



# BIOLOGY

Based on the latest CISCE Curriculum

## SALIENT FEATURES

- NEP 2020 Theme Based Content
- Multi-Disciplinary Based Questions
- Image Based Questions
- Experiential Learning Based Questions
- Application Based Questions
- Practical Skills Based Questions

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# ANSWER KEY

# CHAPTER 1

## MCQs

1. Which of the following statement is correct for diffusion:  
Answer: (a) Diffusion ends when the solution becomes uniform.
2. Transpirational pull is initiated at the –  
Answer: (c) Leaves
3. Exchange of gases occur through small openings on the tree barks is called  
Answer: (c) Lenticels
4. Root hairs are able to absorb a lot of water because:  
Answer: (b) They have a large surface area
5. Xylem parenchyma are :  
Answer: (c) Living cells
6. In diffusion the movement of molecules happen because of  
Answer: (d) Brownian movement
7. We can define transpiration as :  
Answer: (d) Loss of water from the aerial part of the plant as water vapor
8. Phloem being a part of the vascular bundle:  
Answer: (a) Extends all over the plant
9. Which of the following is not a consequence of transpiration?  
Answer: (d) Creation of root pressure
10. Which of the following happens by active transport?  
Answer: (b) Absorption of minerals by the roots

### Fill in the blanks

1. Ascent of sap in tall plants happens through xylem vessels.
2. Plasma membranes are selectively permeable.
3. Of all the water absorbed by a plant, the percentage used in photosynthesis is less than 1%.
4. On a windy day, transpiration is likely to be higher.
5. The movement of water in xylem is unidirectional.
6. Tracheids and vessels make up the xylem tissue.
7. Xylem parenchyma are living cells.
8. The epidermis on the roots are made of one layer/layers.
9. We see imbibition in seeds swelling.
10. A symptom of zinc deficiency in plants is stunted growth.

### Match the descriptions with the terms

1. Entry of minerals in the root despite high solute concentration by spending energy - **(iii) Active transport**
2. Process of movement of food from the leaves to other parts of the plant - **(iv) Translocation**
3. The process of absorption of water by the root hairs - **(vii) Osmosis**
4. Movement of water from the roots to the leaves - **(i) Ascent of sap**
5. Swollen state of guard cells of stomata - **(vi) Turgid cells**

### State True or False and correct the false statement giving reasons

1. In Spirogyra, the movement of substances is by diffusion. **False**
2. In diffusion, molecules move from higher to lower concentration. **True**
3. Openings on the surfaces of leaves are called stomata. **False**
4. The large vacuoles in root hair help in the movement of cell sap. **False**

5. Xylem is responsible for upward conduction of water and mineral salts. **False**
6. Dry raisins kept in strong saline solution will shrink further. **False**
7. Root hairs contain solutions with high solute content than the soil. **True**
8. Transpiration from trees would be low during the monsoon season. **False**
9. On a humid day transpiration is usually low. **False**
10. Nitrogen, Phosphorus and Potassium (NPK) are macronutrients for plants. **False**

### Mark the odd one, giving reasons

1. **Xylem Sclerenchyma** - Tracheids, vessels, and xylem parenchyma are all involved in the transport of water and nutrients. Xylem sclerenchyma, on the other hand, is primarily supportive tissue that strengthens and supports the plant.
2. **Phloem Fibres** - Sieve tubes, companion cells, and phloem parenchyma are all involved in the transport and storage of nutrients. Phloem fibres are supportive cells that do not participate in the transport of nutrients.
3. **Photosynthesis** - Root pressure, cohesion, and transpiration are all processes involved in the movement of water through a plant. Photosynthesis is a process by which plants convert light energy into chemical energy, which is different in function from the other three processes listed.
4. **Zinc** - Nitrogen, Phosphorus, and Potassium are considered macronutrients and are needed in larger quantities by plants. Zinc is a micronutrient, required in smaller quantities.

### Short answer type questions

1. What could happen if roots did not have root hairs?

Ans. If roots did not have root hairs, the plant would have a reduced surface area for water and mineral absorption from the soil, leading to less efficient uptake of these essential nutrients and possibly stunting the plant's growth.

2. What are the xylem vessels composed of?

Ans. Xylem vessels are composed of tracheids and vessel elements, both of which are elongated, dead cells with thick walls that facilitate the transport of water and minerals upward through the plant.

3. What is a semipermeable membrane?

Ans. A semipermeable membrane allows certain substances to pass through it while blocking others, crucial for processes like osmosis.

4. What is meant by vascular cylinder?

Ans. The vascular cylinder, in plant anatomy, is the central region of the root or stem containing the plant's vascular tissue, including the xylem and phloem. It is responsible for the transport of water, nutrients, and sugars throughout the plant.

5. Name the different elements of phloem vessels.

Ans. The phloem vessels consist of four main elements: sieve tubes, companion cells, phloem fibres, and phloem parenchyma. These components work together to transport sugars and other organic nutrients throughout the plant.

6. Why is the translocation of food in phloem not unidirectional?

Ans. The translocation of food in phloem is not unidirectional because it moves nutrients to where they are needed most in the plant, which can be both upwards and downwards. This bidirectional movement allows for the distribution of sugars and other metabolites to growing parts, storage organs, and sites of active metabolism.

7. What are annual rings?

Ans. Annual rings, also known as growth rings, are layers of wood produced by a tree each year in its trunk or branches, reflecting the periodic growth due to seasonal changes. They are visible as rings of varying widths in a cross-section of the trunk, with each ring typically representing one year of growth.

8. Name the three processes by which plants absorb things from the soil.

Ans. Plants absorb substances from the soil through three main processes: osmosis, diffusion, and active transport. Osmosis manages water intake, diffusion allows for the movement of solutes from an area of higher to lower

concentration, and active transport uses energy to move substances against a concentration gradient.

9. Why some minerals are called micronutrients?

Ans. Some minerals are called micronutrients because plants require them in very small quantities for growth and development, despite their crucial roles in plant metabolic processes, enzyme function, and photosynthesis.

10. Where do we use the term translocation?

Ans. The term "translocation" is used in plant biology to describe the movement of sugars and other organic nutrients from the leaves, where they are produced through photosynthesis, to other parts of the plant through the phloem vessels.

### **Long answer type questions**

1. Explain briefly about the elements of xylem vessels.

Ans. The xylem vessels in plants are complex structures essential for water and mineral transport from roots to aerial parts, including leaves and stems. Xylem vessels are composed of several elements, each with unique functions contributing to the overall process of conduction and support within the plant.

Firstly, tracheids and vessel elements are the primary components responsible for water movement. Tracheids are long, thin cells with tapered ends, interconnected through pits in their lignified cell walls, allowing for water and mineral flow. Vessel elements, comparatively shorter and wider, connect end to end, forming continuous tubes that efficiently transport water upwards through the plant.

Additionally, xylem includes two types of support cells: fibers and parenchyma. Xylem fibers are elongated, tough cells that contribute to the structural support of the plant, reinforcing the xylem tissue. Xylem parenchyma cells, on the other hand, are involved in the lateral transport of water and nutrients within the xylem.

2. Explain briefly about the element of phloem vessels.

Ans. Phloem vessels are responsible for the transport of food and nutrients—mainly sucrose and amino acids—from the leaves to other parts of the plant, a process known as translocation.

Phloem is composed of several cell types:

1. **Sieve Tube Elements:** These are long, tube-like structures made of individual sieve tube cells. They have perforated ends called sieve plates that allow for the flow of nutrients.
2. **Companion Cells:** These are closely associated with sieve tube elements and help in the maintenance and function of the sieve tubes.
3. **Phloem Fibres:** These are supportive and strengthening elements within the phloem.
4. **Phloem Parenchyma:** These cells are involved in the storage and lateral transport of nutrients within the phloem.

The phloem vessels work in a coordinated manner to distribute the photosynthetic products from the leaves, where they are produced, to all parts of the plants.

3. How are the minerals absorbed by the plants? Ans. This process involves the minerals being dissolved in water, and plants take up these nutrient solutions through their root hairs by a process called absorption. There are two main methods of mineral absorption:

1. **Passive Absorption:** This occurs without the use of energy, where minerals move into the plant following the concentration gradient, from an area of higher concentration in the soil to a lower concentration in the root cells.
2. **Active Absorption:** This method requires energy, as minerals are absorbed from a region of lower concentration in the soil to a higher concentration in the root cells. The energy for active transport is provided by ATP generated through cellular respiration.

Once inside the plant, minerals can travel to different parts via the xylem vessels, reaching areas where they are needed for various metabolic processes.

4. Explain how water reaches from the soil to the root xylem?

Ans. The absorption of water which is capillary water happens in the roots and root hairs by the process of osmosis.

1. **Absorption:** Water in the soil, which contains dissolved minerals, enters the plant root hairs through osmosis due to the higher solute concentration inside the root hair cells compared to the soil water.
2. **Root Pressure:** As more water enters the roots, it creates a pressure called root pressure that helps in pushing water upwards into the xylem vessels.
3. **Capillary Action:** Water also moves upwards through the tiny tubes in the xylem by capillary action, where the adhesion of water molecules to the walls of the xylem and the cohesion between water molecules help pull the water column up.
4. **Transpiration:** Finally, as water evaporates from the leaves during transpiration, it creates a suction pressure that pulls more water into the leaves from the xylem vessels, replacing the water that was lost.

This continuous movement of water from the soil into the roots and then through the xylem to the leaves is essential for the transportation of water and dissolved minerals.

5. How are xylem vessels different from phloem vessels?

Ans. Xylem and phloem vessels are both part of the plant's vascular system, but they have different functions and structural characteristics.

Criteria	Xylem	Phloem
Location on the leaf	They are towards the upper surface.	They are towards the lower surface.
Function	Carries water and minerals from the roots to the leaves.	Translocates food from the leaves to storage sites and other parts of the plant.
Components	Tracheids, vessels, xylem parenchyma and xylem sclerenchyma.	Sieve tubes, companion cells, phloem parenchyma, phloem fibres.
Conducting cells living or dead	Tracheids and vessels are made of dead cells which are highly lignified.	The cells that conduct food are alive, which helps active transport.
Direction	Conduction is in one direction only.	Translocation is bidirectional.
Energy expense	No energy is spend.	There is expenditure of energy.

6. Which factors affect transpiration in plants?



Ans. Transpiration in plants is influenced by several environmental factors. These include:

1. Day light-The stomata open during the day, turgidity of the guard cells leads to opening of stomata, the stomata shut down when the temperature is very low or very high.
2. Temperature – Transpiration increases as the temperature increases. However, beyond a point when the temperature is beyond 36<sup>0</sup> C, the stomata can shut down and reduce transpiration.
3. Transpiration is faster when it is windy. This is because wind blows away saturated air from around the leaves.
4. Humidity – Transpiration is high when humidity is low and vice versa.
7. How does ascent of sap actually happens in plants?

Ans. The ascent of sap in plants refers to the upward movement of water and minerals from the roots to the leaves. This process is explained through the cohesion-tension theory. Here's a brief overview:

1. **Transpiration:** Water evaporates from the leaf's surface, creating a suction force that pulls water up the plant.
2. **Cohesion and Adhesion:** Water molecules are cohesive (they stick to each other) and adhesive (they stick to the walls of the xylem vessels), which helps them form a continuous water column from the roots to the leaves.
3. **Root Pressure:** Roots absorb water from the soil, creating root pressure that helps push water upwards.
4. **Capillary Action:** The narrow diameter of the xylem vessels facilitates the capillary action, assisting the upward movement of the water column.

These forces work together to move water against gravity from the roots to the highest leaves, ensuring that all parts of the plant stay hydrated and can carry out essential processes like photosynthesis and nutrient transport.

8. The elements of phloem are living tissues. How is this important for translocation?

Ans. The phloem elements being living tissues is significant for the process of translocation—the movement of food substances from leaves to different parts of the plant. The sieve elements are elongated tube like cells they are living cells but lack nucleus. This increases the size of the lumen for transport of material. The end walls are perforated and called sieve plates. The pores facilitate the exchange of materials.

Companion cells are living thin walled elongated cells. They are attached to the sides of the sieve tube by microscopic channels which facilitate transfer of food material to sieve elements.

Moreover, the living cells of the phloem can repair themselves, manage their own waste, and respond to damage, which is crucial for maintaining the flow of nutrients throughout the life of the plant.

9. How do the plants benefit from transpiration?

Ans. Plants benefit from transpiration in several ways:

1. In transpiration water changes from liquid to vapour state, hence a lot of heat is taken up from the plant body. This leads to a cooling effect in the plant. That is why shade of a tree is always cooler than the shade of a terrace on a hot sunny day.
2. Loss of water by transpiration creates a transpiration pull force, in the leaves which extends through the water column and it helps to draw water at the roots.
3. Transpiration is a mechanism that helps to maintain proper concentration of sap (water-mineral balance) in the plant. On one hand loss of water from the leaves prevents too much dilution of the cell sap.
4. Transpiration creates transpirational pull helps in the distribution of absorbed minerals from the soil.
5. Water released by transpiration from plants forms a very important component of water cycle on the Earth which again comes back to the plants.

10. Why are the “NPK” fertilizers important for plants?

Ans. "NPK" fertilizers are essential for plants because they supply the three primary nutrients needed for their growth:

1. **Nitrogen (N):** This is vital for the growth of leaves and stems. It's a major component of chlorophyll, which plants use in photosynthesis to convert sunlight into energy, and it's also a significant part of amino acids, the building blocks of proteins.
2. **Phosphorus (P):** Phosphorus is crucial for the development of roots, flowers, seeds, and fruits. It plays a role in energy storage and transfer as it is a part of ATP, the molecule that provides energy for various processes within the plant cells.
3. **Potassium (K):** Potassium is key for overall plant health. It's involved in protein synthesis, photosynthesis, fruit quality, and reduction of diseases. Potassium regulates the opening and closing of stomata, thus managing water loss and intake and helping in the activation of enzymes.

Plants absorb these elements from the soil, but over time, the soil can become depleted. Using NPK fertilizers replaces these essential nutrients, ensuring that plants have the necessary components for their growth cycle, which can lead to better yield and healthier plants.

### Experiential learning question

1. What are the similarities between the circulatory system in animals and plants?

Ans. The similarities between the circulatory system in animals and plants lie in their basic function, which is the transportation of substances within the organism. The force of transportation in animals is provided by the pumping force of the heart. In case of ascent of sap happens by the forces of transpiration, root pressure, capillary action etc.

2. Which of the following statements is not correct about the transportation tissues in plants?

Ans. (d) All the transportation tissues are made of reinforced dead cells.

### Application based questions

1. What could happen if you could plug all the xylem vessels in a tree?

Ans. If you could plug all the xylem vessels in a tree, the tree would be unable to transport water and minerals from the roots to the leaves. This would lead to a cessation of photosynthesis, nutrient deficiency, wilting, and eventually the death of the tree, as it couldn't maintain its vital functions.

2. Water flows from higher water potential to lower water potential; how is this relevant for plants?

Ans. Water moving from higher water potential to lower water potential is critical for plants because it drives the movement of water from the soil (where water potential is higher) into the root cells (where water potential is lower). This principle underlies the process of osmosis, allowing plants to absorb water and the dissolved minerals they require for growth and metabolism.

### Multi-disciplinary questions

1. From where do the plants get the energy needed for active transport?

Ans. Plants get the energy needed for active transport from ATP (adenosine triphosphate), which is produced during cellular respiration. This process converts the chemical energy found in glucose, which plants make through photosynthesis, into energy that can be used for various cellular activities, including active transport.

2. Is transpiration in plants really a water wasting process?

Ans. We know that only about 1 % of the absorbed water is utilized in photosynthesis. The other large part also has a vital function apart from keeping the plant cool.

*We know that carbon dioxide enters the plant cells, by **diffusion**. For this to happen it must go into solution, because the plasma membrane of the cells is almost impervious to the gaseous carbon dioxide. CO<sub>2</sub>, must touch a moist cell surface for absorption.. However, as moisture is exposed to relatively dry air it*

*is quickly evaporated. Hence to ensure the uptake of carbon dioxide for photosynthesis plants have to do the apparently wasteful process of transpiration.*

### **Play and Learn**

1. How are the two way traffic movement similar to movement of substances in trees?

Ans. Two-way traffic movement is similar to the movement of substances in trees because, in two-way traffic, vehicles can move in opposite directions, just as in trees, where the xylem transports water and minerals upwards, and the phloem transports sugars and other metabolic products downwards or to where they are needed.

2. Keep some raisins in salt solution; do they swell? Explain.

Ans. Raisins in a salt solution typically do not swell. Osmosis causes water to move from an area of lower solute concentration (raisins) to higher solute concentration (salt solution). Since the salt solution is hypertonic compared to the inside of the raisins, water leaves the raisins, causing them to shrink rather than swell.

### **VALUES AND LIFE SKILLS**

In all our residential areas we try to grow as many plants as possible. Explain how plants improve the quality of our lives?

Ans. Plants enhance our lives by purifying air, releasing oxygen, providing shade, reducing noise pollution, and improving mental well-being. They also support biodiversity, offering habitats for various species, and can lower urban temperatures, mitigating the heat island effect. Additionally, plants contribute to food security through fruits, vegetables, and nuts.

### **Image based questions**

1. In the diagram:

(a) Stomata -2

(b) Lenticels- 3

(c) Transpiration-1

(d) Root pressure-5

(e) Root hair- 4

2. For the bell jar experiment:

(a) The water droplets came from water vapor that transpired from the plant and condensed on the cooler surface of the bell jar.

(b) The soil in the pot is covered with polythene to prevent the direct evaporation of water from the soil so that the water droplets can be attributed to transpiration from the plant alone.

(c) If an artificial plant were used, no water droplets would appear on the inside of the bell jar because an artificial plant does not transpire.

3. When two solutions of different concentration are separated by a semipermeable membrane; explain the direction of osmosis.

Ans. When two solutions of different concentrations are separated by a semipermeable membrane, osmosis occurs. Water will move from the dilute sucrose solution (X), where there is a higher water potential, to the concentrated sucrose solution (Y), where there is a lower water potential, until equilibrium is reached.

### **Our Culture**

Almost all the plants that are revered in Indian culture have unique properties and even medicinal value. Name two such plants and elaborate on their medicinal value.

Ans. Two plants that are revered in Indian culture for their medicinal value are:

1. **Neem:** Neem is widely known for its antibacterial, antifungal, and antiviral properties. It is used in treating skin conditions, like eczema and acne, and is a common ingredient in toothpaste and mouthwash due to its ability to fight dental plaque and maintain oral health.
2. **Tulsi (also known as Holy Basil):** Tulsi is considered a tonic for the body, mind, and spirit. It has adaptogenic properties, helping the body adapt to stress and maintain balance. It's also used to treat colds and flu due to its immune-boosting properties, and its leaves are used in teas and oils for their health benefits, including anti-inflammatory and antioxidant effects.

These plants have a long history of use in Ayurvedic medicine, the traditional Indian system of healing. They are used both in preventive and curative manners and have been the subject of numerous scientific studies validating their medicinal benefits.

## CHAPTER 2

### MCQs

1. Which of the following is not a part of 'asexual reproduction'?

Ans. (c) Fertilization

2. In binary fission way of asexual reproduction:

Ans. (a) First the genetic material is duplicated

3. The plants produced by vegetative propagation are;

Ans. (b) Exactly same as the parent

4. Which of the following is a method of artificial propagation in plants?

Ans. (c) Layering

5. Which of the following sentences describes pollination correctly?

Ans. (c) Pollen grains are transferred to the stigma.

6. If it is a wind pollinated plant:

Ans. (d) The pollen grains will be sticky & (b) Large amounts of pollen would be produced.

7. (d) fungi

8. Layering is done on-

Ans. (a) Stem.

9. The carpel in a flower comprises of

Ans. (b) Stigma, style, and ovary.

10. Feathery stigma can be seen in –

Ans. (c) Wind pollinated flowers

### **Match the organisms with their modes of propagation**

(a) Bryophyllum - v. Leaf buds

(b) Spirogyra - iii. Fragmentation

(c) Amoeba - vi. Multiple fission

(d) Yeast - i. Budding

(e) Gladiolus - ii. Corm

(f) Strawberry - vii. Runner

(g) Dahlia - ix Root tuber

(h) Vallisneria (viii) Pollination by water.

### **Fill in the blanks.**

1. Starfish and Planaria reproduce asexually by **fragmentation**.
2. The 'eyes' in the potato are **dormant buds**.
3. Part of the flower that forms the fruit is **ovary**.
4. Fusion of the male and female gamete is called **fertilization**.



5. The reproductive stem of grass is called **runner**.
6. In adverse conditions, the amoeba forms a protective structure called **cyst**.
7. The whorls of a flower rest on the **thalamus**.
8. The pollination in dioecious flowers is **cross-pollination**.
9. After fertilization, the zygote develops into an **embryo**.
10. Water lily is pollinated by **insects**.

Find the odd one giving reasons

1. Budding is natural process of asexual reproduction others are artificial processes.
2. Dahlia tuber is root others are stems.
3. Layering -others are stages in micro propagation.
4. pedicel- not part of the whorl of flower.

State True or False for the following and correct the false statements giving reasons

1. True. In fragmentation, each part can develop into a new individual, typical in organisms like starfish and some plants.
2. False. In cutting, new plants are not produced.
3. False. The spores of ferns lead to the formation of gametes.
4. False. A tuber differentiated into nodes and internodes will be a stem tuber.
5. False . Fruits produced after grafting have a different variety.
6. False. A flower with all the whorls (calyx, corolla, androecium, and gynoecium) will be bisexual.
7. True. After repeated cycles of vegetative reproduction, plants can experience a decrease in vigor due to a build-up of mutations or a lack of genetic diversity.

8. True. Cross-pollination occurs when pollen from the flower of one plant is transferred to the stigma of a flower on a different plant.
9. False. A zygote is formed after a sperm from the pollen has fused with an egg in the ovary.
10. True. Seeds in a fruit develop from ovules after they have been fertilized by pollen and a zygote is formed.

### **Short answer type questions**

1. Asexual reproduction is a mode of reproduction where offspring arise from a single parent and inherit the genes of that parent only, without the involvement of gametes.

2. Examples of plant structures are:

- Tuber: Potato
- Bulb: Onion
- Rhizome: Ginger
- Corm: Gladiolus

3. A complete flower is one that has all four main floral parts: sepals (calyx), petals (corolla), stamens (androecium), and carpels (gynoecium).

4. Stem tuber is a swollen underground stem, differentiated into nodes and internodes. Whereas root tuber is a swollen root, not differentiated into nodes and internodes. Stem tuber is borne at the tip of underground stem branches. Whereas root tuber develops adventitiously from any part of the stem.

5.
  1. Unwanted characteristics of plants cannot be eliminated.
  2. There is a fall in vigour of plants in later generations.

3. We can store seeds for longer periods, whereas the same cannot be done for vegetative parts of a plant.
6. The parts of the stamen are the anther and filament, while the carpel (or pistil) comprises the stigma, style, and ovary.
7. Micro-propagation is a technique in which fragments of plants are cultured and grown in a laboratory. This method is beneficial for the production of disease-free plants and increased crop yield.
8. The lotus is pollinated by insects because it though it is an aquatic plant its flowers are exposed to the atmosphere.
9. In nature pollination takes place with the help of pollinating agents . These include **abiotic agents**, such as wind and water, and **biotic agents**, such as bees, butterflies, rodents etc. Of all the biotic agents, insects are the most common.
10. Artificial pollination is the deliberate transfer of pollen from the anther to the stigma by human action, as opposed to natural pollination by pollinators like insects or wind.

### **Long answer type questions**

1. In yeast budding is the process of asexual reproduction. Parent Yeast cells produce one or more tiny outgrowths called buds. The buds keep growing. Meanwhile the nuclear material also divides into two. One nucleus passes in to the bud. Finally the bud detaches and becomes independent. The newly formed Yeast is an identical copy of the parent.
2. 1. Compared to seed propagation new plants are produced in less time.

2. The plants produced are exact copies of the parent plant. Thus desirable characteristics are preserved.
3. Plants propagated vegetatively usually need less attention than plants grown from seeds.
4. By artificial propagation a large number of same kind of healthy plant and hence its produce is obtained. It gives the farmer the economics of scale.

This processes lead to better quality and quantity of outcomes.

5. The activity can be timed to avoid unfavourable environmental conditions.
  6. Better survival rates of plants lead to superior crop yield and better business.
- 3. 1.** A unisexual flower contains either male (stamen) or female reproductive organs (pistils). Whereas a bisexual flower contains both male and female reproductive organs .
2. Monoecious plants have separate male and female flowers on the same plant. Dioecious plants have male and female flowers on separate plants. A bisexual flower can also be called a perfect flower, whereas a unisexual flower can be called an imperfect flower.
  3. While monoecious flowers can undergo self and cross pollination. Dioecious flowers undergo only cross-pollination. The bisexual flowers can undergo go both self-pollination and cross pollination.

4. Spore formation in fungi is a primary method of reproduction, crucial for their survival, spread, and diversification. In fungi, the hyphae that grow upwards as slender columns are called **sporangiophores**. Its tip ends in an oval structure called **sporangium** which contains large number of **spores**.

The spores are very light and when these spores are released they spread over a large area and grow into new individuals wherever favourable conditions are available.

5. Grafting is a horticultural technique where tissues from one plant (the scion) are inserted into those of another plant (the rootstock), allowing them to fuse and grow as a single plant. This process combines the most desirable traits of both plants, such as disease resistance or hardiness from the rootstock and superior fruit, flower quality, or yield from the scion.

- (a) A healthy stem or bud of one plant of desired quality is taken and tightly implanted on the rooted stem of another plant of the same species or related species. The implant is called **scion** and the receiving stem is called **stock**.
- (b) When stem is used as scion the cut surfaces are made oblique. The oblique cut surface after being inserted over the cut stem of another rooted plant is tied together.
- (c) After some days, new branches develop that show combined features of the two plants. This method is commonly used in roses, mango and other fruits

6. (a) Wind-pollinated flowers are small, and not showy. They are not colourful or scented and do not produce nectar.

(b) The flowers produce large quantities of dry pollen that is easy to spread by wind. As a lot of pollen is blown away and wasted, large quantity of pollen production is important for ensuring pollination.

(c) The stigma on wind pollinated flowers are adapted to capture pollen from the air, such as they are sticky and have feathery structures to catch the pollen from the wind.

(d) Many wind pollinated flowers do not have petals. They have longer stamens and stigma that is exposed to wind.

7. Insect-pollinated flowers, or entomophilous flowers, are specifically adapted to attract and facilitate pollination by insects. These flowers are usually colorful and visually appealing to draw the attention of their insect pollinators. They often produce a fragrance or nectar to lure insects such as bees, butterflies, and beetles.

- (a) Insect pollinated flowers are usually large and brightly coloured to attract insects. When the individual flowers are small, they form clusters.
- (b) The flowers are scented and produce nectar that is favourite food of many insects.
- (c) Some insects like bees also eat pollen for its protein content. They also use it as food for larva.
- (d) The pollen grains of these flowers are spiny, and surrounded by a yellow oily sticky substance so they stick to the body of the insect visiting the flower.
- (e) The stigma of these flowers are also sticky, this facilitates the transfer of pollen grains on them.

8. Fertilization is the fusion of male *and the female gamete to produce a zygote*.

- (a) Once a pollen grain has landed on the stigma of the same species, it germinates.
- (b) A sugary solution is secreted by the stigma that stimulates the germination of the pollen tube from weak spots, on the pollen grain.
- (c) The pollen tube, carrying the male gamete grows through the style and reaches the ovule (in the ovary).
- (d) After reaching the ovule, the tip of the pollen tube bursts, releasing the male gamete.

The male gamete fuses with the female gamete to form **zygote**. This process is called fertilisation.

9. Self-pollination and cross-pollination are two distinct mechanisms of plant reproduction. Self-pollination occurs when pollen from a flower's anther fertilizes ovules in the same flower or another flower on the same plant. The offspring that are genetically identical to the parent, thus maintaining specific plant traits through generations.

Cross-pollination, on the other hand, involves the transfer of pollen from the anther of one plant to the stigma of a flower on a different plant of the same species. This process is often facilitated by external agents such as insects,

birds, wind, or water. Cross-pollination encourages genetic diversity by combining the genetic material of two different plants.

10. After fertilization in plants, several key changes occur, leading to the development of seeds and fruits.
  - (a) After the formation of zygote, the petals, sepals and stamens wither away and fall. The style and stigma also fall.
  - (b) Only the ovary remains. It contains the fertilised ovule which contains the zygote. The zygote divides and forms the embryo.
  - (c) The walls of ovule develop hard layers and develop into seeds consisting of the embryo. The embryo contains one or two cotyledons with stored food. They are covered by hard protective seed coat.
  - (d) The ovary ripens to form the fruit. Fruits are the means by which many plants spread their seeds.

### **Experiential learning question**

1. The actor converted his ranch to a bee sanctuary for two reasons: to preserve and save wild bees and to create a healthy environment.
  
2. The reasons for colony collapse disorder include a combination of parasites, pesticides, and habitat loss.
  
3. The consequences of the collapse of bee populations can lead to ecological and agricultural issues since bees are key pollinators for plants. Declining bee populations affect vegetation and agricultural crops globally.

### **Application based question**

1. Vegetative propagation often involves parts like tubers, bulbs, and rhizomes, which store food. For humans, this is vital because these parts not only enable

propagation of crops but also provide a significant source of nutrients and calories, essential for our diet. They ensure food security by allowing efficient crop production and ease of storage for use at the time of need.

2. Many white flowers are pollinated by insects because insects have ultraviolet receptors in their eyes (which humans do not have). Most of the white flowers appear colourful to the insects. In fact, flowers that appear white to insects are very rare. That why flowers that appear white to the human eye are also insect pollinated.

3. Both self-pollination and cross-pollination have their advantages, but cross-pollination is generally considered better due to its promotion of genetic diversity. This diversity is crucial for the adaptation and survival of species as it leads to offspring with a combination of traits, potentially increasing resilience to diseases and environmental changes. While self-pollination ensures reproduction when pollinators are scarce, it can lead to inbreeding and a decrease in vigor over time. Cross-pollination contributes to the evolutionary success of plant species by enhancing genetic variability.

### **Multi-disciplinary questions:**

Micropropagation has had a significant impact on crop output for farmers by providing a rapid and efficient method of producing large numbers of plants from a small amount of plant tissue. This technique, often known as tissue culture, involves growing plants in a controlled, sterile environment from cells or tissues.

The benefits to crop output include:

1. **Disease-free plants:** Micropropagation can produce plants free from pathogens, resulting in healthier and more vigorous crops, thus increasing yields.
2. **Rapid Multiplication:** It allows for the production of large quantities of plants in a relatively short period, which is particularly useful for rapidly introducing new cultivars.



3. **Saving endangered species:** It can help in the propagation of rare or endangered plant species, which may be difficult to grow by conventional means, thereby also benefiting the diversity of crops available to farmers.

Overall, micropropagation can lead to a significant increase in crop output, allowing farmers to maximize their resources and cater to the market more effectively, which can translate into higher economic gains.

## **STEM Project**

(DO IT YOURSELF QUESTION)

### **Image based questions:**

(a) The usefulness of the flower parts labeled from 1 to 4 are:

1. Petal: Attracts pollinators with its color and sometimes scent.
2. Stamen: Produces pollen, the male reproductive cells.
3. Sepal: Protects the developing flower bud.
4. Receptacle: Supports the flower; where the other parts are attached.

(b) The parts labeled as 'a' and 'b' are:

- (a) stigma
- (b) style

For the bottom left image: The significance of a feathery stigma in some flowers is to increase the surface area for catching wind-borne pollen, which is a characteristic of wind-pollinated plants.

For the bottom right image: The image shows artificial pollination, where pollen is being manually transferred from the anther of one flower to the stigma of another to facilitate fertilization and seed production.

## VALUES AND LIFE SKILLS

Plants enrich our lives by providing oxygen, food, and beauty. To reciprocate their gifts, we must care for them diligently. Start by understanding their specific needs: sunlight, water, and soil quality. Regular watering, pruning, and fertilizing promote their health. Support local conservation efforts and plant trees to combat deforestation. Embrace sustainable practices like composting and reducing chemical usage. Educate others about the importance of greenery in our environment. By nurturing plants, we not only repay their kindness but also sustain the planet for future generations.

## CHAPTER 3

### MCQs

1. (c) Fallopian tube
2. (b) Pear shaped hollow muscular bag
3. (d) One egg every alternate month
4. (c) Head of the sperm containing the nucleus penetrate the egg.
5. (d) Five to six days

### Fill in the blanks

1. scrotum
2. vas deferens
3. implantation
4. prostate gland
5. funnel

### Match the following

- |                     |   |
|---------------------|---|
| a. Fallopian tubes  | (iii) It connects the uterus and the ovaries                                      |
| b. Seminal vesicles | (iv) Releases fluids that form the medium to transport sperms                     |
| c. Epididymis       | (i) Sperm producing tubules join to form epididymis which connects to sperm ducts |
| d. Prostate gland   | (v) Secretes an alkaline fluid  |
| e. Cervix           | (vii) Connects the uterus and the vagina  |

### State True or False and correct the false statements giving reasons

1. False. The nucleus in a sperm cell lies in its head, not its tail. The tail of a sperm cell contains the flagellum, which helps in propulsion.
2. False. The fallopian tubes do not produce the egg; they are the site of fertilization and serve as a passageway for the egg to travel from the ovary to the uterus.
3. True.
4. True. Fertilization in humans occurs internally, typically within the fallopian tubes.
5. False. The temperature in the scrotum is lower than the body temperature. This lower temperature is necessary for proper sperm production (spermatogenesis).

### Select the odd one giving reasons

1. Fallopian tube -others are parts of male reproductive organ.
2. Odd one out: Epididymis.

Reason: The epididymis is part of the male reproductive system, while the other three terms are components of the female reproductive system.

3. Odd one out: Regeneration.

Reason: Regeneration is not a process related to human reproduction. The other three terms are involved in various stages of human reproduction.

4. Odd one out: Urethra.

Reason: Urethra is not directly related to the process of human reproduction; it is a part of the urinary system. The other three terms are developmental stages of a human organism.

### Short answer type questions

1. Reproduction is vital for the continuation of species and genetic diversity. It ensures the survival of organisms and passes on genetic information to the next generation.

2. The carriers of male gametes is sperm and carrier of female gamete is egg (ova) produced in the ovary.

3. Sperm are male reproductive cells produced in the testes, containing genetic material for fertilization. Ova, or eggs, are female reproductive cells produced in the ovaries, carrying genetic material and potential for fertilization.

4. Ovaries are a pair of white coloured oval structures on either side of the uterus. It is located in the lower abdominal cavity. One egg is produced by an ovary every month alternately. The process is called **ovulation**. The egg (or ovum) is a single celled structure.

The uterus is a pear shaped hollow muscular organ situated between the urinary bladder and the rectum. The uterus extends into a narrow passage called **cervix** which opens on the outside through the vagina.

5. The testes consists of numerous sperm producing tubules which join to form a coiled structure called **epididymis**. **The two epididymis also serve as a site for sperm maturation.**

## Long answer type questions

1. The testes in humans are located outside the body primarily for temperature regulation necessary for spermatogenesis, the process of sperm production. The testes are encased in **scrotal sack** that lies out of the abdominal cavity. The benefit of having the testes out of the abdominal cavity is that the testes remain at a temperature that is 2 to 3 °C, lower than the body temperature. The temperature of 34°C to 35°C, most suitable for sperm production (**spermatogenesis**).

2. Fertilization in humans happens inside the body of the female, hence it is called **internal fertilization**. It happens in following steps:

(i) A mature egg (ova) is released from the ovary (by the process of ovulation) it passes into the oviduct.

(ii) The sperms released in the vagina move towards the oviduct.

(iii) Out of the millions few sperms are able to reach the oviduct and only one of them fuse with the ovum.

(iv) As the fusion happens the tail of the sperm is left behind, and head part containing the nucleus penetrates the egg.

(v) The nucleus of the sperm and the nucleus of the ovum unite to form single celled structure called **zygote**. The fusion of the male and female gametes is called **fertilization**.

The zygote divides repeatedly to give rise to a ball of cells. The cells then begin to differentiate to form groups of cells that develop into different tissues. This structure is called an **embryo**. The embryo gets embedded in the wall of the uterus for further development. This is called **implantation**.

3. Fertilization in humans is called **internal fertilization**. It happens in following steps:

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4. The ovary and uterus are two essential organs in the female reproductive system, each with distinct functions.

Ovaries are a pair of white coloured oval structures on either side of the uterus. It is located in the lower abdominal cavity. One egg is produced by an ovary every month alternately. The process is called **ovulation**. The egg (or ovum) is a single celled structure.

The uterus is a pear shaped hollow muscular organ situated between the urinary bladder and the rectum. The uterus extends into a narrow passage called **cervix** which opens on the outside through the vagina.

5. The human male reproductive system consists of several organs working together to produce and deliver sperm for fertilization.

**1.A pair of testes** encased in **scrotal sack** that lies out of the abdominal cavity. The testes consists of numerous sperm producing tubules which join to form a coiled structure called **epididymis**.

**2.Two sperm ducts** (or Vas deferens) – One sperm duct comes out from each epididymis. The two sperm ducts open into the urethra.

(iii) **Two seminal vesicles** – These are glands that produce the fluids that form the medium to transport the sperms. The seminal vesicles open into the corresponding sperm duct before it joins the urethra. The sperm and the secretion of the seminal vesicle forms the milky looking **semen**.

(iv) **Prostate gland** – This gland encircles the base of the urethra. It releases an alkaline secretion into the semen.

(v) **Cowper's glands** – These are two small pea sized glands below the prostate. They produce thick clear mucus prior to ejaculation that drains into the urethra.

(vi) **A penis** – The urethra passes through the penis. It can carry semen during mating.

### **Application based questions**

1. It is important for semen to contain a large number of sperm because only a small percentage of sperm cells successfully reach and fertilize the egg during reproduction. Having a higher number of sperm increases the likelihood of successful fertilization. Thus, a higher sperm count enhances the chances of successful conception and pregnancy.

2. We know that an alkaline medium is suitable for the health of sperm in humans because sperm are sensitive to acidic environments. The female reproductive tract, particularly the vagina, is naturally acidic, which can be harmful to sperm. Therefore, an alkaline medium, such as the one provided by secretions from the prostate gland and seminal vesicles, helps neutralize the acidity of the female reproductive tract, creating a more hospitable environment for sperm survival and motility.

### **Multi-disciplinary question**

In some women oviducts (fallopian tubes) are blocked. These women cannot give birth to babies because sperms cannot reach the egg for fertilisation. In such cases, egg and sperm is collected from the parents and kept together for in vitro fertilization (IVF). In case of successful fertilisation the zygote is allowed to develop for about a week and then it is planted in the mother's uterus.

Development of the embryo and then the foetus takes place in the uterus and the baby is born like any other baby. Babies born through this technique are called **test-tube babies**.

## **Play and Learn**

The Virginia opossum, is a marsupial native to North and Central America. One of its most fascinating defensive behaviors is thanatosis, commonly known as "playing possum." When threatened or in danger, the opossum can enter a state of apparent death, where it becomes completely immobile and unresponsive.

During thanatosis, the opossum will lie on its side or back, with its mouth open and tongue hanging out, resembling a deceased animal. It may also emit a foul-smelling odor or froth at the mouth, further convincing predators of its demise. This behavior can last from a few minutes to several hours, allowing the opossum to escape potential harm while its predator loses interest.

## **Image based questions**

### **For the first image**

1. Fallopian tube connects uterus and ovary
2. Ovary produces eggs
3. Uterus
4. Cervix

### **For the second image**

1. Cowper's gland-These are two small pea sized glands below the prostate. They produce thick clear mucus prior to ejaculation that drains into the urethra. This secretion, provides lubrication and helps to neutralize the acidity in urethra (due to previous micturition).
2. Vas deferens or sperm duct– One sperm duct comes out from each epididymis. The two sperm ducts open into the urethra.
3. Seminal vesicle
4. Urethra



# CHAPTER 4

## MCQs

1. (c) Sunlight
2. (b) Consumers
3. (c) Dispersal of pollutants
4. (b) There is little growth of plants
5. (c) Decomposers

## State true or false for the following and correct the false statements giving reasons

1. False. Tigers are not primary consumers; they are tertiary consumers. They typically feed on herbivores (primary consumers) or other carnivores (secondary consumers).
2. False. Canopy in a forest is not formed mostly by shrubs. Canopy refers to the upper layer of trees in a forest that forms a dense covering. Shrubs are typically found in the understory or lower layers of the forest.
3. False. Rhizobium found in the roots of leguminous plants form a symbiotic relationship with the plant, providing it with fixed nitrogen. They are not parasites as they benefit the plant without causing harm.
4. True. In predation, the prey is indeed harmed as it is captured and consumed by the predator.
5. False. Energy flow in an ecosystem is unidirectional, flowing from producers to consumers and eventually lost as heat. It does not flow in both directions.

## Fill in the blanks

1. **biotic**
2. **humification**
3. **symbiosis**

4. **tropics**

5. **dead organic matter**

### **Match the two columns**

1. Emergent layer: d Tropical rainforest
2. Scavengers: f Vultures
3. Understory: b 5% light reaches here
4. Goat: a Primary consumer
5. Edaphic factor: c Soil salinity
6. Detritivores: i Earthworms

### **Short answer type questions**

1. Primary consumers are organisms that feed directly on producers (plants) in a food chain or food web, such as herbivores.

2. Humans can be primary consumers by consuming plant-based foods such as fruits, vegetables, grains, and nuts, which are produced by plants.

3. A quaternary consumer typically occupies the highest trophic level in a food chain or food web, consuming tertiary consumers. Since it is at the top of the food chain, there may not be a predator higher up in the chain, resulting in no direct predation on quaternary consumers.

4. A predator is an organism that hunts, kills, and consumes other organisms (prey) for sustenance.

5. The pyramid of numbers represents the graphical representation of the number of organisms at each trophic level in a food chain or food web. Typically, it depicts a pyramid shape, with the producer level at the base having

the highest number of organisms, and successive higher trophic levels having progressively fewer organisms, reflecting the energy transfer and biomass distribution in an ecosystem.

### **Long answer type questions**

1. In a food chain, energy transfer between trophic levels is not efficient, leading to a decrease in available energy as we move up the chain. This decrease occurs because energy is lost at each trophic level through metabolic processes such as respiration, growth, and waste production. As a result, there is insufficient energy to sustain populations beyond a certain number of trophic levels.

Additionally, with each successive trophic level, there is a decrease in biomass, as energy is converted into the biomass of the organisms at that level. This further limits the number of consumers that can be supported in higher trophic levels.

2. A food chain is a linear representation of the feeding relationships within an ecosystem, showing the transfer of energy and nutrients from one organism to another. It typically starts with producers, such as plants or algae, which convert sunlight into chemical energy through photosynthesis. Primary consumers, such as herbivores, then consume these producers. Next, secondary consumers, such as carnivores, feed on primary consumers. This continues with tertiary consumers, which may prey on secondary consumers.

The energy flow in a food chain is unidirectional, moving from one trophic level to the next. Producers harness energy from the sun and convert it into organic compounds through photosynthesis. When herbivores consume these producers, they obtain energy stored in the organic compounds. This energy is transferred to higher trophic levels as consumers feed on other organisms. However, energy is lost at each trophic level through metabolic processes, heat production, and waste, resulting in a decrease in available energy at higher trophic levels.

3. Symbiosis is a biological relationship between two different species that live in close proximity to each other, often resulting in mutual benefit. There are three main types of symbiotic relationships:

(a) **Commensalism**, in which one species benefits while the other species neither benefits nor is harmed. Example – When a bird makes a nest on a tree. Here though the tree provides shelter to the bird, the tree is not benefitted or harmed in any significant way. Other examples include Orchids Growing on Branches, Tree frog living on plants.

(b) **Mutualism**, in which both participating species benefit. Example Leguminous plants have beads on their roots, which contain a bacteria called *Rhizobium*. The bacterium fixes atmospheric nitrogen converting it into compounds which the plant can easily absorb. In turn the plant provides shelter to the bacterium. Another example is of a bird feeding on an alligators teeth.

(c) Parasitism may be regarded as a special form of symbiosis in which the parasite, is much smaller than the prey (usually called the **host**) and is closely associated with it. Parasitism is always harmful to the host and beneficial to the parasite.

Parasites may be **ectoparasites** - such as fleas, leeches, and lice—which live on the body surface of the host or **endoparasites** - such as roundworms or tapeworms which live inside the host (intestine of humans).

4. Energy flow in a food chain decreases at every trophic level due to inefficiencies in energy transfer and utilization. At each trophic level, organisms consume organic matter to obtain energy for growth, reproduction, and metabolic activities. However, energy is lost at each step of the food chain. In most cases the food chains Food chains consist of only three or four steps. This is because a lot of energy is lost at every step (in the form of heat) and hence very little energy is left in a 'system' after four trophic levels. The energy flows through an ecosystems in one direction only. Hence all ecosystems have

to rely on a continuous supply of energy from an outside source, which is usually the Sun.

A plant can only fix about 1% of the sun's energy that falls on its green parts. Members coming next in the food chain can take into their bodies about 10% of the energy available in the organisms on which they feed. Thus there is a loss of energy level at each trophic level.

An important fact is that about 1000 kg of green plants ends up supporting just 1 kg of carnivore body weight.

5. Scavengers and decomposers play vital roles in keeping the environment clean by efficiently recycling organic matter and nutrients, thereby preventing the accumulation of dead and decaying organisms.

A scavenger is an organism that mostly consumes dead meat or plant material. They are usually carnivores but they do not hunt. Scavengers play an important role in the food web. They keep an ecosystem free of the bodies of dead animals. Example : Vultures and hyenas when they are alone.

### **Decomposers**

These are saprophytes such as fungi and bacteria. They directly thrive on the dead and decaying organic matter. They decompose the organic matter by secreting enzymes and in the process draw nutrition. Decomposers are an essential part of ecosystems as they help in recycling nutrients and in the process help to keep the environment clean.

### **Application based questions**

1. The functions of an ecosystem include regulating biogeochemical cycles such as the carbon and nitrogen cycles on the Earth. It plays a big role in maintaining homeostasis on our planet.
2. If forests are lost at a rapid pace, the consequences could be severe. Deforestation can lead to habitat loss and fragmentation, threatening

biodiversity and causing the extinction of species. It can disrupt ecosystem leading to increased greenhouse gas emissions and climate change.

### **Multi-disciplinary questions**

1. Despite scientific evidence highlighting the importance of forests for biodiversity, climate regulation, and ecosystem services, human activities such as deforestation continue to threaten forest ecosystems. The destruction of forests often arises from various socio-economic factors, including agricultural expansion.

2. The Amazon tropical rainforest plays a crucial role in regulating global climate patterns and supporting biodiversity. If it were destroyed, the consequences would be severe. The Amazon acts as a carbon sink, absorbing vast amounts of carbon dioxide from the atmosphere, thus helping mitigate climate change. Its destruction would release significant amounts of stored carbon, contributing to greenhouse gas emissions and accelerating climate change. Additionally, the loss of biodiversity in the Amazon would impact global ecosystems and food chains. The rainforest also influences regional climate patterns, including rainfall patterns, which could lead to droughts and disrupt agricultural productivity not only in South America but also globally.

### **VALUES AND LIFE SKILLS**

1. The discrepancy in language usage between animals and trees, such as "kill" for animals and "destroy" for trees, reflects societal attitudes and perceptions towards different forms of life. Trees and other plants have been regarded more as objects or resources rather than living entities with intrinsic value. Therefore, the term "destroy" is used for trees, reflecting the perception of trees as commodities rather than living organisms. However, this linguistic distinction does not accurately reflect the ecological reality. Trees are indeed living organisms, vital for biodiversity, ecosystem stability, and human well-being. Recognizing trees as living beings deserving of protection and respect is essential for fostering sustainable coexistence with nature.

2. Social forestry, focusing on the management, protection, and afforestation of forests on public lands, offers numerous benefits. Firstly, it contributes to environmental conservation by enhancing forest cover, restoring degraded ecosystems, and mitigating climate change through carbon sequestration. Social forestry projects also provide livelihood opportunities for local communities through activities like tree planting, sustainable harvesting, and ecotourism, thereby promoting economic development and poverty alleviation. Additionally, afforestation efforts help to conserve soil, water, and biodiversity, improving the resilience of ecosystems to natural disasters and climate variability.

## CHAPTER 5

### MCQs

1. (c) The nervous and endocrine systems are interlinked.
2. (b) Metabolic rate declines
3. (a) Iodized salt
4. (c) Stunted growth and mental retardation
5. (d) Some teenagers develop diabetes.

### Fill in the blanks

1. feedback regulation
2. glucagon
3. thyroxine
4. Myxedema
5. anterior pituitary gland

### Match the endocrine glands with their location

(a) Pituitary            –            (v) Base of the brain

- (b) Thyroid – (i) On either side of the trachea  
(c) Pancreas – (iv) Behind the stomach  
(d) Adrenal – (ii) On the top of the kidneys

**State True or False and correct the false statements giving reasons**

1. True
2. False - Endocrine secretions typically have long-term effects, influencing processes such as growth, metabolism, and reproduction.
3. True
4. True
5. False - Glycogen is converted back to glucose with the help of glucagon, not insulin.

**Short answer type questions**

1. A gland is a specialized organ or tissue in the body that synthesizes and secretes substances such as hormones, enzymes, or saliva, either into the bloodstream (endocrine glands) or into ducts leading to body surfaces or cavities (exocrine glands).
2. "Fight or flight" is a physiological response triggered by perceived threats or stressors. It prepares the body for action by releasing hormones such as adrenaline and cortisol, increasing heart rate, dilating airways, and redirecting blood flow to essential organs, enabling individuals to either confront the threat or flee from it.
3. Hormone receptors are specialized proteins located on the surface of or within target cells that bind to specific hormones. Once bound, hormone-receptor complexes initiate cellular responses, triggering various biochemical reactions within the cell and ultimately influencing physiological processes.



4. Cretinism - In children the thyroid hormones promote growth and stimulate maturation of the central nervous system. Children with underactive thyroid glands are therefore stunted in their growth and suffer severe mental retardation, a condition called **cretinism**.

5. The function of Follicle-Stimulating Hormone (FSH) is to regulate reproductive processes in both males and females. In males, FSH stimulates the production of sperm in the testes. In females, FSH promotes the growth and development of ovarian follicles, which contain the maturing egg cells (oocytes) and stimulates the secretion of estrogen.

### Long answer type questions

1. Exocrine glands have the following characteristics:
  - a. These glands have ducts
  - b. They secrete enzymes, sweat, mucus, milk etc.
  - c. They are located near the site of the action.
  - d. Their secretions are usually in moderate to large quantities.
  - e. Secretions of exocrine glands influence daily or short term activities such as digestion, excretion etc.
  - f. Examples – mammary glands, salivary glands etc.

On the other hand endocrine glands have the following characteristics:

- (a) These glands do not have ducts.
  - (b) They secrete hormones.
  - (c) They can be near or far away from the actual site of function.
  - (d) The hormones are secreted in very small quantities.
  - (e) Endocrine secretions have long term influences; such as growth, reproduction ability etc.
  - (f) Examples – pituitary gland, thyroid gland etc.
2. Endocrine system comprises of various endocrine glands which secrete hormones. *The hormones are chemical substances secreted by endocrine glands in minute quantities (yet they are very important). The hormones are*

*poured directly into the blood stream and carried to different parts of the body, to act on target tissues.*

The different hormone levels in the blood are regulated by a '**negative feedback system**'. It works like a switch and comes into operation, when the original effect of the stimulus is reduced by the output. Negative feedback mechanism normalizes the things when they start becoming excessive.

Hormones produce their effects on target tissues by binding to specific proteins called **hormone receptors that** are located in the target cells only.

3. Thyroxine deficiency, also known as hypothyroidism, can lead to various adverse effects on the human body due to inadequate levels of thyroid hormones. Some of the effects of thyroxine deficiency include:

Thyroid deficiency is quite common in India .It can be easily prevented by taking iodine enriched common salt. Thyroid deficiency can cause:

(a) Simple Goitre – It is the enlargement of the thyroid gland which can appear as a huge growth on the neck. The most common cause of goitre worldwide is a lack of iodine in the diet. It can also be caused by a change in thyroid function.

(b) Cretinism - In children the thyroid hormones promote growth and stimulate maturation of the central nervous system. Children with underactive thyroid glands are therefore stunted in their growth and suffer severe mental retardation, a condition called **cretinism**.

(c) Myxoedema – It is a condition when adults suffer from severe thyroxine deficiency-**hypothyroidism**. The symptoms include thickened skin with fluid retention. This leads to puffiness, particularly in the face around the eyelids and in the hands, drowsiness, sensitivity to cold etc.

4. The endocrine functions of the pancreas are crucial for regulating blood sugar levels and maintaining metabolic homeostasis in the body. The pancreas contains clusters of cells called islets of Langerhans, which produce and secrete hormones involved in glucose metabolism, namely insulin and glucagon.

As the glucose level rises (after a meal) insulin is secreted which stimulates cells to take up glucose and the liver to store it as glycogen.

When the glucose level in the blood falls glucagon is released which stimulates the liver to convert the glycogen back to glucose.

5. During adolescence, individuals undergo significant emotional changes as they navigate the transition from childhood to adulthood. Some of the emotional changes that occur during adolescence include:

a. Increased mood swings: Adolescents may experience frequent fluctuations.

1. In many cases they are unable to understand the physical changes and this makes them self-conscious and anxious.
2. Because of the hormonal changes adolescents tend to have more intense emotions (than children or adults), which can be termed as 'mood swings'.
3. The social behavioural changes include : a desire for independence development of interest in the opposite sex a desire to spend more time with peer group.
4. They develop an increasing interest in their looks. This sometimes leads to self-conscious behaviour and low self-esteem.
5. Peer pressure and influence of social media: With more time spent with the peer group it begins to have an influence on likes and dislikes. It can influence ways of dressing, ways of social behaviour, use of language (slang) etc. Too much of interaction on electronic device based social media can make one self-centred. A conscious or sub-conscious comparison with others can affect self-esteem leading to anxiety.

### **Application based questions**

1. Simple goitre, also known as endemic goitre, usually happens due to iodine deficiency in the diet. To prevent simple goitre, individuals can ensure adequate intake of iodine-rich foods such as iodized salt, seafood, dairy products, and certain vegetables.

2. The pancreas is both an exocrine gland and an endocrine gland due to its dual functions in the body. As an exocrine gland, the pancreas secretes

digestive enzymes and bicarbonate ions into the digestive tract through ducts, aiding in the digestion and absorption of nutrients from food. These enzymes help break down carbohydrates, proteins, and fats in the digestive system. As an endocrine gland, the pancreas contains clusters of hormone-secreting cells called the islets of Langerhans, which produce and release hormones such as insulin and glucagon directly into the bloodstream. These hormones regulate blood sugar levels and play essential roles in glucose metabolism and energy homeostasis. Thus, the pancreas serves both exocrine and endocrine functions, contributing to both digestion and metabolic regulation in the body.

### **Multi-disciplinary questions**

1. Insulin cannot be taken orally because it is a protein hormone that would be broken down by the digestive enzymes in the gastrointestinal tract if ingested. Thyroxine (and the steroid hormones such as contraceptive pills), can be taken orally because they are nonpolar and can pass through the plasma membranes of intestinal epithelial cells without being digested.

2. Cognitive changes during adolescence include advancements in abstract thinking, problem-solving abilities, and reasoning skills. During adolescence brain development is also accelerated. Adolescents are able to think more about abstract concepts.

Because of the rapid growth of the brain tissue (neurons) they are able to practice more complex and sophisticated thinking. (The last to develop is the front part of the brain 'frontal cortex'. This area of the controls functions like planning and prioritizing.)

The mental capabilities that develop during adolescence are : Abstract thinking, reasoning skills, control of impulsive behaviour, problem solving and decision making skills.

### **VALUES AND LIFE SKILLS**

Certainly! One example of coordinated effort by multiple organizations for the betterment of society is seen in disaster response and relief efforts. When a natural disaster or humanitarian crisis occurs, various organizations, including

government agencies, non-governmental organizations (NGOs), international aid organizations, local community groups, and volunteers, come together to provide assistance and support to affected populations.

These organizations collaborate to assess needs, mobilize resources, coordinate logistics, and deliver aid to affected areas efficiently and effectively. They may provide emergency medical care, food, water, shelter, sanitation facilities, and other essential supplies to ensure the safety, health, and well-being of disaster survivors.

### **Image based questions**

1. The endocrine glands are:
  - Pituitary gland (1): Located at the base of the brain, behind the bridge of the nose. It has an anterior lobe and a posterior lobe.
  - Thyroid gland (2): Located in the front of the neck, wrapped around the trachea.
  - Adrenals (3): On the top of the kidneys.
  - Pancreas (4): Under the stomach.
2. Pituitary gland: Its important secretions are Growth hormones, Thyroid stimulating hormone (TSH), Adrenocorticotrophic hormone (ACTH), Follicle-stimulating hormone (FSH) etc.

## **CHAPTER 6**

### **MCQs**

1. (a) Meninges
2. (b) Outer part of cerebrum and inner part of spinal cord.
3. (a) To control all involuntary action in the body.
4. (d) Between the meninges

5. (a) Involuntary action

### Fill in the blanks

1. spinal cord
2. the brain and spinal cord
3. the autonomic nervous system
4. meninges
5. blushing

### State true or false and correct the false statements giving reasons

1. False- Synapse formation occurs between an axon terminal and either a dendrite or cell body of another neuron, not between two axons.
2. True
3. True
4. True
5. False- The left and right brain hemispheres are connected by a structure called the corpus callosum, not the pons.

### Short answer type questions

1. There is no mixing of impulses between nerve cells because each neuron communicates with another neuron through a synapse, where neurotransmitters are released to transmit signals across the synaptic gap. Further a **nerve** consists of a bundles of axons neurons enclosed in a tubular medullary sheath. Each axon is separated from the other, hence there is no mixing of the impulses.

2. A synapse is a specialized junction between neurons where communication occurs. A neuron is never physically connected with another neuron. There is a small gap between the two. This gap is known as **synaptic cleft**. The neural

impulse from axon of one neuron to dendrites of another neuron happens through chemical substances called **neurotransmitters**. The movement of impulses is unidirectional.

3. **Medulla oblongata** is the lowest part of the brain. It controls the involuntary primary life functions such as breathing, heart rate, digestion etc. that is why any injury to the medulla, can be fatal. Medulla oblongata continues further down into the spinal cord. It connects the cerebrum and cerebellum to the spinal cord.

4. **Somatic nervous system** - This system guides the voluntary movements. The nerves can be from the brain ( 12 pairs of cranial nerves) and are sensory or motor nerves going to the eyes, ears etc. these can also be nerves from the spinal cord ( 31 pairs of spinal nerves) which are of mixed type that goes to organs such as the skin.

5. The **enteric nervous system** is an extensive, web of neurons that is capable of functioning independently of rest of the nervous system. It contains over 100 million neurons and is primarily responsible for the regulation of the digestive processes.

### **Long answer type questions**

1. A neuron cell is made up of two main parts:

- (a) An elongated cell body called **cyton**. It contains cytoplasm, a nucleus and many elongated hair like extension called **dendrites**. The dendrites receive signals from axon terminals of other nerve cells through synapse.

Dendrites are cytoplasmic extensions that contain the important cell organelles. These are the impulse receiving part of the neuron. It receives **synaptic** inputs from axons of other neurons with the help of chemicals called neurotransmitters.

- (b) **Axon** – It is the thin elongated structure extending up to a metre from the cyton. It is the conducting unit of a neuron. It conducts nerve impulse away from the cell body. The axon is covered by a **protective, fatty, insulating** layer called **myelin sheath**. An individual nerve cell may be up to a metre long. Many nerve fibres bound by connective tissue make up a **nerve**.

The end away from cyton (distal end) is branched as **axon terminals** that forms a connection with the dendrite of the next neuron by forming a **synapse**.

**Glia or neuroglia** - The Glia are non-neuron cells. They perform many important functions that keep the nervous system working properly, such as :

- (a) Help in supporting and holding neurons in place.
- (b) Protect neurons, by creating insulation called **myelin**, which helps move nerve impulses.
- (c) Repair neurons and help restore neuron function.
- (d) They trim the dead neurons
- (e) Regulate neurotransmitters

2. The brain is exceptionally well protected by several layers of defense mechanisms and anatomical structures that safeguard its delicate tissues and functions:

- (a) The human brain is encased in a bony structure the skull (or the cranium), and three layers tough membranes called meninges.
- (b) The spaces between the meninges are filled with cerebrospinal fluid that acts as a cushion for the brain .
- (c) There is a blood-brain barrier. This barrier is made up of tightly bound cells that function as semi-permeable entrance. It keeps the brain (and the spinal cord) safe from pathogens, toxins and harmful substances that may be present in the blood. It however, allows entry to oxygen and vital nutrients.
- (d) The blood-spinal cord barrier (BSCB) is the functional equivalent of the blood-brain barrier in the spinal cord.



3. Neurons are considered the functional units of the nervous system due to their unique structure and specialized functions in transmitting and processing information. **Nervous Tissue form a basic units of the nervous system.**

The human nervous system is made up of billions of **neurons** or nerve cell and **glia** cells.

Neurons are the fundamental units of the brain and the nervous system.

Glia cells have various supportive functions.

(a) Neurons are capable of converting various forms of stimuli into electrical impulses.

(b) They can receive, conduct and transmit information in the form of electrical signals along its length and by neurotransmitters from one neuron to another.

(c) Over 100 types of neurotransmitters are used in the brain.

(d) Neurons collect information from sense organs or from other neurons, carry the information to the **central nervous system** (brain and spinal cord), and bring **motor information** from the central nervous system to the motor organs (muscles and glands) for taking appropriate action.

4. Reflex action- It is an involuntary action in response to a stimulus. This is a spontaneous action without any thought.

Reflex action is the result of the coordination of the spinal cord and peripheral nervous system. This action does not involve the brain. The pathway in which impulses travel during the reflex action is called a **reflex arc**.

#### **Steps in the Reflex Action:**

1. **Stimulus** detected by the **receptors** in the finger.

2. The **impulse** is carried by sensory neurons to the spinal cord.

3. At the spinal cord the impulse passes from sensory neuron to interneuron and is converted to a motor instruction; and it passes to motor neurons.

4. The motor **response** is passed on to the **effector** muscle for suitable action. In this case removal of the finger.

5. The human brain consists of several major parts, each with distinct functions that contribute to overall cognition, behavior, and bodily functions:

(a) **Cerebrum**: The cerebrum is the largest part of the brain. It accounts for about 85% of the brain's weight.

It has a characteristic deeply wrinkled outer surface with numerous ridges and furrows. The cerebrum is the seat of intelligence and will power; it controls functions such as : memory, thought, reasoning, planning and the voluntary actions.

The cerebrum is divided by a longitudinal fissure into left hemisphere (LH) and right hemisphere (RH) . These two hemispheres are connected by a thick band of nerve fibres called the corpus callosum ensuring smooth transfer of information. The outer part of the cerebrum is called **cortex** and the inner part is called **medulla**. The cortex part contains neural cell bodies that appears grey (hence called **grey matter**). The inner medulla contains the nerve fibres and appears white (hence called **white matter**).

(b) **Cerebellum** - second-largest part of the brain is the cerebellum. It is located under the back of the cerebrum. The cerebellum has two hemispheres that are joined by **pons**.

Cerebellum plays an important role in coordinating muscular movement, posture, and balance of the body. Cerebellum is quickly affected by alcohol that is why an intoxicated person finds it difficult to maintain body balance.

(c) **Medulla oblongata** –It is the lowest part of the brain. It controls the involuntary primary life functions such as breathing, heart rate, digestion etc. that is why any injury to the medulla, can be fatal. Medulla oblongata continues further down into the spinal cord. It connects the cerebrum and cerebellum to the spinal cord.

### **Experiential learning question**

1. The various tests that doctors use to check the health of the nervous system include fluoroscopy, EEG (electroencephalogram), MRI (magnetic resonance imaging), and CAT scan (computerized axial tomography).

2. (d) Sensory neurons send signals to get muscles and glands working.

### **Application based questions**

1. The sympathetic and parasympathetic nervous systems are two branches of the autonomic nervous system that often act in opposition to regulate physiological processes and maintain homeostasis in the body.

a. Sympathetic Nervous System: The sympathetic nervous system is responsible for the body's "fight or flight" response, which prepares the body for action in response to stress or danger. It increases heart rate, dilates airways, and redirects blood flow to muscles, enabling a rapid response to perceived threats.

b. Parasympathetic Nervous System: In contrast, the parasympathetic nervous system promotes a "rest and digest" response, which conserves energy and promotes relaxation. It slows heart rate, constricts airways, and stimulates digestion and other non-emergency functions, allowing the body to rest and recover.

While these two systems often act in opposition to each other to maintain balance, they also work together to regulate various bodily functions. For example, during a stressful situation, the sympathetic nervous system activates to mobilize resources for action, while the parasympathetic nervous system eventually kicks in to restore calm and balance once the threat has passed.

2. Habituation is a psychological phenomenon where repeated exposure to a stimulus leads to a decreased response over time. In the context of wearing clothes, habituation occurs because the sensory receptors in the skin become less sensitive to the stimulus of the clothing as they are continuously stimulated.

### **VALUES AND LIFE SKILLS**

Certainly! One example from my own experience that illustrates the concept of learned response and conditioned reflex is learning to drive a car. When I first

started learning to drive, I found it challenging to coordinate the pedals, steering wheel, and gear shift while simultaneously paying attention to traffic, road signs, and other vehicles. It felt overwhelming, and I often made mistakes or felt anxious behind the wheel.

However, over time and with practice, I began to develop a learned response to driving. Through repetition and experience, I became more familiar with the controls of the car and learned to anticipate and react to different driving situations. Eventually, tasks such as shifting gears, parallel parking, and navigating busy intersections became more automatic and effortless.

### **Image based questions**

For the first image:

(a) The parts in the image are:

1. Cerebrum
2. Cerebellum
3. Medulla Oblongata

The part that is quickly affected by alcohol intake is cerebellum.

(b) The functions of cerebrum are:- memory, thought, reasoning, planning and the voluntary actions.

(c) The part (2), extends to become the spinal cord.

(d) Meninges are found surrounding the brain and spinal cord.

For the second image:

(a) In the image of reflex action, the type of nerves are:

1. Sensory nerve - carries impulses from the receptor to the central nervous system
2. Integration center - processes the sensory information and initiates a response
3. Motor nerve - carries impulses from the central nervous system to the effector

(b) The function of nerve (2), the integration center, is to process the sensory information and coordinate the response.

(c) Reflex action is a faster response because it bypasses the brain hence the need for conscious thought and decision-making, allowing for a more rapid response to potentially harmful stimuli.

## CHAPTER 7

### MCQs

1. (d) Interatrial septum and Interventricular septum
2. (a) Ventricles are more muscular
3. (a) Left auricle
4. (d) Electrocardiograph
5. (b) It protects the body against infections.

### Fill in the blanks

1. pericardium
2. muscular contractions
3. electrical impulses from the sinoatrial (SA) node
4. (Antibody B)
5. emotional stress

### Match the biological facts with their correct reasons

- (a) Thick walls in ventricles iv. Pump blood to artery
- (b) A universal blood recipient vi. No antibodies in plasma
- (c) Presence of tricuspid valve i. Prevent back flow in the right ventricle

(d) Oxygenated blood from the lungs vii. Pumped from right auricle to right ventricle

(e) Pulmonary circuit ii. Pulmonary vein and artery

### **State True or False and correct the false statements giving reasons**

1. False. The heartbeat in the human heart is triggered by the sinoatrial (SA) node, not the mitral valve. The SA node is often referred to as the heart's natural pacemaker.
2. False. People having blood group AB are universal recipients, not universal donors. Universal donors are individuals with blood type O-negative because their blood lacks A, B, and Rh antigens, making it compatible with all blood types.
3. True. The pulmonary vein carries oxygenated blood from the lungs to the heart, specifically to the left atrium.
4. False. Blood moves in veins from thin blood vessels (capillaries) to thick blood vessels (veins).
5. True.

### **Short answer type questions**

1. The three types of blood vessels in humans are arteries, veins, and capillaries.
2. Pericardial fluid is found in the pericardial cavity, which surrounds the heart. It acts as a lubricant, reducing friction between the layers of the pericardium during heartbeats and movements, thereby preventing damage to the heart.
3. The function of valves in the veins is to prevent the backflow of blood. They ensure that blood flows in one direction toward the heart.
4. Two differences between arteries and veins are:
  - Arteries carry oxygenated blood away from the heart, while veins carry deoxygenated blood back to the heart.
  - Arteries have thicker, more muscular walls to withstand high blood pressure, while veins have thinner walls and contain valves to aid in blood flow back to the heart.

5. Tissue fluid, also known as interstitial fluid, bathes the cells in tissues, providing them with nutrients, oxygen, and removing waste products. It facilitates the exchange of substances between blood capillaries and cells, ensuring proper cellular function and maintaining tissue health.

### **Long answer type questions**

1. The mechanism in which blood circulates twice through the heart in one complete cycle is known as double circulation. Systemic circulation and pulmonary circulation are two pathways in which the blood flows in double circulation.

**(a) Pulmonary circuit**-The two largest veins in the body, the superior vena cava and the inferior vena cava, deliver oxygen depleted blood from the systemic circulation to the right atrium. From the right atrium, blood passes into the right ventricle via the tricuspid valve. From the right ventricle the blood reaches the lungs through the pulmonary arteries. Here the blood is oxygenated and it drops its carbon dioxide. The pulmonary veins carry oxygen-rich blood from the lungs to the left atrium of the heart, completing the pulmonary circuit.

**(b) Systemic circuit** -From the left atrium the blood then flows into the left ventricle through the bicuspid valve. The left ventricle is the most powerful heart chamber. The force of contraction of the left ventricle sends blood into the aorta, the largest artery in the body. The blood then circulates throughout the body before returning to the veins that deliver blood to the right side of the heart. This completes the systemic circuit.

2. The movement of blood on the right side of the heart involves the flow of deoxygenated blood from the body to the lungs for oxygenation.

a. Deoxygenated blood returns to the heart via the superior and inferior vena cavae, entering the right atrium.

b. When the right atrium contracts, the tricuspid valve opens, allowing blood to flow into the right ventricle.

c. The right ventricle then contracts, forcing the blood through the pulmonary valve into the pulmonary artery.

d The pulmonary artery carries the deoxygenated blood to the lungs, where it undergoes gas exchange, with carbon dioxide being released and oxygen being absorbed.

3. The ABO blood grouping system is determined by the presence or absence of specific antigens on the surface of red blood cells (RBCs) and antibodies in the plasma.

The four main blood groups defined by the **ABO system** are:

**Blood group A** – has A antigens on RBC and anti-B antibodies in the plasma. **(Donor for A and AB)**

**Blood group B** – has B antigens on RBC and anti-A antibodies in the plasma. **(Donor for B and AB)**

**Blood group O** – has no antigens on RBC however, both anti-A and anti-B antibodies are present in plasma. **(Donor for A, B, AB and O)**

**Blood group AB** – has both A and B antigens on RBC, but no antibodies in the plasma. **(Donor for AB)**

Receiving blood transfusion from the wrong ABO group can be life-threatening.

4. The lymphatic system is called a parallel circulatory system because it runs parallel to the blood circulatory system, providing an additional route for fluid and waste transport throughout the body. The human cardiovascular system is a closed system because all of its vessels are connected with one another. However, some plasma and solutes in the blood plasma do filter through the walls of the capillaries to form the **interstitial (tissue) fluid**. The filtration happens because of the pressure of blood in the capillaries.

The tissue fluid enters the lymph capillaries and forms the **lymph** a straw coloured liquid. The cells of the lymph capillaries are not connected as tightly together as those of blood capillaries. Hence the lymph capillaries often admit bacteria, viruses, and other large particles. These capillaries converge into larger lymph vessels that eventually empty into veins. Thus the fluid returns to the blood through veins near the neck. This is why the lymphatic system is called the **parallel circulatory system**.



## Application based questions

1. CPR stands for cardiopulmonary resuscitation. It is an emergency life-saving procedure performed on individuals who are in cardiac arrest or experiencing a sudden loss of heartbeat and breathing. CPR involves chest compressions to manually pump blood through the heart and artificial ventilation to supply oxygen to the lungs, thereby maintaining circulation and oxygenation until advanced medical help arrives.

2. Regular exercise improves cardiac output by strengthening the heart muscle and enhancing its efficiency. During exercise, the heart pumps blood more vigorously, leading to increased cardiac output. Over time, regular physical activity improves the heart's ability to pump blood with each beat (stroke volume) and increases the heart rate variability, allowing it to adapt more efficiently to changing demands.

## Multi-disciplinary questions

1. We must remember that **blood is always red**, whether hemoglobin is oxygenated or not.

*Veins appear bluish because blue light does not penetrate human tissue as much as red light. Hence veins that are close to the surface of the skin reflect more of the blue light to the eye. If arteries were closer to the skin, they would also appear blue just like the veins.*

**The blue colour usually given to veins in diagrams - is just a way to differentiate between veins and arteries.**

2. Donating plasma and whole blood are two different processes with distinct purposes.

People often need plasma transfusions in serious medical situations. Typically, plasma transfusions are used to stop or prevent bleeding due to blood clotting problems. A plasma transfusion can also help increase blood volume and prevent shock.

Donating whole blood involves giving a standard blood donation, where a pint of whole blood is collected from the donor's arm. Whole blood donation is used for transfusions to replace blood lost due to surgery, trauma, or medical conditions.

In both plasma and whole blood transfusion ABO grouping should be done.

## **VALUES AND LIFE SKILLS**

The comparison of blood flow in arteries to the movement of water from a water tank to our house, and blood flow in veins to the movement of waste water from our homes to the sewage processing plant, illustrates the directional flow and purpose of each circulatory pathway.

Arteries start as thick vessels and gradually become thin ending in capillaries.

Our water supply system also begin with thick pipes and till they reach our homes they become narrow.

Veins in our body begin as capillaries and gradually become thick.

Our sewage systems similarly begin at our homes as narrow pipes and gradually they open into pipes of larger diameter.

## **Image based questions**

For the first image:

1. The vessels marked 1 are the coronary arteries.
2. Their function is to supply oxygenated blood to the heart muscle itself.
3. Blockages or narrowing of these arteries can lead to heart disease by restricting blood flow and oxygen supply to the heart muscle, potentially causing a heart attack.

For the second image:

1. The valve marked 1 is semi-lunar valve.
2. The valves marked 2 and 3 are the tricuspid valve and mitrial valve.

3. The wall marked 4 is thick because it is the muscular wall of the left ventricle, which needs to be strong to pump blood out to the entire body.
4. The structure marked 5 is superior vena cava.

## CHAPTER 8

### MCQs

1. (d) Disease caused by microbes
2. (c) Drying all puddles of water
3. (a) Tetanus
4. (a) Consumption of tobacco
5. (b) Producing antibody in the body

### Fill in the blanks

1. fractures or sprains
2. outer layer of the skin (epidermis)
3. specific pathogens or diseases
4. liver cirrhosis
5. viruses

### Match the two columns

- (a) Human Immunodeficiency Virus causes iv. AIDS
- (b) Plasmodium causes v. Malaria
- (c) A symptom of Dengue vi. Low platelet count
- (d) Vector for spreading Chikungunya ii. Aedes mosquito
- (e) A disease prevented by vaccine i. Measles

### State True or False and correct the false statements giving reasons

1. False. Dengue is a vector-borne disease transmitted by the Aedes mosquito, whereas measles is an airborne disease caused by the measles virus.
2. False. Herd immunity typically requires a higher percentage of the population to have immunity, often around 70-90%, depending on the contagiousness of the disease, to effectively prevent its spread.
3. True.
4. True.
5. False. Vaccines do not cause disease; instead, they stimulate the immune system to produce an immune response against specific pathogens, thereby providing protection against future infections.

### Short answer type questions

1. A communicable disease is an illness caused by an infectious agent or pathogen that can be transmitted from a sick person to a healthy person, directly or indirectly, through various means such as airborne droplets, physical contact, or contaminated objects.
2. Antigens are substances that trigger the immune system to produce an immune response, while antibodies are proteins produced by the immune system in response to the presence of antigens. Immunity is obtained by vaccination. It is done by stimulating the production of **antibodies** by introducing harmless version of the pathogen (**antigen**). Antibodies are proteins made by lymphocytes (a type of WBC) in our body to fight disease. This can also help stimulate other parts of our immune defences, such as T cells (a type of WBC).
3. Hygiene refers to practices and behaviors that promote cleanliness and health, including personal hygiene (such as regular bathing, handwashing, and oral care), environmental hygiene (keeping living spaces clean and sanitary),

and food hygiene (ensuring the safety and cleanliness of food preparation and storage).

4. Wearing a mask can prevent the spread of diseases, particularly respiratory infections, by acting as a barrier that blocks respiratory droplets containing infectious agents from entering the air and being inhaled by others. Masks also help prevent individuals from touching their faces, reducing the risk of transferring pathogens from contaminated surfaces to mucous membranes.

5. The first aid for superficial bleeding involves applying direct pressure to the wound using a clean cloth or bandage to control bleeding, elevating the injured area if possible to reduce blood flow, and cleaning the wound with mild soap and water to prevent infection.

### **Long Answer type questions**

#### **Modes of spread of communicable diseases**

1. Consuming contaminated food and water – The food we eat can be contaminated if it is handled by dirty hands or is left uncovered. The common germ spreading agents are houseflies, cockroaches and rats. These organisms sit on dirty garbage, dung, faecal matter etc. and carry the germs on their body parts and contaminate uncovered food items. Drinking water can easily get contaminated if it mixes with untreated sewage. Diseases like jaundice, cholera, diarrhoea spread through contaminated food and water.

2. Direct contact – Many diseases spread through physical contact. In many cases the articles used by the sick person also can spread the disease. Diseases like scabies, ringworm and other fungal disease, conjunctivitis, influenza etc. spread by direct contact.

3. Infection from airborne, droplets and surface contamination –

Pathogens of various disease are airborne as in the case of tuberculosis, measles etc. Airborne infections travel longer distances. Naturally produced droplets such as those produced by breathing, talking, sneezing and coughing also carry infectious agents like bacteria, fungi and viruses. When other people breathe these droplets they also get infected. Droplet infections travel up to 2 m.

When these droplets fall on surfaces such as table tops the surfaces also get contaminated and can infect others. The pandemic of Covid-19, has a history of spreading by this process. Other diseases like common cold, influenza and pneumonia, tuberculosis etc. are known to spread by this process.

4. Disease spread by other organisms or Vectors – Transmission of disease may be facilitated by a vector mechanically or biologically.

Mechanical vectors carry the infectious agent on the outside of its body and transmits it causing infection. For example a housefly which sits on rotting organic matter contaminates itself with bacteria and transmits the bacteria to food before it is eaten. In this case the pathogen never enters the body of the fly.

Biological Vectors on the other hand allow the pathogen to harbour in the body and then infect a person. Biological vectors are responsible for serious diseases such as malaria, dengue etc. Biological vectors include mosquitoes, ticks, fleas etc. They are often a part of the life cycle of the pathogen.

2. The statement "vaccines are dangerous because they contain germs" is a misconception that is not supported by scientific evidence. In fact, vaccines are one of the most effective and safest tools available for preventing infectious diseases. Here's why the assertion is untrue:

**1. Vaccines Do Not Contain Live Pathogens in Most Cases:**

- Modern vaccines typically do not contain live, replicating pathogens. Instead, they contain either weakened (attenuated) or killed (inactivated) forms of the pathogen, or specific proteins or genetic material from the pathogen.

**2. Vaccines Are Purified and Highly Regulated:**

- Vaccines undergo rigorous testing and purification processes to ensure they are safe and effective before they are approved for use.

Vaccines are one of the most useful category of medicine . This is because they prevent disease rather than treat it. This is done by stimulating a person’s immune system to take note of a specific disease-causing pathogen.

Dangerous diseases like small pox and polio have been nearly eradicated because of widespread use of vaccines.

3. Vector control is a crucial component of public health strategies aimed at preventing the spread of diseases transmitted by vectors such as mosquitoes, ticks, fleas, and flies. Implementing effective vector control measures can significantly reduce the incidence of vector-borne diseases.

Vector control of mosquitoes is one of the most important approach to prevent malaria and reduce transmission .

Keeping the neighbourhood clean of garbage and stagnant water are important measures in vector control of various disease carrying insects.

Keeping cut fruits and other food items covered prevents disease transmission by flies.

Use of bleaching powder, phenyle ect. prevent breeding of insects.

#### 4.

Immunity refers to the body's ability to resist or defend against harmful pathogens, such as bacteria, viruses, fungi, and parasites, as well as foreign substances, like toxins and allergens. We can attain immunity by vaccination in a planned way.

When we get immunized, the **body is tricked into thinking that it has been infected** with the disease. It makes antibodies that kill the germs.

(a) These antibodies stay in the body for a long time and remember to fight the germ.

(b) At birth we get antibodies from the mother, which protects us from certain disease this is ***inherited immunity*** and lasts for few months. c)After birth through immunisation we acquire protection against many more diseases, this is called ***acquired immunity*** the effects of which can last from few months to a lifetime.

5. All forms of tobacco are 100%, harmful. Apart from cigarette smoking, other forms of tobacco use are water-pipe tobacco, smokeless tobacco products, chewing tobacco bidis and gutka.

(a) According to WHO, tobacco kills more than 8 million people each year. More than 7 million of those deaths are the result of direct tobacco use while around 1.2 million are the result of second-hand smoke.

(2) There is no safe level of tobacco use. The main chemical in tobacco is nicotine, it is very addictive and leads to decreased appetite, increased heart rate and blood pressure. The other chemical wood tar is toxic to the tissues and is carcinogenic.

(3) Studies show that smoking increases the risk of coronary heart disease by 2 to 4 times and developing lung cancer by 25 times.

(4) Smoking damages blood vessels, make them thick and narrow leading high blood pressure.

(5) Smoking causes lung disease by damaging the airways and the alveoli. Smokers suffer from emphysema and chronic bronchitis and prone to lung infections.

(6) Tobacco consumption can cause cancer in almost any part of the body such as lungs, larynx, kidney, blood, liver, cervix etc. In India chewing tobacco is a major cause of cancer in the mouth and throat.

### Multi-disciplinary questions

1. Proper sewage disposal prevents the spread of diseases by removing human waste and contaminated water from living environments, reducing the risk of exposure to disease-causing pathogens. Effective sewage systems prevent the contamination of water sources, soil, and air with fecal matter, which can harbor bacteria, viruses, and parasites responsible for diseases like cholera, typhoid fever, and gastrointestinal infections. By safely disposing of sewage, the transmission of these pathogens to humans and animals is minimized, thereby reducing the incidence of waterborne and fecal-oral diseases.
2. The application of the bacteria Wolbachia in disease control involves its use to combat mosquito-borne diseases such as dengue, Zika, and chikungunya. Wolbachia is a naturally occurring bacterium that can be introduced into mosquito populations to reduce their ability to transmit viruses. It has been found that Wolbachia blocks viruses of dengue, chikungunya and Zika from growing in the bodies of Aedes mosquitoes. This means that Wolbachia mosquitoes have a reduced ability to transmit viruses to people.
3. The different types of vaccines include:
  - (a) (i) Whole virus vaccine – Many conventional vaccines like the measles-mumps-rubella (**MMR**) vaccine use a weakened form of the virus that can still replicate but do not cause disease.
  - (ii) Inactivated vaccines such as hepatitis A use viruses whose genetic material has been destroyed so they cannot replicate.
  - (iii) The Salk vaccine for polio is inactivated (killed) polio vaccine (IPV) ; whereas the Sabin vaccine is a live attenuated (weakened) oral polio vaccine (OPV) .
- (b) **Nucleic acid vaccines-** They use genetic material – either DNA or a type of RNA – to provide cells with the instructions to make the antigen. Some of the new COVID-19 vaccines use messenger RNA technology.



- (c) **Viral vector vaccines** – They also contain genetic material that give our cells instructions to produce antigens. They use a harmless virus as the ‘vector’ or carrier – which is different from the one the vaccine is targeting. Example – Ebola vaccine.
- (d) **Toxoid vaccines** - These vaccines, such as the tetanus vaccine, use controlled amounts of a toxin made by the germ. They create immunity to the **disease-causing parts of the germ**. Thus the immune response is targeted to the toxin instead of the whole germ.

## VALUES AND LIFE SKILLS

Achieving cleanliness in the environment requires collective efforts from all members of the community. Here are some ways we can accomplish this effectively:

1. **Promoting Education and Awareness**: Conduct educational campaigns to raise awareness about the importance of cleanliness and its impact on health. Provide information about proper waste disposal, sanitation practices, and environmental conservation.
2. **Organizing Community Clean-Up Drives**: Coordinate regular clean-up drives where community members come together to remove litter and debris from public spaces such as parks, streets, and beaches. These events foster a sense of civic pride and ownership in maintaining a clean environment.
3. **Enforcing Environmental Regulations**: Enforce existing laws and regulations related to environmental protection and cleanliness. Implement penalties for littering, illegal dumping, and other environmental offenses to deter irresponsible behavior.
4. **Creating Green Spaces**: Develop and maintain green spaces within the community, such as parks and gardens, that provide opportunities for recreation and relaxation while promoting environmental stewardship.

### **Image based questions**

1. Drying out standing water puddles can help prevent mosquito breeding grounds, reducing the risk of mosquito-borne diseases like malaria or dengue fever.
2. Patients with certain contagious diseases may need to be isolated to prevent the spread of the disease to others through airborne transmission or direct contact.
3. Crowds of people in a small area or a confined space, as depicted by the droplet diagram, can be dangerous because it increases the chances of airborne transmission and infection for those nearby through coughing, sneezing or even breathing out viral particles. Maintaining proper distance is important to reduce exposure risks in such situations.

## **CHAPTER 9**

### **MCQs**

1. (d) Carbon dioxide
2. (a) Paddy
3. (a) Crop rotation
4. (d) Nectar
5. (a) In the roots of legumes

### **Fill in the blanks**

1. yeast
2. fermentation
3. watermelon
4. cotton

5. green house gases

### Match the two columns

- (a) Floriculture - v. Large scale cultivation of flowers
- (b) Broiler - ii. Chicken reared for meat
- (c) White revolution - vii. Increased production of milk
- (d) Organic farming - iii. Does not use any chemical inputs
- (e) Tassar - vi. A variety of silk

### State True or False and correct the false statements giving reasons

1. True.
2. False. Rabi crops are typically mature in winter hence a good rain causes damage to the crop.
3. False. Milk-giving animals are typically referred to as dairy animals.
4. False. Mugga is not a variety of silk.
5. False. Most microorganisms cannot easily grow in honey due to its low water content and high sugar content.

### Short answer type questions

1. Three uses of bacteria in the food industry include:

#### In the dairy industry

**Curd** – It is formed by the action of *Lactobacillus* bacteria on the sugar (lactose) present in the milk, converting it to lactic acid. A small amount of curd is put in warm milk as starter culture and in about five hours the milk converts to curd.

**Cheese** – Here too *Lactobacillus* bacteria plays a key role in its production. It begins with the a starter culture and as it grows, the sugar in the milk is converted to lactic acid. An enzyme (rennet) is added and the whey is

removed. The product is kept for ripening at a suitable temperature and humidity.

### **In health food industry**

*Lactobacillus* bacteria packaged as tablets or granules is used as medicine or as supplements in the health food industry.

2. Lactobacillus granules are beneficial as medicine due to their probiotic properties. They contain live beneficial bacteria that can improve gut health by restoring the balance of gut microflora, aiding in digestion, and improve our well being.

3. Organic farming is considered eco-friendly because it promotes sustainable agricultural practices that minimize environmental impact. It avoids the use of synthetic pesticides and fertilizers, and promotes biodiversity by maintaining natural habitats.

4. The benefits of pisciculture (fish farming) include:

a. Sustainable protein production: Fish farming provides a reliable source of high-quality protein, reducing pressure on wild fish populations and helping meet global food demand.

b. Economic opportunities: Pisciculture creates employment opportunities in rural areas and contributes to economic development, especially in regions with limited access to other forms of employment.

c. Environmental benefits: Well-managed fish farms can help improve water quality by acting as biofilters, removing excess nutrients from the water. Additionally, they can promote habitat restoration and conservation efforts in aquatic ecosystems.

5. An important aspect of fish farming is keeping the quality of water in the pond healthy and slightly alkaline. It involves;

(a) Aeration of water for adequate oxygen content

(b) Removal of weeds, and predatory

(c) Keeping the water slightly alkaline to prevent growth of microbes.

### Long answer type questions

1. Fungi are eukaryotic organisms, hence they have a well-defined nucleus. Common examples are yeast, mushrooms, toadstools . They play a very important role in the food industry.

1. *Agaricus bisporous* is the most common edible mushroom eaten practically all over the world.
2. Baker's yeast is used to make bread and other flour based products. Yeast is also used in the making of alcoholic beverages by the process of fermentation.
3. Yeast contains B vitamins such as B1 (thiamine), B2 (riboflavin), B3 (niacin), B5 (pantothenic acid), B6 (pyridoxine), folic acid and biotin.
4. **Nutritional yeast** is similar to the yeast used in baking but it is dried hence becomes inactive. It can be used as a supplement for people with "food allergies or those on restricted diets.

2. In India, the green revolution was very successful and from a food-deficient economy India became one of the world's leading agricultural nations. It was particularly successful in the states of Punjab, Haryana and Uttar Pradesh.

It is important to note that between 1952 and 2010, production of food grains in India became four times. However, there was only 25% increase in cultivable area.

a. Increased agricultural productivity: The introduction of high-yielding crop varieties, combined with modern agricultural practices and technologies such as irrigation and fertilization, led to substantial increases in crop yields.

b. Economic development: Higher agricultural productivity spurred economic growth in rural areas by generating employment opportunities, increasing farm incomes, and stimulating rural economies.

3. Mariculture refers to the cultivation of marine organisms in controlled aquatic environments such as oceans, seas, or coastal waters. It involves the farming of various marine species including fish, shellfish, algae, and other aquatic plants for commercial purposes. Mariculture practices may take place in offshore cages, ponds, tanks, or other artificial structures designed to mimic natural marine habitats.

The primary objective of mariculture is to produce seafood for human consumption, meeting the growing demand for fish and other marine products while alleviating pressure on wild fish stocks. Mariculture also provides economic opportunities for coastal communities and contributes to global food security.

4. The success of the Green Revolution can be attributed to several key factors:

The main factors that led to the increased productivity were:

- (a) Use of high yield variety (HYV) of seeds developed by scientific plant breeding.
- (b) By optimising fertiliser use.
- (c) Improving irrigation facilities.
- (d) Protecting plants from pests by using pesticides.
- (e) Control of plant disease by using disease resistant seeds.
- (f) Use of mechanised farm machinery

5. The White Revolution, also known as the Operation Flood, was a dairy development program implemented in India in the 1970s, aimed at transforming the country's dairy industry and improving milk production and distribution. The benefits of the White Revolution to society include:

The benefits of operation flood were manifold:

- (a) Increases milk production at a fast pace.
- (b) Additional the income of rural folk

(c) Provides milk to millions of consumers regularly at fair prices. This was made possible by forming the national grid of over 700 towns and cities on India.

(d) It reduced price variations. It also ensured that the producers, that is the farmers get a major share of the price that customer pays.

Overall, the White Revolution had profound socio-economic impacts, including increased milk production, rural development, employment generation, improved nutrition, and enhanced dairy infrastructure, making it a transformative initiative for Indian society.

### **Application based questions**

1. How is yoghurt made?

Make yoghurt at home and answer.

2. Mixed farming gives the farmer sustained income. How?

Mixed farming involves the cultivation of different crops and the rearing of livestock on the same farm. This practice offers several advantages that contribute to sustained income for farmers:

**Diversification of income sources:** By engaging in both crop cultivation and livestock rearing, farmers can diversify their income sources. This reduces dependence on a single commodity or market, thus mitigating risks associated with fluctuations in crop prices or livestock markets.

**Utilization of resources:** Mixed farming allows farmers to optimize the use of available resources such as land, water, and labor. For example, crop residues can be used as feed for livestock, and animal manure can be utilized as organic fertilizer for crops, resulting in efficient resource utilization and cost savings.

### **Multi-disciplinary questions**

1. **Why are manure and fertilizers used in fields?** Manure and fertilizers are used in fields to improve soil fertility and provide essential nutrients

to crops, thereby enhancing their growth and productivity. Manure, which consists of organic matter derived from animal dung, plant residues, or compost, serves as a natural soil conditioner and nutrient source. It enriches the soil with organic carbon, nitrogen, phosphorus, and other micronutrients, promoting soil structure, water retention, and microbial activity. On the other hand, fertilizers are synthetic or mineral-based substances containing concentrated nutrients such as nitrogen (N), phosphorus (P), and potassium (K), which are essential for plant growth. They provide readily available nutrients to plants.

## 2. What are the advantages of intercropping and crop rotation?

- **Intercropping:** Inter cropping involves cultivating two or more crops simultaneously in the same field. The advantages include:
  - **Efficient resource utilization:** Different crops have varying nutrient requirements and growth patterns. Intercropping optimizes resource utilization by utilizing sunlight, water, and soil nutrients more efficiently, resulting in higher overall productivity.
  - **Soil health improvement:** Intercropping enhances soil fertility and structure by increasing organic matter, nitrogen fixation, and microbial diversity. Leguminous intercrops, for example, fix atmospheric nitrogen, enriching the soil for subsequent crops.
- **Crop rotation:** Crop rotation involves alternating the cultivation of different crops in sequential seasons or years on the same piece of land. The advantages include:
  - **Nutrient cycling and soil fertility:** Crop rotation helps maintain soil fertility and balance by varying nutrient demands and replenishing soil nutrients. Different crops have different nutrient uptake patterns, reducing nutrient depletion and enhancing nutrient cycling.

## 3. What is genetic manipulation? How is it useful in agricultural practices?

Genetic manipulation, also known as genetic engineering or biotechnology, involves modifying the genetic material.



- **Pest and disease resistance:** GM crops can be engineered to express toxins or proteins that repel pests or inhibit the growth of pathogens, reducing the need for chemical pesticides and minimizing crop losses due to pests and diseases.
- **Herbicide tolerance:** GM crops can be designed to tolerate specific herbicides, allowing selective weed control without harming the crop. This enables farmers to effectively manage weeds and reduce weed competition, improving crop yields and efficiency.
- **Enhanced nutritional value:** Genetic manipulation can enhance the nutritional content of crops by increasing levels of essential vitamins, minerals, or proteins. For example, biofortified GM crops may offer improved nutritional profiles, addressing malnutrition and improving human health.

## VALUES AND LIFE SKILLS

Farmers face numerous challenges, including the impact of demand and supply and other kinds of market forces. Some of the following suggestions can make an improvement in their economic well being:

1. **Financial Management:** Farmers need to develop skills in budgeting, record-keeping, and financial planning to effectively manage their income and expenses. Understanding cost structures, pricing mechanisms, and profit margins can help farmers make informed decisions and optimize their financial resources.
2. **Market Intelligence:** Farmers should possess knowledge of market trends, demand-supply dynamics, and pricing mechanisms in the agricultural sector. By staying informed about market conditions, price fluctuations, and consumer preferences, farmers can make strategic decisions regarding crop selection, timing of sales, and marketing strategies to maximize profits.
3. **Diversification:** Diversifying agricultural activities by growing multiple crops, raising livestock, or engaging in value-added activities such as agro-processing, beekeeping.