other half containing Y-chromosome. All the female gametes contain one X-chromosome. It is just a matter of chance whether a sperm carrying X-chromosome fuses with ovum developing into a girl child or a sperm carrying Y-chromosome fuses with ovum giving rise to a male child.

7. Experiment conducted by Miller and Urey has given evidence of origin of life from inanimate matter. Miller and Urey assembled a reducing atmosphere similar to that thought to exist on early earth composed of molecules like ammonia, methane and hydrogen sulphide over water. This was maintained at a temperature just below 100°C and sparks were passed through the mixture of gases to simulate lighting. At the end of one week, 15% of the carbon from methane had been converted to simple compounds of carbon including amino acids which make up protein molecules.

8. A characteristic or trait of an organism which is developed in response to the change in external environment and is not inherited is called an acquired trait. For example, learning dance, suntanned skin, cut marks on skin etc.

Inherited trait is characteristic or a trait of an organism which are controlled by specific genes and are passed on from one generation to another. For example, skin and eye colour, height, etc.

The traits acquired during the life time of an individual do not bring any change in the gene of the reproductive cell and hence cannot be passed on to the progeny.

9. Characters inherited from the parents may not be always expressed. Some characters are recessive which are not expressed in the presence of dominant genes.

In case of monohybrid cross in pea plant, the F_1 generation produced by crossing of homozygous parents, will have all the individuals showing characteristic of dominant parent. But they are carriers of both dominant and recessive genes. When they are self-pollinated, the recessive genes reappear in F_2 generation.

For example, if pure tall and pure dwarf plants are crossed in monohybrid cross, only tall plants are visible in F_1 generation. No dwarf plants are visible in F_1 generation but they reappeared in

F_2 generation after self-pollination of F_1 plants. This states that in F_1 generation though all plants were tall, dwarf trait was inherited but was not expressed as it was a recessive trait.

10. The traits which are acquired during the life time of an individual cannot be passed on to the next generation. These traits involve changes in non-reproductive cells or somatic cells which are not transferred to germ cells. So these traits cannot be passed on to the next generation. Such traits are called acquired traits.

For example, suppose we breed a group of mice. Then we will get all the progeny with tails. If their tails are removed by surgery, we will not get tailless mice in the progeny. The cut-tail of mice is an acquired trait which is not passed on to the progeny because cutting the tail does not change the gene in their reproductive cell.

11. An experience of life time of an individual is an acquired trait which does not bring any change in the gene of the reproductive cell and therefore cannot be inherited or transmitted from parents to offsprings.

For example, a wrestler develops large muscles because of his training programs. These traits cannot be passed on to his offsprings as these acquired traits do not bring any change in the genes of the reproductive cell.

12. Natural selection is a phenomenon wherein, nature in the wild, select traits favourable to the species in the environment.

Let us consider a group of nine red-coloured beetles living in some bushes of green leaves. They reproduce sexually and therefore generate variation. Let us assume, crow is their natural predator. As a result, the population of these beetles decrease and fewer beetles are available to reproduce. If a colour variation occurs during reproduction in the population of red beetles resulting in one green beetle instead of red which reproduces and passes it green colour to progeny, this green colour is heritable and has survival advantage. The crow cannot see the green beetles on green leaves of the bushes and cannot eat them. Thus the population size of green beetle increases as compared to red-beetles.

Thus green colour is providing survival advantage to the species and hence nature selected the trait which helped the beetle population to suit their environment.

13. Every organism or species have an inbuilt tendency of genetic variation which plays an important role in the origin of new species and forms the basis of evolution. Organism appear to be the same because of similarity in their inherited body design. The more characteristics two species have in common, the more closely they are related and are likely to evolved from common ancestor. Differences in them is due to adaptation to different environment. Classification is organizing organisms in different groups based on similarities and differences of characteristic. Classification shows the orderly increase in the complexity of the organism thus interlinking classification to evolution.

14. The process by which new species is developed from the existing species is known as speciation.

Factors leading speciation:

(i) Geographical isolation of a population due to any physical barrier.

(ii) Reproductive isolation due to which there is no gene flow between separated population groups.

(iii) Genetic drift leading to accumulation of changes in genetic make-up.

(iv) Variation caused due to natural selection.

15. Individuals with a particular trait may increase in population by:

(i) Geographical isolation of population due to any physical barrier.

(ii) Genetic drift leading to accumulation of changes in genetic make-up.

(iii) Variation caused due to natural selection.

16.

	Homologous organs	**Analogous organs**
(i)	Organs are similar in structure and origin but different in function.	Organs are similar in function but different in structure and origin.
(ii)	Evolved from common ancestors.	Evolved from different ancestors.
(iii)	Divergent evolution for adaptation to varied conditions.	Convergent evolution to adapt to common conditions.
	For example, forelimbs of bird and horse.	For example, wings of birds and bat.

Wings of bird and wings of bat are analogous organs. Wings of bats are skin folds stretched mainly between elongated fingers. However, the wings of a bird are feathery covering all along the arm. The basic design and structure of wings of bat and bird are very different. They only look similar because both are adapted for flying but their origins are not common.

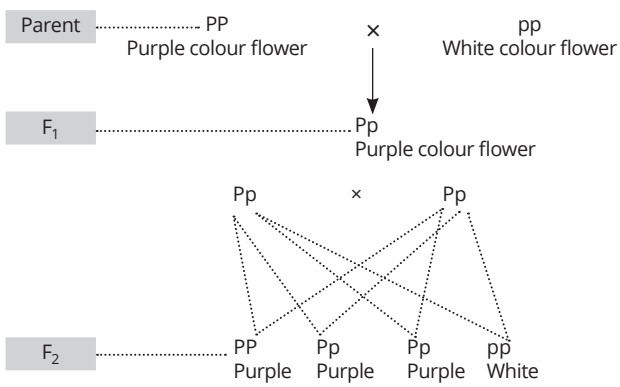
17. Fossils are the remains or impressions of dead organisms preserved in sedimentary rocks or other substances that lived in the remote past. Sometimes when an organism dies, its body or a part of its body may be present in an environment that does not let it decompose immediately. For example, if an insect gets caught in hot mud, its body does not decompose immediately. Also, the mud becomes hard and dry, retaining the part of the insect. All such preserved parts or traces of living organisms from the remote past are called fossils.

There are two ways to know the age of fossils:

(i) **Relative method:** If the earth is dug to find fossils, it can be assumed that those fossils which are found close to the surface are more recent than those found in deeper layers.

(ii) **Radioactive method:** Isotopes of carbon are used for dating the fossils to detect the ratios of different isotopes of the same element in the fossil material.

18. Pea plant bearing purple colour (PP) flowers is crossed with white colour (pp) flowers bearing pea plant.



Visible characters or phenotypes of

F_1 progeny – All purple colour flower

F_2 progeny – 3 purple colour flower: 1 white colour flower

(3:1 ratio)

19. Fossils provide direct and most reliable evidences for evolution. They provide the evidence that the present animals have originated from previously existing ones through the process of continuous evolution. A regular gradation from simple to complex is noted in the fossils of animals found in the rocks of successive eras. This geological succession shows that evolution has occurred.

There are two ways to know the age of fossils:

(i) **Relative method:** If the earth is dug to find fossils, it can be assumed that those fossils which are found close to the surface are more recent than those found in deeper layers.

(ii) **Radioactive method:** Isotopes of carbon are used for dating the fossils to detect the ratios of different isotopes of the same element in the fossil material.

20. Genetics is the branch of biological sciences which deals with the study of genes, genetic variation, and heredity in living organisms.

The decrease in the number of tigers is a cause of concern from point of view of biodiversity and in turn genetics because decrease number of tigers means lesser variations which in turn means lesser ability to adopt the changes in the environment. Since the tigers fail to adopt the environmental changes they may become extinct.

21. The process by which new species is developed from the existing species is known as speciation. The factors leading to the formation of a new species are as follows:

(i) Geographical isolation of a population due to any physical barriers.

(ii) Reproductive isolation due to which there is no gene flow between separated population groups.

(iii) Genetic drift leading to accumulation of changes in genetic make-up.

(iv) Variation caused due to natural selection.

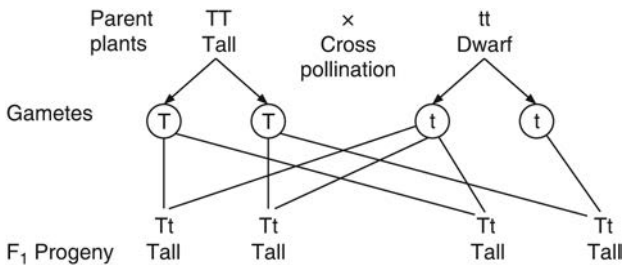
22. Organs similar in structure and origin but different in function are called homologous organs, such as the forelimbs of seal (flippers), bird (wing), bat (patagium), horse and human being.

Yes, it is necessary that homologous organs have a common ancestor, since otherwise there cannot be any similarity in basic plan, origin or internal structure. The forelimbs of whales, humans, birds, and dogs look pretty different on the outside. That's because they're adapted to function in different environments. However, if you look at the bone structure of the

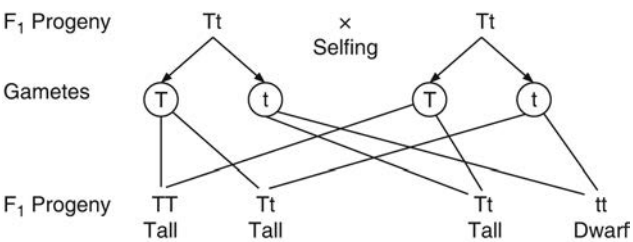
forelimbs, you'll find that the pattern of bones is very similar across species. It's unlikely that such similar structures would have evolved independently in each species, and more likely that the basic layout of bones was already present in a common ancestor of whales, humans, dogs, and birds.

D. Long Answer Type Questions

1. a. Mendel's experiment showing dominant and recessive trait can be explained by monohybrid cross. Mendel crossed pure tall and pure dwarf plants to get the F_1 progeny. All the plants in F_1 generation were tall. He then allowed the self-pollination of F_1 plants to get the F_2 progeny. Both tall and dwarf plants were obtained in F_2 generation in the ratio of 3 : 1. The trait which is expressed in F_1 generation (tallness here) is called dominant trait while the trait which remains hidden in F_1 generation is called recessive trait.



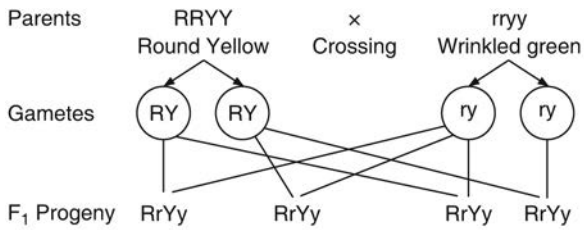
All plants in F_1 are Tall but they carry the hereditary unit for dwarf plants.

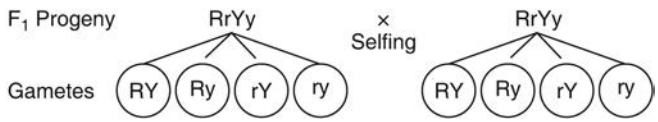


F_2 Phenotypic ratio → 3 Tall : 1 Dwarf

F_2 Genotypic ratio → 1 TT : 2 Tt : 1 tt

b. Mendel selected pure line variety of pea plant with two different characteristics to explain traits are inherited independently. Such cross are called dihybrid cross. Mendel crossed plants having round seeds of yellow colour with wrinkled seeds of green colour. All the plants in F_1 generation were having round seeds of yellow colour. This showed round seeds were dominant over wrinkled seeds and yellow colour were dominant over green colour. When F_1 plants were self-pollinated, the F_2 plants showed four types of phenotypes of seeds – Round yellow, round green, wrinkled yellow and wrinkled green in the ratio of 9 : 3 : 3 : 1 respectively. It was observed that not only both the parental traits were present, new combination of traits also appeared in F_2 generation. Thus the traits round/wrinkled yellow/green are independently inherited.





	RY	Ry	rY	ry
RY	RRYY Round Yellow	RRYy Round Yellow	RrYY Round yellow	RrYy Round yellow
Ry	RRYy Round yellow	RRyy Round green	RrYy Round yelow	Rryy Round green
rY	RrYY Round yellow	RrYy Round yellow	rrYY Wrinkled yellow	rrYy Wrinkled yellow
ry	RrYy Round yellow	Rryy Round green	rrYy Wrinkled yellow	rryy Wrinkled green

Phenotypic ratio: 9 Round Yellow, 3 round green, 3 Wrinkled yellow, 1 Wrinkled green.

2. Equal genetic contribution of male and female parents is ensured in the progeny through inheritance of equal number of chromosomes from both the parents. Chromosomes are the carriers of genes. Each gene has two alternative forms of a character producing different effects. In a diploid organism like humans, all chromosomes are present in pairs within the nucleus. During meiosis, a gamete receives only one chromosome of a pair, hence, each gamete has only one allele of the pair of alleles for a characteristic. When two germ cells combine, they will restore the normal number of chromosomes in the progeny and ensure the stability of the DNA of the species.

3. In sexual reproduction, two parents are

involved, each will have variation accumulated from previous generations. When two DNA copies combine during fertilization, it creates a new combination of the variant, which is novel. Thus sexual reproduction brings about variation in species, which increases its adaptability and helps in evolution of species.

Whereas asexual reproduction involves making copies of exact body designs. It leads to the production of genetically identical off-springs. Sometimes, the biochemical reactions occurring in the cells may get affected. Since there are more chances of occurrence of variation in sexual reproduction, therefore it is more advantageous than asexual reproduction in course of evolution.

4. Evolution is defined as a naturally occurring slow, continuous and irreversible process of change in the body design of an organism which helps an organism to survive in its surroundings. Evolution occurs due to:

(i) Variation in the gene pool of members of a population.

(ii) Natural selection favouring accumulation of advantageous variation.

(iii) Genetic drift or chance selection.

Fossils provide evidence that the present animal have originated from the previously existing ones through the process of continuous evolution. Fossils can be used to reconstruct evolutionary history of an organism. The distribution pattern of the fossils shows that the ancient fossils present in the bottom rock are simple, while the most recent ones are highly evolved.

5. Every organism has an inbuilt tendency of genetic variation which plays an important role in the origin of new species i.e. speciation which forms the basis of evolution. Organisms appear to be same because of similarity in their inherited body design. The more characteristics the two species have in common, the more closely they are related and are likely to evolve from a common ancestor. Differences in them is due to a depletion to different environment. Classification is organizing different organisms in different groups based on similarities and differences of characteristics. It involves orderly increase in the complexity of the organism. Thus evolution, speciation and classification are linked.

6. Fossils are the remains or preserved traces of dead plants or animals, which died millions of years ago. The study of fossil has helped us to know how two species are linked to each other. It tells how new species developed from the old ones.

Refer to sol. 19 (Short Answer Type-II Questions)

7. Differentiate between the following.

a. A gene is a part of the DNA. Alleles, on the other hand, refer to different versions of the same gene.

b. Chromosomes are filamentous thread-like bodies present in the nucleus of a cell, composed of chromatin material whereas gene is a section of DNA found on chromosomes which forms the unit of inheritance.

c. The genetic constitution of an organism is called the genotype whereas the outward visible expression of genes which is an inherited feature in an individual's appearance is called phenotype.

d. The gene which decides the appearance of an organism even in presence of an alternative gene is called dominant gene whereas the gene which cannot express itself in presence of a dominant gene is called a recessive gene.

e. Law of dominance states that when two homozygous individuals with one or more sets of contrasting characteristics are crossed, the characteristics which appear in F_1 hybrids are dominant and those which do not appear in F_1 generation are recessive.

Law of segregation states that when a pair of alleles is brought together in a hybrid, the members of the allelic pair remain together without mixing and separate or segregate from each other when the hybrid forms gametes.

8. Differences between acquired and inherited traits:

Acquired traits	Inherited traits
These traits are acquired during the lifetime	These traits are already present in the organism from birth
They are not passed on to the next generation	They are passed on to the next generation
Example: Increase in body weight, length of hair, etc.	Example: Eye colour

There are certain characters or traits developed

during the lifetime of an individual and are known as the acquired characters. There are traits which are expressed just physically and do not have any genetic significance like an increase in the weight and length of the hair. These traits are generally not passed on to the next generation as there are no genes which are coding for these traits.

If these acquired traits are developed due to some type of genetic mutation, then the character can be passed on to the next generation.

9. a. Equal genetic contribution of male and female parents in the progeny is ensured by the equal inheritance of chromosome from each parent. Human possesses 23 pairs of chromosomes, of which 22 pairs are autosomes and 1 pair is the sex chromosomes. The two sex chromosomes in human are X and Y. Females have 2 X chromosomes and males have one X and one Y chromosome. During the process of fertilization, a haploid sperm fuses with a haploid ovum to produce a diploid zygote. Zygote receives equal amount of genetic material from each parent and thus, retains the diploid nature on fertilization.

b. Animals present today show a vast diversity in their bodies so, it seems that they must have diverse ancestry too. Common ancestry would greatly limit the extent of diversity. This diversity is due to adaptation of each species to a different niche. The niche of a species includes the area, function, and interrelationship of that species with other biotic and abiotic factors in its environment. Among adaptations seen in Kingdom Animalia, many have developed multiple times throughout evolutionary history. Consider the wings of a bat and those of a bird as an example. These structures are not a result of evolutionary relatedness, but have instead arisen from convergent evolution. Convergent evolution occurs when two organisms independently evolve similar traits due to similar environmental pressures or niches.

The occurrence of diversity in the animals shows diversity in their ancestry to some extent but when observed deeply they still remain connected through some link. For instance, the reptile, birds, mammals have evolved from different ancestors but still, they are collectively grouped under amniotes. The major feature of the amniotes is the presence of the fluid-filled sac around the embryo.

10. a. When two alleles of contrasting expressions of a hereditary trait are brought together by fertilization, only one is expressed, while the other is suppressed. The characteristic that is expressed, is called dominant or expressive characteristic, and the characteristic that is repressed (not expressed), is called recessive or suppressive characteristic. This is Mendel's first law of heredity – law of dominance. It states that when two homozygous individuals with one or more sets of contrasting characteristics are crossed, the characteristics that appear in the F_1 hybrids are dominant and those that do not appear in F_1 generation are recessive. For example, when homozygous tall pea plant (TT) is crossed with homozygous dwarf pea plant (tt), in F_1 generation all the plants are tall (Tt). Therefore, tallness characteristic is dominant over dwarfness.

b. Refer to sol. 8.

E. Source-based/Case-based/Passage-based/ Integrated assessment questions CBQ

1. a. (iii) **b.** (iv) **c.** (iii) **d.** (i) **e.** (ii)

2. a. (iii) **b.** (iii) **c.** (iii) **d.** (ii) **e.** (ii)

P. 160 HIGHER ORDER THINKING SKILLS (HOTS) QUESTIONS

A. 1. i. YR **ii.** YR **iii.** yr **iv.** YyRr **v.** YyRr **vi.** YyRr

2. Phenotypes of F_1 will be yellow and round seeds

3. Phenotypes of F_2 progeny will be yellow round, yellow wrinkled, green round and green wrinkled.

4. The ratio of F_2 progeny will be 9:3:3:1.

5. Law of independent assortment

B. From the given information, it is difficult to conclude that light eye colour is dominant or recessive for considering a trait as dominant or recessive, we need data of at least three generations. The data provided here is about two generation. So, it is not possible to know whether the parents in this case are homozygous or heterozygous for light eye colour. So we cannot be sure whether light eye colour is dominant or recessive trait.

C. 1. bb **2.** Blue eyed **3.** 1:1

D. Selecting pea plant was one of the most important features in success of Mendel's experiment. Pea has a short life span and thus a large number of generations can be studied and examined. Pea has seven pairs of contrasting characters. Pea plant can be easily cultivated. Pea plant bears bisexual flowers. The structure of flower is such that it completely encloses the reproductive organs until fertilization, which ensures self-pollination. In pea plants due to self-fertilization it is easy to get pure lines for several generations.

E. No.

Humans have a more complex body design but that does not mean that they are more advanced than primitive bacteria. Complexity is not a measure of evolution.

Bacteria with their prokaryotic body design can live in the most extreme conditions. Like deep sea, thermal vents, hot springs. Bacteria have evolved characteristics that made them very robust and help to adapt to extreme condition. Both human and bacteria are well adapted to the ecological niche they exist in.

P. 160 VALUE-BASED QUESTIONS (OPTIONAL)

1. a. Parthiv finds similarity in physical appearance of his family members and relatives because those physical appearances are genetically inherited. As the family members and relatives have some common ancestry (family tree) they show some similarities among themselves.

b. The phenomenon by which living organisms transmit parental characteristics or traits to the successive generations is called heredity or inheritance.

2. a. The phenomenon known for differences among individuals of same species is called variation.

b. The process of sexual reproduction introduces variation into the species because the alleles that the mother and the father carry are mixed together in the offspring.

c. Genetics

CHAPTER – 5

SUSTAINABLE MANAGEMENT OF NATURAL RESOURCES

P. 167 CHECK YOUR PROGRESS 1

1. Anything obtained from natural environment that is required by man to meet his various requirements is known as natural resources. Air, water, soil, forests, etc., are natural resources.

2. The development that suffices the basic human needs and also preserves the resources for use by future generation is known as sustainable development.

3. The protection, preservation, restoration, and rational use of all the resources in the environment is known as conservation.

We should conserve natural resources for:

(i) **Sustainable development:** It is necessary to properly manage, conserve and replenish the natural resources for sustainable development.

(ii) **Future generation:** The management of natural resources requires a long-term perspective so that they can last for generation to come and will not be merely exploited for short-term gains.

(iii) **Equitable distribution** of natural resources so that everyone has access to these resources and benefits from the development of these resources.

(iv) **Preventing damage to environment:** There should be safe disposal of secondary waste material produced as a result of extracting various resources for our use.

4. We should conserve forests because forests are biodiversity hotspots. Biodiversity of different life forms like, fungi, plants, insects, birds, reptiles and other animals are found conserved in forests. Any disturbance in the basic structure of forests will damage biodiversity leading to a loss of ecological stability of forest ecosystem which will cause an overall imbalance in nature. In addition, forests provide us oxygen, cause rain, prevent soil erosion. It also provides us various medicines, and various forest products are used as raw materials in industries.

5. There should be an equitable distribution of natural resources so that everyone has access to these resources and benefit from the development of these resources.

6. '*Chipko Andolan*' or 'Hug the tree' movement was a forest conservation movement in India to end the alienation of local people from their forests. The *Chipko* movement originated in Garhwal region, where the people clasped the tree trunks with their arms to protect them from being cut down by contractor's worker thus saving the forest.

This movement benefitted the local people by providing them with their basic forest needs like firewood, timber, fruits, nuts, medicine and fodder, etc.

The environment is benefitted by this movement as forest helps in maintaining ecological stability. Forest prevents soil erosion, improves rainfall pattern, reduces green house effect and thus prevents global warming.

7. We can preserve the natural habitats of wild animals by establishing wildlife sanctuaries and national parks.

P. 170 CHECK YOUR PROGRESS 2

1. Water harvesting is the process of collecting rainwater and storing it for direct use or recharging it into the ground for indirect use.

2. Some traditional systems of water harvesting are:

(i) *Khadins*, *nadis* and tanks in Rajasthan

(ii) *Bandharas* and *tals* in Maharashtra

(iii) *Bundhis* in MP and UP

(iv) *Ahars* and *pynes* in Bihar

(v) *Kulhs* in Himachal Pradesh

(vi) Ponds in Kandi belt of Jammu

(vii) *Eris* in Tamil Nadu

(viii) *Surangams* in Kerala

(ix) *Kattas* in Karnataka

3. Water is supplied by municipal board through taps in our locality. This water is obtained from river.

The water supply is not equally available to all people living in the area. Few rich and resourceful people have more water supply as compared to poor people. There is lack of equitable distribution of water resource.

4. (i) By using water judiciously and not allowing the wastage of water.

(ii) Rain water harvesting.

P. 171 CHECK YOUR PROGRESS 3

1. (i) Glass and plastic bottles of jam or pickle can be reused to store things in kitchen.

(ii) Old clothes can be recycled to carry bags.

2. Coal and petroleum are fossil fuels produced by the degradation of biomass. These resources are available in limited amount. Once exhausted, it will take millions of years to be replenished. So, we need to conserve these non-renewable sources of energy.

3. (i) Using public transport instead of using our own vehicle.

(ii) Increasing the efficiency of machines and engines by ensuring complete combustion.

(iii) Using fluorescent tube instead of bulb in our homes.

P. 172 EXERCISES

A. Objective Type Questions

I. Choose the most appropriate answer.

1. b. **2.** c. **3.** c. **4.** c. **5.** b.

6. c. **7.** d. **8.** a. **9.** d. **10.** b.

11. c. **12.** c. **13.** b. **14.** d.

II. Assertion – Reasoning Type Questions CBQ

1. b. **2.** b. **3.** c. **4.** c. **5.** b.

6. a. **7.** d. **8.** d.

III. Name the following.

1. Forests
2. Sustainable development
3. Wildlife
4. National park
5. Sanctuary
6. Water harvesting

IV. Very short answer type questions

1. The means of supply that are required by human to meet various requirements that are obtained from nature are known as natural resources. Five natural resources are:

   Air, water, soil, forests and wildlife.

2. Area reserved for welfare of wildlife only and where forestry, grazing, cultivation of crops are not allowed is called a national park. Examples of national parks are Jim Corbett National Park, Kaziranga National park, Gir National park.

3. Judicious use of natural resources for a more stable development without impairing the abilities of future generations to use these resources is called sustainable management of resources.

4. *Chipko Andolan* took place in Garhwal region.

5. All organisms like plants, animals and micro-organisms which live in their natural habitat and do not have to be domesticated and cultivated are known as wildlife. Examples include tigers in forests and crocodiles in rivers.

6. Coliform bacteria

7. Define these terms.

   (a) **Natural resource management:** The use of natural resources in a systematic and most effective manner to avoid their wastage.

   (b) **Conservation:** Conservation is an ethic of resource use, allocation, and protection. Its primary focus is upon maintaining the health of the natural world: its fisheries, habitats, and biological diversity.

   (c) **Sustainable development:** The development that suffices the basic human needs and also preserves the resources for use by future generations.

   (d) **Stakeholders:** Stakeholder may refer to a person, group, organization, or system who affects or can be affected by an organization's actions.

   (e) **National park:** Area reserved for welfare of wildlife only and where forestry, grazing, cultivation of crops are not allowed is called a national park.

   (f) **Sanctuary:** Area preserved for the conservation of wildlife and where activities such as cutting of timber, collection of minor forest products, etc., are allowed so long as they do not affect the animals adversely is called a sanctuary.

   (g) **Water harvesting:** Process of collecting rainwater and storing it for direct use or recharging it into ground for indirect use is called water harvesting.

B. Short Answer Type-I Questions

1. The stakeholders in the management of natural resources include the people who live around the area, the industries which are dependent on the natural resource, the authorities that control the resources, and the nature and wildlife conservationist who wish to conserve nature.

2. We can conserve the wildlife of India by taking the following measures:

   (i) The killing and poaching of wild animals must be made a punishable offence.

   (ii) The natural habitats of wildlife and other animals should be preserved by establishing national parks and sanctuaries.

(iii) All the species should be conserved, especially the most threatened and endangered species.

(iv) There should be regular surveys regarding population of all species of wild animals and birds.

(v) The endangered species should be subjected to captive breeding or artificial insemination to increase their number and maintain their gene pool.

(vi) Unauthorised cutting down of trees must be stopped.

3. Long term aims in conservation of natural resources is more advantageous as they can last for generations to come and will not be merely exploited for short term gains.

4. A dam is a structure built across a stream or river to hold water back.

Advantages of building dams:

(i) Dams ensure the storage of adequate water for irrigation and also for generating electricity.

(ii) From these dams, a large amount of water can be transferred by canals to great distances for use by people for drinking, bathing and other use.

Disadvantages of big dams:

(i) Displacement of people during construction.

(ii) Often disrupts local ecosystems.

C. Short Answer Type-II Questions

1. Local people have been using the resources judiciously for centuries without causing much damage to the environment. They have been working traditionally to conserve the resources ensuring proper management and utilization of resources. Hence, with the involvement of local people, resources can be utilized in a sustainable manner establishing a proper balance between economic growth and ecological conservation.

2. *Chipko* movement was a non-violent movement that aimed at protection and conservation of forest. During this movement people hugged the trees so as to prevent them from cutting down. This movement has helped to maintain ecological stability by protecting the natural habitat of wildlife. Conservation of forest has resulted in reduction in green house effect and global warming, improvement in rainfall pattern and water availability as well as prevention of soil erosion conserving the fertile top soil.

3. Forests are biodiversity hotspots. Biodiversity of many species of different life forms like bacteria, fungi, plants and animals are conserved in forest. Thus by conserving wildlife and forest, we are ensuring that all diverse species in an area survive, breed and flourish maintaining ecological stability. In addition, conservation of wildlife and forest improves the quality of soil, water resources and rainfall pattern. The local people who are dependent on forest for timber, firewood, medicine, fruits, nuts, and fodder can obtain these resources from the forest.

4. Human activities that directly influence the forest environment:

(i) **Deforestation:** Various industries like timber, paper, lac and sports goods obtain their raw material from forest which has resulted in indiscriminate cutting down of trees. This has resulted in vegetation degradation, global warming, flooding and animal displacement.

(ii) **Poaching:** Poaching of key predators like lions, tigers and bears remove the animals that keep plant consumer in balance and prevent overgrazing. This disrupts the food chain and creates ecological imbalance in nature.

(iii) **Construction of Roads, Dams and Agriculture Purposes:** Large forest cover is cleared to construct road, dams, buildings as well as to obtain land for agriculture. This results in loss of biodiversity and ecological imbalance.

5. Deforestation accelerates soil erosion and affects underground flow of water adversely. Destruction of forests leads to disappearance of wildlife and many wild varieties of plants because of destruction of their natural habitats.

6. There are various stakeholders who influence the forest conservation:

(i) **Various people who live in or around forests** and depend on forest produce for their living and daily needs. However, these people have been using the forest resources judiciously for centuries without causing much damage to the forest resource. They use the forest resource in a sustainable manner.

(ii) **Various industries using forest produce:** There are many industries based on forest produce including timber, paper, lac and sports goods industries which has resulted in over exploitation of forest resources. These industries consider forest as merely a source

of raw material for their factories without being interested in sustainable development of the area.

(iii) **Forest Department of the Government:** The forest authorities owns and controls the resources from forests. They also do not involve the local people and ignore their experience and knowledge. They promote monoculture of pine, teak and eucalyptus which generates revenue for the Forest Department at the cost of loss of biodiversity in the area.

(iv) **Nature and Wildlife Enthusiastic:** These people are in no way dependent on the forests but they recognise the need to conserve the biodiversity as a whole.

7. With the active participation of local people in the management of forests, there can be an increase in the forest produce as well as the forests can be conserved. In 1972, the West Bengal Forest Department devised a scheme to revive the degraded sal forests by involving local people. It began from Arabari forest range in Midnapore district. A Forest Officer, A.K. Banerjee involved the local villagers to protect 1,272 hectares of badly degraded sal forest. In return, these villagers were given employment in both silviculture and harvesting operations, and 25 percent of the final forest produce. They were also allowed to collect firewood and fodder from forest area on a nominal payment. With the active participation of local people, the sal forests again became thick and green and revived within 10 years from a worthless to ₹ 12.5 crores forest.

8. Advantages of water stored in ground are:

(i) Water stored in ground does not evaporate.

(ii) It is protected from contamination by human and animal waste.

(iii) This water also recharges wells and provides moisture for vegetation over a wide area.

(iv) Unlike stagnant water stored in ground is free from breading mosquitoes.

9. The five things which I did in the last one week:

a. To conserve natural resources:

– Used bicycle for going to school.

– Took bucket bath and stopped using the shower.

– Used old envelopes for doing rough work during my homework.

– Took a public transport bus while going to a relative's place.

– Planted 5 seedlings.

b. To increase pressure on our natural resources:

– Forgot to close the water tap when bucket got full.

– Wasted electricity

– Used non-renewable resources of energy

– Used plastics and polythene bags for carrying goods

– Traveled by car for long-distance instead of traveling by train.

10. One should incorporate the following changes in life-style in a move towards sustainable use of our resources:

– Stop cutting trees and practise the plantation of trees.

– Stop using plastic and polythene bags for carrying goods.

– Use recycled paper.

– Throw biodegradable and non-biodegradable waste into separate bins.

– Waste minimum amount of water while using and repair leaking taps.

– Practice rainwater harvesting.

– Avoid using vehicles for short distances. Instead, one can walk or cycle to cover short distances. To cover long distances, one should take a bus instead of using personal vehicles.

– Switch off electrical appliances when not in use.

– Use fluorescent tubes in place of bulbs to save electricity.

– Take the stairs and avoid using lifts.

– During winters, wear an extra sweater to avoid using heaters.

11. a. National Parks should be allowed to remain in their pristine form to preserve the habitat of animals and birds in their natural form, to reduce human interference, and maintain self-sustainability in a national park.

b. The process of reuse is better than recycling because recycling requires huge investment, energy consumption and releases toxic waste which pollutes the environment. Reuse involve usage of same material for a number

of time for different purposes which does not utilize any money, energy and release of toxic waste.

D. Long Answer Type Questions

1. Building of dams is advantageous because dams ensure the storage of adequate water for irrigation and generating electricity. From the dams a large amount of water can be transported by canals to long distances.

However dams are not always advantageous. There are many disadvantages also. The mismanagement of water supply from dams may lead to problems. When there is no equitable distribution of water, people close to the sources grow water intensive crops like sugarcane and rice while people farther downstream do not get any water. A large number of people living in a particular area for centuries have been displaced due to building up of dams.

2. Rains in India are largely due to monsoons and most of the rain falls in a few months of the year. But water is required throughout the year for agriculture, domestic and industrial purposes. Hence the water needs to be conserved. Water harvesting is the process of collecting rainwater and storing it for direct use or discharging it into the ground for indirect use. For this purpose rainwater that falls on the ground or rooftops of the buildings is channelled by canals and recharged into the ground by digging channels. This water percolates into the soil, thus maintaining water table at satisfactory level. Water reservoir in largely level terrain are mainly earthen embankments or low, straight concrete and rubble checkdams built across seasonally flooded gullies.

3. Conservation and protection of the environment and its components like air, water, forests and wildlife is called ecological conservation. Several activities of humans have disturbed the ecological balance. The deforestation has led to soil erosion, disappearance of animal species, increase in the concentration of carbon dioxide. The uncontrolled use of fossil fuels increases the carbon dioxide content. The excessive use of automobiles and setting up of industries increases the concentration of oxides of sulphur and nitrogen that are causes of acid rain.

E. Source-based/Case-based/Passage-based/ Integrated assessment questions CBQ

1. a. (ii) **b.** (iv) **c.** (iv) **d.** (i) **e.** (iv)

2. a. (iv) **b.** (iv) **c.** (ii) **d.** (ii) **e.** (iii)

P. 175 HIGHER ORDER THINKING SKILLS (HOTS) QUESTIONS

1. Conventional sources of energy like fossil fuels are non-renewable sources of energy. Fossil fuels like coal and petroleum are mainly used as fuels to run vehicles, generate electricity and other purposes. These resources are available in limited amount. Once exhausted, it will take millions of years to be replenished. Hence, it will not be available to the future generations of mankind and they will have to depend on non-conventional sources of energy.

2. Increasing demand of energy has led to the over exploitation of fossil fuel. Fossil fuel contain carbon, hydrogen, nitrogen and sulphur. When these are burnt, oxides of hydrogen, nitrogen, carbon and sulphur are produced. At high concentration, carbon dioxide is a green house gas which results in global warming. Oxides of nitrogen and sulphur causes acid rain while carbon monoxide is a poisonous gas.

3. Construction of dams require a large area of land which leads to deforestation and loss of biodiversity. Many important medicinal plants and other flora and fauna get submerged in the water reservoir and are damaged.

4. Yes, conservation of water is necessary because all living organisms need water to carry out various life processes. Existence of life is not possible without water. Water is a finite and vulnerable resource that sustains life, economic development and the environment. Water conservation improves the use of water resources to benefit people and the environment.

5. Fossil fuels are non-renewable source of energy which are available in limited amount. Once exhausted it will take millions of years to be replenished. Hence we need to conserve fossil fuels.

6. Coal and petroleum are non-renewable source of energy because these resources are formed from degradation of biomass millions of years ago. These are available in limited amount and once exhausted cannot be replenished.

P. 175 VALUE-BASED QUESTIONS (OPTIONAL)

1. a. Effect of deforestation on our life as well as on wildlife:

– Increase in global warming

– Increase in greenhouse gas emissions

– Soil erosion

– Floods

– Wildlife extinction and habitat loss

– Acidic oceans

– The decline in life quality of people

Deforestation also lead to a direct loss of wildlife habitat as well as a general degradation of their habitat. The removal of trees and other types of vegetation reduces available food, shelter, and breeding habitat.

b. We should conserve forests because forests are biodiversity hotspots. Biodiversity of different life forms like fungi, plants, insects, birds, reptiles and other animals are found conserved in forests. Any disturbance in the basic structure of forests will damage biodiversity leading to a loss of ecological stability of forest ecosystem which will cause an overall imbalance in nature. In addition, forests provide us oxygen, cause rain, prevent soil erosion. It also provides us various medicines, and various forest products are used as raw materials in industries.

2. a. Sanjay and his friends show values of responsibility and concerns towards our environment.

b. Refer to sol. 6, Short answer type-II questions

c. The most obvious reason for conservation is to protect wildlife and promote biodiversity. A natural habitat is an ecological or environmental area where a specific species lives. Preserving habitats is essential to preserve biodiversity. Preservation of these habitats helps to prevent the entire ecosystem being harmed. As more and more species face extinction, the work being done to protect wildlife is becoming more and more important.

3. a. Kapil shows values of responsibility and concerns towards natural resources and their sustainable uses.

b. We need to conserve water because of the following reasons:

– Demand for water is on rise due to the increase in population and urban centers in the country.

– Many water resources like rivers, lakes, ponds etc. are getting polluted.

– Overuse of water has resulted in the lowering of water table in many regions.

– Global warming has led to climatic changes. This has resulted in repeated droughts in several countries.

c. We can conserve water through rain water harvesting.

Water reuse is the method of recycling treated wastewater for beneficial purposes, such as agricultural and landscape irrigation, industrial processes, toilet flushing, and groundwater replenishing.

CHAPTER – 6

OUR ENVIRONMENT

P. 178 CHECK YOUR PROGRESS 1

A. Answer the following questions.

1. Environment can be defined as the physical and biological world where we live. It has two major components:

(i) Physical surroundings which include the abiotic environment, that is air, water, soil and so on.

(ii) Living organisms which constitute the biotic environment i.e. plants, animals and microorganisms.

2. The waste material that can be broken down or decomposed into simple substances in nature by the action of microorganisms in due course of time is called biodegradable waste material.

For example, dead plants and animals, animal excreta, paper, tea leaves.

3. Substances which are organic in nature are biodegradable. These substances can be broken down into simple, non-poisonous substances by the action of specific enzymes secreted by decomposers. While other substances which cannot be broken down to simpler substances by the action of microorganisms are non-biodegradable. These substances persist in the environment for a longer period.

4. DDT cannot be decomposed into simple, non-poisonous compounds by the action of microorganisms. They remain unchanged chemically and get accumulated in the environment and become harmful for humans, animals and even plants. Hence, DDT is a non-biodegradable substance.

5. Egg shell, butter, leather shoes, coconut.

6. Ways in which biodegradable substances affect the environment:

(i) By recycling the raw materials in nature.

(ii) By improving the humus content in soil

Ways in which non-biodegradable substances affect the environment:

(i) By increasing the burden on the environment, because these substances accumulate.

(ii) By producing harmful polluting gases, if they are burnt.

7. Biodegradable and non-biodegradable wastes should be discarded in two separate dustbins of different colours. Segregation of wastes at the source itself allows effective treatment and disposal of waste. Biodegradable waste can be decomposed in a natural manner by the process of composting or can be recycled. Non-biodegradable waste can be sent for recycling or safe disposal.

8. Yes, this will also have an impact on environment. Even if the waste are biodegradable, excess amount will end up by polluting our environment. This is because nature will be unable to decompose the waste into harmless materials at the right time. Heaps of biodegradable waste provides a breeding ground for mosquitoes, flies and worms which spread many diseases.

P. 184 CHECK YOUR PROGRESS 2

1. Ecosystem is a structural and functional unit of the biosphere consisting of biotic and abiotic components which interact with each other and maintain a balance in nature.

There are two components of ecosystem:

(i) Abiotic components which include the non-living components like soil, water, air, sunlight, humidity, temperature, rainfall, etc.

(ii) Biotic components which include the living organisms like plants, animals and microorganisms.

2. Air.

3.

	Primary consumer	Secondary consumer
(i)	Primary consumers obtain their food and energy directly from producers.	Secondary consumers obtain their food and energy by feeding on primary consumers.
(ii)	All organisms are herbivores.	Organisms are mainly carnivores.
(iii)	They get more nutrients.	They get less nutrients.
	For example, Deer, sheep	For example, Lion, tiger

4.

	Food chain	Food web
(i)	Food chain is a single linear pathway through which energy and nutrients travel in the ecosystem.	Food web are a number of interconnected food chains through which energy and nutrients travel in the ecosystem.

(ii)	Usually member of high trophic level feed upon a single type of organism of lower trophic level.	Members of higher trophic level feed upon many types of organisms of lower trophic level.
(iii)	Separate and isolated food chain makes it unstable.	Food web providing alternative pathway for food availability makes it more stable.
(iv)	It has no effect on improving the adaptability and competitiveness of organisms.	Food web providing alternative pathway for food availability makes it more stable.

5. The various links or steps representing organisms in a food chain at which transfer of food and energy takes place are called trophic levels. The various trophic levels are:

(i) The producers or the plants constitute the first trophic level.

(ii) The primary consumers or herbivores form the second trophic level.

(iii) Secondary consumers or carnivores make up the third trophic level.

(iv) Large carnivores or top carnivores constitute the fourth trophic level.

The amount of energy at each trophic level decreases as it moves through an ecosystem. Only 10% of the total energy at any trophic level is transferred to the next level and the rest is lost to the environment through metabolic processes as heat.

6. In absence of sunlight, life would not be possible on earth. Green plants trap the solar energy to synthesize organic food by the process of photosynthesis. Other organisms i.e. heterotrophs obtain their food energy directly or indirectly from green plants. Hence, in absence of sunlight, plants cannot synthesize food and therefore food and energy will not be available to organisms of higher trophic level making life impossible on earth.

7. Third trophic level – snake

Fourth trophic level – eagle

8. 1000 Joules of energy available to second trophic level. [10% of 10,000 J = 1000 Joules]

9. If we kill all the organisms in a trophic level, it will adversely affect the food chain leading to ecological imbalance. The transfer of food and energy to the next trophic level will stop and hence organism of successive trophic will starve and perish away. At the same time, there will be overpopulation of individuals belonging to previous trophic level resulting to ecological instability.

10. The increase in concentration of harmful chemical substances in the body of living organisms at each trophic level of a food chain is called biological magnification. For example, waterbodies like pond, river or lake contain a small amount – 0.02 ppm of harmful chemicals like DDT. When this water is consumed by phytoplanktons and zooplanktons, the concentration of DDT increases to 0.04 ppm. Small fishes feeding on these planktons were found to contain 0.5 ppm of DDT. Large fishes feeding on these small fishes were found to contain 2 ppm of DDT. Birds feeding on these large fishes were found to contain 25 ppm of DDT. Thus, there is an increase in concentration of DDT at each trophic level.

P. 185 CHECK YOUR PROGRESS 3

1. Ozone depleting substances (ODS) like chlorofluorocarbon [CFCs].

2. Ozone absorbs ultraviolet (UV) radiation from the sun. So, ozone is very important for life on earth as it prevents harmful UV rays from the sun from reaching the earth.

3. Cataract, skin cancer, dimming of eyesight and immune system malfunctioning.

4. Ozone depleting substances like chlorofluorocarbon are synthetic, harmful chemicals which are used in refrigerators and air conditioners as coolants, in aerosol sprayers, etc. Once released in the air, these harmful chemicals produce active chlorine (Cl and ClO radicals) in the presence of UV radiations.

These radicals, through chain reactions, then destroy the ozone layers (O_3) by converting it into oxygen (O_2). Due to this, the ozone layer in the stratosphere becomes thinner.

5. Ozone layer in the upper atmosphere is like a cover that protects us by screening the dangerous UV radiations from the sun. Without ozone shield, there will be many ill effects on living organisms, such as:

(i) Diseases in human beings: UV radiation can cause diseases in human beings such as

cataract, skin cancer, dimming of eyesight and immune system malfunctioning.

(ii) Mutation: The UV radiations may cause mutations.

6. Montreal protocol.

7. Ozone is a gas composed of three atoms of oxygen. In stratosphere, ozone layer acts as a protective shield to the earth from harmful UV-radiation. Excess exposure to UV rays can lead to skin cancer and cataract. Thus the presence of ozone layer is essential to block the entry of harmful UV rays.

P. 186 CHECK YOUR PROGRESS 4

1. (i) Creative posters and slogans can be used.

(ii) Making the residents aware of the harmful effect and diseases caused by improper waste disposal.

(iii) Conducting street plays.

(iv) Using mass media for spreading the message.

2. Government of India is imposing a ban on use of polythene bags because they are non-biodegradable in nature. They persist in the environment for a longer duration causing environmental pollution.

(i) Polythene clogs the drain as they do not allow water to seep in.

(ii) Polythene bags when accidentally eaten by cattles and other stray animals, can harm them leading to their death.

(iii) Burning of polythene releases toxic gases in the environment causing air pollution.

Alternatives of these bags:

(i) One should carry jute or cloth bags whenever going for shopping.

(ii) Paper bags should be used which can be reused and recycled too.

These alternative bags are environmental friendly as they are biodegradable. They can be reused and recycled. So, they will help to reduce pollution.

P. 188 EXERCISES

A. Objective Type Questions

I. Choose the most appropriate answer.

1. c. **2.** b. **3.** a. **4.** b.
5. b. **6.** d. **7.** a. **8.** d.
9. a. **10.** a. **11.** b.

II. Assertion – Reasoning Type Questions CBQ

1. b. **2.** c. **3.** b. **4.** a. **5.** b.
6. d. **7.** b. **8.** a. **9.** d.

III. Name the following.

1. Ecosystem
2. Environment
3. Consumers
4. Decomposers
5. Food chain
6. Biomagnification

IV. Very short answer type questions

1. Silver foil, plastic mugs.

2. Ecosystem is the structural and functional unit of biosphere consisting of living beings and the physical environment, which interact with each other and maintain a balance in nature.

3. Water, oxygen.

4. Because they break down complex organic substances present in dead bodies of organisms and organic wastes into simpler inorganic substances.

5. Trophic level

6. Rabbit and deer

7. First – plant, third – frogs

8. 200 J

9. When farmers use pesticides in the field, they enter into the food chain through soil and water and being non-biodegradable their concentration increases in successive trophic levels by the phenomenon of biological magnification.

10. Peacock

11. Ozone will be formed.

12. Because CFCs react with the ozone layer, destroying it gradually.

13. The biotic components of an ecosystem which is made of a community of living organisms (like plants, animals and microbes) is the living environment of the ecosystem.

The non-living components of an ecosystem that include soil, water, air, sunlight, temperature, humidity, moisture, rainfall, etc., constitutes the physical environment of an ecosystem.

14. Autotrophs are photosynthetic plants which are able to synthesize organic food such as starch from inorganic substances, carbon dioxide and water in presence of chlorophyll and sunlight.

15. Saprophytes are the organisms which feed on dead and decaying organic matter.

16. Food chain is a sequential process in which one organism consumes another organism to transfer food energy.

    The network of various food chains which are interconnected at various trophic levels is called a food web.

17. As energy passes through various trophic levels, the energy goes on decreasing with each trophic level as only 10% energy from one trophic level is available to the next.

18. Pesticides and chemicals sprayed on the plants being non-biodegradable chemicals, remain toxic in the soil from where they are washed off into water bodies. They are absorbed by the plants and from plants they enter into animal body, when they consume these plants. When human beings consume these plants or animals, these chemicals reach their bodies.

19. The ozone depleting substances (for example, chlorofluorocarbons, methane, nitrous oxides, etc.) react with UV radiations and release chlorine and bromine atoms which destroy ozone.

20. Skin cancer and cataract.

B. Short Answer Type-I Questions

1. Biodegradable substances are those substances which can be broken down into simpler compounds by decomposers in the environment. The non-biodegradable substances cannot be broken down into simpler compounds and hence persist in the environment.

2. Trophic levels are the feeding position in a food chain such as primary producers, herbivore, primary carnivore.

   Plants→grasshopper→frog→snake

3. The first trophic level is formed by plants and they exhibit autotrophic mode of nutrition whereas the organisms in third trophic level can be carnivores or omnivores (for example, frog).

4. A food chain having three organisms will be more efficient in terms of energy to top carnivores because with each trophic level, the amount of available energy goes on decreasing because of 10% of energy will be transferred to the next trophic level. The lesser the trophic levels, the more will be the energy available to the next level.

5. If the tiger has 30 J of energy, grass must have 3000 J of energy initially. This is because the tiger must have obtained only 10% of energy from goat which must have obtained 300 J of energy from grass (10% of energy possessed by plants). Hence the plants must have had 3000 J of energy.

6. The flow of energy is said to be unidirectional because energy is lost during its flow and the lost energy cannot be regained.

7. Biological magnification is the phenomenon in which harmful chemicals enter in the food chain and its concentration increases at each tropic level. The levels of biological magnification is different at different levels of the ecosystem. It will increase with each successive level.

C. Short Answer Type-II Questions

1. **a.** Ecosystem is a structural and functional unit of the biosphere consisting of living beings and the physical environment which interact with each other to maintain a balance in nature.

   Its two main components are the

   (i) **Abiotic components** like soil, water, air, sunlight, temperature, humidity, moisture and rainfall.

   (ii) **Biotic components** like plants, animals and microbes.

   b. Pond is a natural ecosystem which is independent and self-sufficient in nature having more biodiversity than aquarium. The decomposers present in pond ecosystem breakdown the waste material into simple inorganic substances hence cleaning the pond ecosystem.

   The aquarium is an artificial ecosystem lacking soil and decomposers hence the waste produced in the aquarium cannot be recycled and therefore it has to be cleaned regularly.

2.

	Biodegradable substances	Non-biodegradable substances
(i)	These can be broken down to simple, non-poisonous substances by the action of microorganisms in nature.	These cannot be broken down to simple, non-poisonous substances by the action of microorganisms in nature.
(ii)	These can be recycled naturally as well as by humans and their products do not pollute the environment.	These cannot be recycled naturally and their products cause environmental pollution.

(iii)	They can produce useful products after biodegradation.	They remain unchanged chemically because they are not biodegradable.
(iv)	They do not disturb the ecological balance in nature.	They tend to disturb the ecological balance in nature.
	For example, paper, cowdung	For example, DDT, plastics

Two changes in habit to dispose non-biodegradable waste:

(i) Non-biodegradable waste must be segregated and discarded in separate dustbin.

(ii) Use of non-biodegradable waste should be reduced and wherever possible it should be reused.

3. Food chain is a sequential process in which one organism consumes another organism to transfer food energy.

At each trophic level in a food chain, a large amount (90%) of energy is utilized by the organisms for their maintenance and lost as heat. Only 10% of the energy is available for transfer to the next trophic level. Therefore, amount of energy available to the higher trophic level goes on decreasing. The longer the food chain, less is the energy available to the last member of the food chain. Food chain generally consists of three or four steps because after that energy available for the next trophic level will be so small that it will be insufficient to sustain the life of that organism.

4. Food chain is a sequential process in which one organism consumes another organism to transfer food energy. At each trophic level in a food chain, only 10% of the energy is transferred to next trophic level and a large amount (90%) of energy is utilized by the organisms and lost as heat. Since energy lost cannot be regained, the energy flow is said to be unidirectional.

Various pesticides and chemicals which are used to protect the crops from pests enter the food chain and cause biomagnification. This can be understood using a flow chart.

Pesticides sprayed on crops
↓
Pesticides washed down into the soil or water during irrigation and rains
↓
Plants absorb them along with other nutrients. Pesticides taken up by aquatic plants and animals in water bodies.
↓
Hence, they enter the food chain.

Being non-biodegradable, these substances get accumulated at each trophic level. When the organisms of previous trophic level are eaten up by organisms of next trophic level, the concentration of these chemicals keeps on increasing. As the tertiary consumer occupies the highest level of food chain, they get the maximum quantity of these harmful chemicals.

5. According to the ten per cent law, only 10% of the total energy enters a particular trophic level of consumer, and out of this, only 10% is available for transfer to the next trophic level. Green plants capture only 1% of the total solar energy that falls on their leaves. This captured energy is converted into food. These green plants are eaten up by the herbivorous animals. Most of the energy is lost as heat. Some energy is utilized in life processes like digestion, growth and reproduction. On an average, 10% energy received from producers is made available to the next consumers. These herbivorous animals are eaten up by consumers which also on average received only 10% of the available energy from herbivores. Law of ten per cent can be illustrated by the following example:

Sun	→	Producers	→	Herbivore	→	Carnivore
1000 cal		(Plants) 10 cal (1% of 1000 cal)		(Deer) 1 cal (10% of 10 cal)		0.1 cal (10% of 1 cal)

6. The increase in the concentration of harmful chemical substances in the body of living organisms at each trophic level of a food chain is called biological magnification. Harmful substances like pesticides are non-biodegradable. These chemicals are added to crops to protect them from pests and diseases. These chemicals are washed down into the soil and absorbed by the plant along with water and minerals and hence enters the food chain. Being non-biodegradable these substances get accumulated at each trophic level. When the organisms of previous trophic level are eaten up by organisms of next trophic level, the concentration of these chemicals keeps on increasing. As the tertiary consumer occupy the highest trophic level of food chain, they

get the maximum quantity of these harmful chemicals.

7. Grains, fruits and vegetables contain pesticides which are used during their cultivation in the field. Pesticides are non-biodegradable and highly stable chemicals. When the animals consume these contaminated plants, the pesticides enter into the body of these animals. The concentration of these chemicals increases at each trophic level. This increased accumulation of harmful chemicals in the body of living organisms at successive trophic level is called biomagnification. This is the reason why our food grains, vegetables, fruits and meat contain varying amounts of pesticide residue.

8. The ozone depleting substances (for example, chlorofluorocarbon, methane, nitrous oxides, etc.) react with UV radiations and release chlorine and bromine atoms which destroy ozone.

Due to the depletion of ozone layers, UV rays reach the earth surface causing following harmful effects:

(1) They cause skin cancer.

(2) UV rays cause eye disease called cataract.

(3) They damage immune system, thus lowering body's resistance to diseases.

9. Ozone forms a layer in the upper atmosphere. It shields the surface of the earth from ultra-violet radiation (UV) coming from sun as these radiations are very harmful to us. Chlorofluorocarbons may destroy the ozone layer and thereby disturb this natural process.

10. a. Refer to Sol. 1. b

(Short Answer Type-II Questions)

b. Decomposers are the microorganisms that decompose the dead organisms and break down the complex compounds of dead organisms into simple nutrients. They play a very important role in an ecosystem.

If decomposers are completely removed from the surface of earth then the remains of dead plants and animals will accumulate. The minerals and organic or inorganic material present in them will not be made again available for use. The ecosystem will be filled by plants and animal wastes as there will be no decomposition of waste material.

11. Stratospheric ozone is formed naturally through the interaction of solar ultraviolet (UV) radiation with molecular oxygen (O_2).

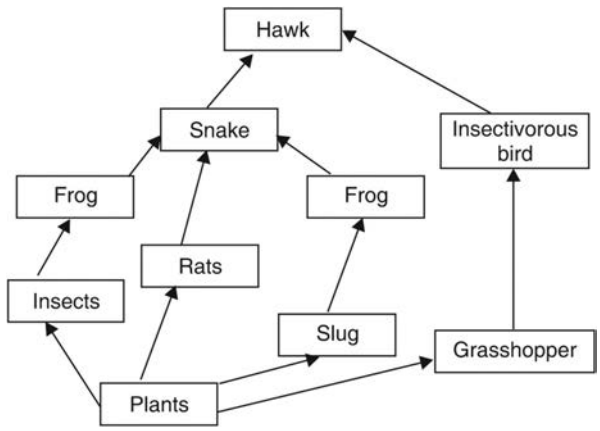
Ozone layer absorbs ultraviolet radiation.

Refer to Sol. 8 (Short Answer Type-II Questions)

D. Long Answer Type Questions

1. The difference between a food chain and a food web is that a food chain is a community of organisms where each member is eaten in turn by another member and a food web is a community of organisms where there are several interrelated food chains.

Food Chain: Plants → Rats → Snakes → Hawks.
Food web**:**



2. Ozone layer absorbs ultraviolet radiation. If ozone layer disappears then the sun rays will not be filtered and the harmful ultraviolet radiation will reach the surface of the earth. The ultraviolet radiation is harmful to us and it may cause skin cancer and eye disorders. We can prevent ozone depletion by avoiding use of aerosols which contain chlorofluorocarbons.

E. Source-based/Case-based/Passage-based/ Integrated assessment questions CBQ

1. a. (iv) **b.** (i) **c.** (iii) **d.** (ii) **e.** (iv)

2. a. (iv) **b.** (ii) **c.** (iv) **d.** (iii) **e.** (iii)

P. 192 HIGHER ORDER THINKING SKILLS (HOTS) QUESTIONS

1. The flow of energy in biosphere follows 10% law. According to the ten per cent low, only 10% of the total energy enters a particular trophic level of a consumers, and out of this, only 10% is available for transfer to the next trophic level. Green plants capture only 1% of the total solar energy that falls on their leaves. This captured energy is converted into food. These green plants are eaten up by the herbivore animals. Most of the energy is lost as heat. Some energy is utilized in life processes like digestion, growth and reproduction. On an average 10% energy received from producers

is made available to the next consumers. These herbivore animals are eaten up by consumers which also on average received only 10% of the available energy from herbivores. Law of ten per cent can be illustrated by the following example:

Sun	→	Producers	→	Herbivore	→	Carnivore
1000 cal		(Plants) 10 cal (1% of 1000 cal)		(Deer) 1 cal (10% of 10 cal)		0.1 cal (10% of 1 cal)

2. a. Phytoplankton → larvae → fish.

b. Phytoplanktons

First trophic level.

c. The concentration of pesticide will be highest in the fish because pesticides are non-biodegradable in nature and gets accumulated at each trophic level. Hence, its concentration increases at each trophic level. Fish being the top consumer will have the highest concentration of pesticides.

3. a. Gas A → Oxygen → O_2

Gas B → Ozone → O_3

b. X – Ultraviolet rays

D – Chlorofluorocarbons

c. Antarctic region.

d. Ozone layer. It protects us from harmful ultraviolet rays.

e. By stopping the use of aerosol and other ozone depleting substances.

P. 192 VALUE-BASED QUESTIONS (OPTIONAL)

1. a. It is necessary to conserve our environment for sustenance of present life form as well as for future generation.

b. Green dustbin is used to dispose off biodegradable waste while blue to dispose non-biodegradable waste. Biodegradable waste can be converted to compost and biogas for agricultural purposes and other use. Nonbiodegradable waste can be sent to factories for recycling.

c. My classmate is environment friendly, initiative taker and sensible student.

2. a. Mohit's mother is observant, environment friendly and sensible.

b. If biodegrable and non-biodegradable wastes are not segregated, they cannot be treated accordingly to produce compost neither they can be recycled.

c. If garbage is not disposed off properly, it can turn into breeding grounds for microorganisms, flies, mosquitoes, etc. which may lead to cause several diseases.

3. a. DDT is an insecticide used in agriculture. It is non-biodegradable and in high concentration poisonous to human beings.

b. The increase in concentration of harmful chemical substances in the body of living organisms at each trophic level of a food chain is called biological magnification. For example, waterbodies like pond, river or lake contain a small amount – 0.02 ppm of harmful chemicals like DDT. When this water is consumed by phytoplanktons and zooplanktons, the concentration of DDT increases to 0.04 ppm. Small fishes feeding on these planktons were found to contain 0.5 ppm of DDT. Large fishes feeding on these small fishes were found to contain 2 ppm of DDT. Birds feeding on these large fishes were found to contain 25 ppm of DDT. Thus, there is an increase in concentration of DDT at each trophic level.

4. Refer to Sol. **3.**