PHYSICS WALLAH

UDAAN

From School to Competitive Level

BIOLOGY

Class 10

With Theory and Solved Examples
SELF STUDY

Detailed Solutions
NCERT EXERCISE

Separate Sections For School Level Concepts and Exercise
CBSE LEVEL

Separate Sections for Competitive level Concepts and Exercise
COMPETITIVE LEVEL

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CHAPTER

Life Processes

School Level

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Introduction

In the world outside, where you study, play, and perform arts, there is a network of processes that maintains everything. You eat and rest at home, travel to school to get educated, learn to play guitar strings at a local arts centre and then return home to sleep. Have you wondered why? Cars exhaust if they run continuously for long period of time, but your heart pumps blood throughout your life without ever asking for a timeout! What makes us unique; what does it cost to be alive?

We can find many things around us, from plants and animals to mountains and the ocean. The earth on which we live is composed of various things. These "things" can be classified into two distinct types: living and non-living things.

- **Living things:** They can breathe, eat, move, grow, reproduce and have senses.
- **Non-living things:** They do not grow, move, breathe, eat or reproduce. They do not have any senses.

While the above characteristics are general observations, many bacteria do not 'breathe', they can make their food in sun, some bees do not reproduce. So, then *how do we define living?*

What are Life Processes?

A bacterium and a giant blue whale are made up of cells with membranes and structures made up of molecules. The complexity of structure can vary. Cells are the functional and structural units of all living organisms. Cell aggregates together to make a tissue, tissues organizes themselves to make organs and organs make organ system and organ system finally constitute the body of the living organism. Some organisms are unicellular, while some of them are multicellular. Viruses do not show any molecular movement in them (until they infect some cell), which is why, there is a controversy about whether they are truly alive.

However, this ordered structure is bound to break due to several fundamental reasons, primarily related to the inherit challenges and limitation of life process and nature of the physical world. For this, we need **molecular movement**, or *metabolism,* as molecular movements are essential for a wide range of biological processes from basic cellular function to complex physiological organism function. We must **acquire energy and matter from surroundings** to repair and even grow or reproduce. Hence, living beings are *ordered structure capable of self maintenance.* **Life processes are maintenance processes required to execute properties of living.** The major life processes include:

- acquiring matter and energy- nutrition
- releasing energy to fuel metabolic reactions – tespiration
- transport food, and energy within the organism – transportation
- throw waste materials outside the body generated during metabolism – excretion

Activity-1

Aim: To understand that carbon dioxide is an important component of photosynthesis.

Method: Take two potted plants which have been destarched by keeping them in the dark for around three days. Place them on glass slabs. Place a watch glass comprising potassium hydroxide solution on one slab. Place an inverted bell jar over each potted plant. Seal the edges of bell jars by vaseline. Place the two sets in the presence of sunlight. After two hours, pluck one leaf from each pot and test these leaves for starch.

Fig. 2: Experimental Set-up (A) with potassium hydroxide (B) without potassium hydroxide

Observation: The leaf of set B turns blue-black because there is no potassium hydroxide solution, whereas the leaf of set A with potassium hydroxide solution remains pale-coloured.

Conclusion: The leaf of set B, which appear blue-black, has synthesized starch via photosynthesis. Its bell jar comprises carbon dioxide, as there is no potassium hydroxide absorb CO_2. The leaf of set A has not produced starch, as photosynthesis did not occur. The bell jar of this set does not comprise any carbon dioxide as the same is absorbed by potassium hydroxide solution. Thus, carbon dioxide is essential for photosynthesis.

Activity-2

Aim: To understand that chlorophyll is essential for photosynthesis.

Method: Destarch a potted croton or money plant with variegated leaves (comprising both green and non-green parts) by keeping it in complete darkness for 2-3 days. Expose the destarched potted plant to sunlight for six hours. Then, pluck a variegated leaf and place a sheet of paper over it. Draw the outline of green and non-green areas. The green areas contain chlorophyll. The non-green areas are pale in colour and devoid of chlorophyll. Place the leaf in boiling water for 5-10 minutes. Dip the leaf in spirit or alcohol kept at 50°– 60° C with the help of a water bath. After 30 – 45 minutes, the leaf will be decolourised completely. Take out the decolourised leaf, dip in hot water to soften the same. Spread the leaf in petri dish. Pour dilute iodine solution over the leaf. After 4-5 minutes, rinse the excess iodine and observe.

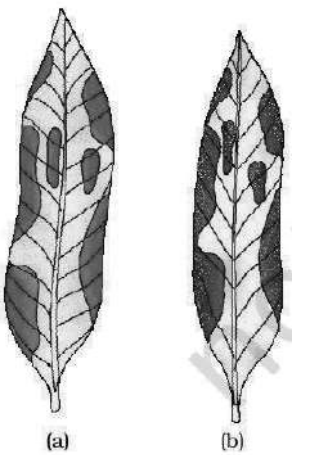


Fig. 3: Variegated leaves

Observation: The leaf has two kinds of patches, bluish-black and yellowish. The bluish-black areas are the ones which consist of starch. The bluish-black colour is because of the reaction of iodine with starch. The yellow areas are without starch. Compare the bluish-black and pale areas with green and non-green areas sketched on paper. Bluish black areas are the ones which were green previously, whereas non-green areas remain pale-coloured.

Conclusion: Only chlorophyll containing areas have starch which is a product of photosynthesis. Therefore, chlorophyll is very important for the process of photosynthesis to occur.

Activity-3

Aim: To understand that sunlight is essential for photosynthesis.

Method: Fold a circular piece of black paper and cut a design in its centre. Place black paper or tin foil, with the cut design in its centre on the surface of a leaf of destarched potted plant through cellotape clips or strips.

Place the plant in sunlight for 2-3 hours. Take the black paper or Ganong's light screen. Pluck the leaf. Test this leaf for the presence of starch

Observation: Covered part of the leaf remains yellow, whereas parts of the leaf which received light turn bluish-black. Bluish black colour shows the presence of starch.

Conclusion: Only that leaf shows photosynthesis or a positive starch test, which is exposed to light. As the covered part did not receive sunlight, thus it did not perform photosynthesis which is evident from the absence of starch. Therefore, sunlight is necessary for photosynthesis.

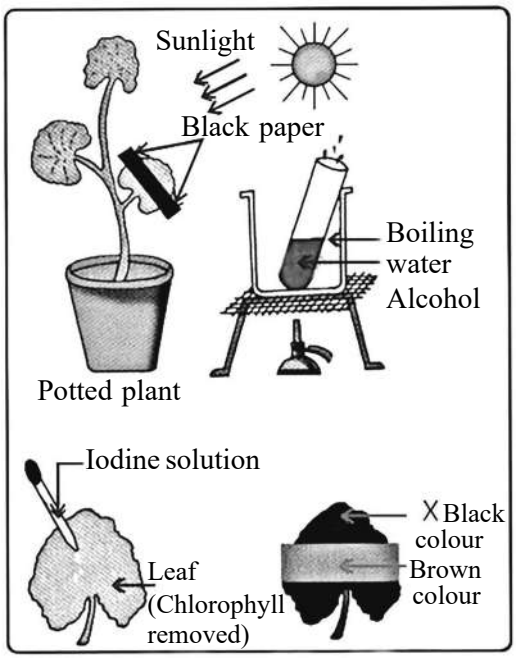


Fig. 4: Demonstration to show the presence of sunlight is necessary for photosynthesis

Site of Photosynthesis

- The leaves contain specialised cells called mesophyll cells which contain chloroplasts (the pigment containing organelle). These are the actual sites of photosynthesis.
- The photo-synthesis pigment, chlorophyll, is the principal pigment involved in photosynthesis. It is a large magnesium containing molecule and absorbs violet, blue and red region light of the visible spectrum and reflects green light and thus, appear green in colour.
- The role of the pigments is to absorb light energy, thereby converting it to chemical energy. These pigments are located on the thylakoid membrances of chloroplast.

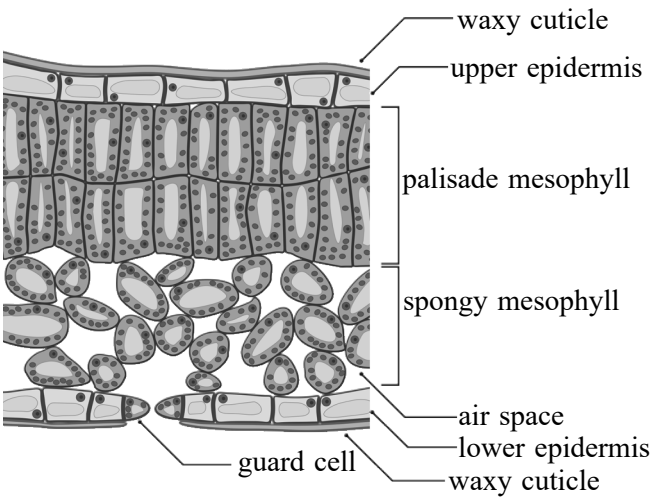


Fig. 5: Cross Section of Leaf

Stomata

Stomata are tiny pores or microscopic apertures present on the epidermis of leaves guarded by two bean or kidney-shaped guard cells.

Role of Stomata

- A large amount of gaseous exchange occurs in the leaves through stomata. The exchange of gases also takes place across the surface of root, leaves and stem.
- Transpiration occurs through the stomata. A large amount of water is lost in the form of vapours through stomata.

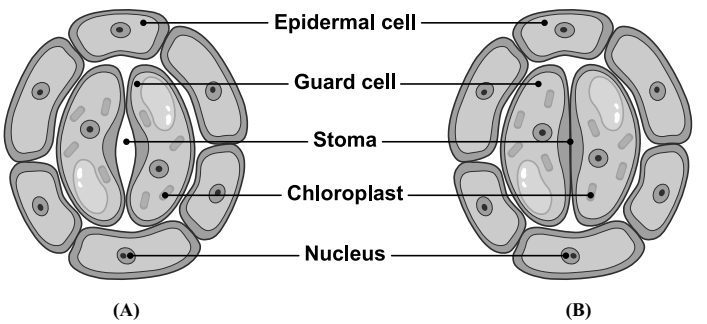


Fig. 6: (A) Open and (B) Closed Stomatal Pore

Significance of Photosynthesis

- Photosynthesis is an anabolic process (simple compounds are used to make complex compounds- building up reaction) which provides food to the autotrophs. These autotrophs sustain almost all major food chains. e.g., plants are eaten by herbivores, herbivores by carnivores and so on.
- It maintains CO_2 and O_2 concentration in the atmosphere.

How Do Organisms Obtain Their Nutrition?

Holozoic nutrition in *Amoeba*

(*a*) **Ingestion:** When an *Amoeba* comes near its food, it stops moving and pseudopodia (false feet) are formed above, below and on the sides of food to form a food cup,which does not touch the food. Finally edges of food cup around the food form a non- contractile food vacuole. This process is **phagocytosis** (if the *Amoeba* is ingesting a food particle) and **pinocytosis** (if it is ingesting liquid droplets).

(*b*) **Digestion:** The food vacuole act as a temporary stomach when a lysosome fuses with it releasing digestive enzymes. Inside the food vacuole, complex substances are broken down into simpler substances.

(*c*) **Absorption:** The digested food gets absorbed and diffuses into the cytoplasm and then assimilated.

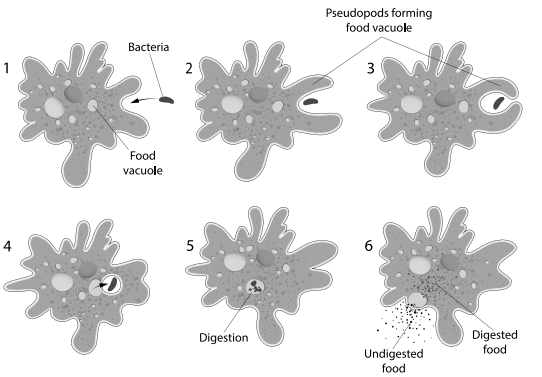


Fig. 8: Nutrition in *Amoeba*

(*d*) **Assimilation:** Assimilation is the utilization of digested food in various anabolic and catabolic reaction conversion (resynthesis) of absorbed food into complex molecules for various purposes such as production of energy growth, repair and storage.

(*e*) **Egestion:** The remaining undigested food is passed to the cell's surface and expelled out.

Nutrition in *Paramecium*

In *Paramecium*, which is also a unicellular organism, the cell has a definite shape and food is taken in at a specific spot. Food is moved to this spot by the movement of cilia which cover the entire surface of the cell.

Nutrition in Human Beings

The human digestive system consists of an alimentary canal and the associated digestive glands.

The digestive tract or alimentary canal extends from mouth to anus. It is a muscular-coiled tubular structure. The food passes through the different structures of the alimentary tract and is broken down into simpler absorbable forms. These various structures of digestive tract in an order are:

Mouth → Oesophagus → Stomach → Small Intestine → Large Intestine → Rectum → Anus

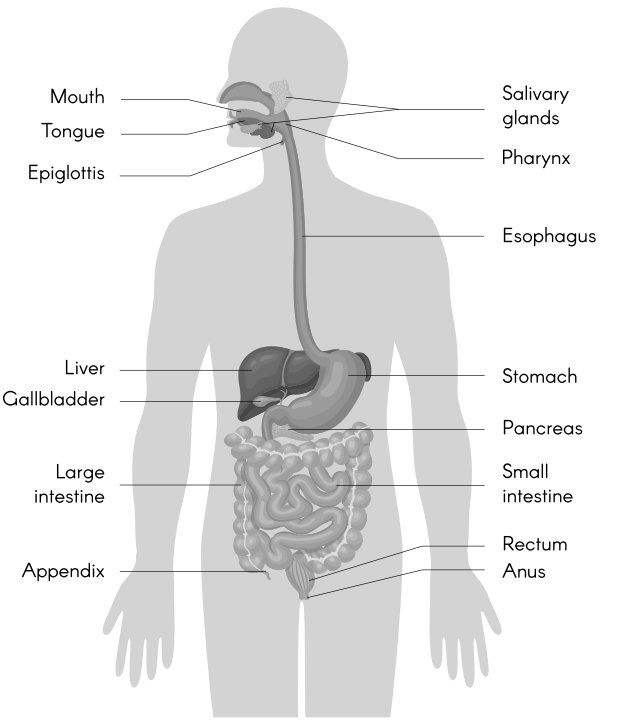


Fig. 9: Human Digestive System

Mouth

- **Mouth:** Mouth is a transverse aperture bounded by movable lips. It helps in taking the food into the buccal (mouth) cavity.
  - **Buccal cavity:** In buccal cavity, three pairs of **salivary glands** are present and on the floor of the cavity, a tongue is present. The roof of the mouth is formed by the palate, which separates the air channel from the food channel. The cavity is supported by upper and lower jaws. Each tooth is embedded in a socket of jaw bone. This type of attachment is called **thecodont**.

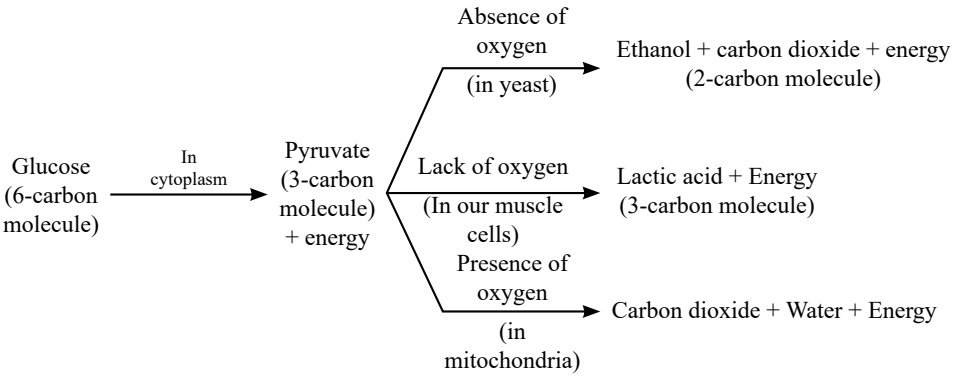


Fig. 13: Break-down of glucose by various pathways

Activity-4

Aim: To demonstrate that Yeast, a microorganism, can produce CO_2 by fermentation of sugar.

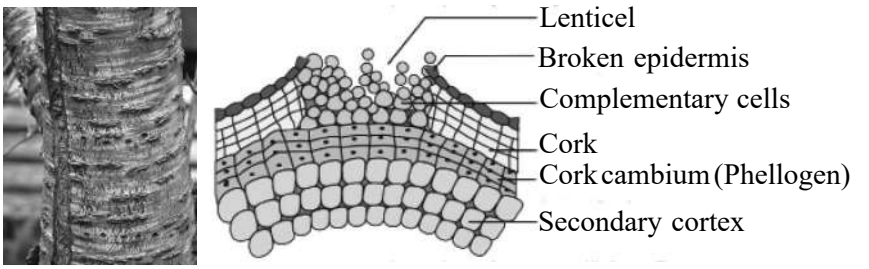
Method: Take some fruit juice or sugar solution in a test tube and add some Yeast into it. Put a few drops of oil to reduce the contact of external air. Cover the test tube with a one holed cork. Attach a bent glass tube in the cork and dip the other end of tube into another test tube having lime water (solution of calcium hydroxide). Observe these test tubes after few hours.

Observation and Conclusion: The lime water turns milky. This milky colour shows that CO_2 is liberated from the mixture of sugar and Yeast. Fermentation of sugar results in the production of CO_2 and ethyl alcohol.

Respiration in Plants

In plants, the exchange of gases occurs from stems, leaves and roots individually. Import and export of gases in plants are very slow and take place by simple diffusion. Thus, they have a quite large surface area as compared to their volume. Leaves are present on each branch, absorbing gases. Being composed of mostly dead tissues, their energy needs are also less. Therefore, diffusion alone can fulfill their needs and plants do not need specialized organs like humans. Respiratory roles in plants are served by:

- **Young roots:** Air is found in soil interspaces. Root hairs are in contact with them. The oxygen of the soil air diffuses via root hair and reaches all internal cells of the young root. Carbon dioxide produced by root cells diffuses in the opposite direction.
- **Stems:** In herbaceous plants, the stem consist of small openings in their epidermal cells known as **stomata,** the oxygen from air enters through stomata and carbon dioxide is released alternatively. In hard and woody stems of big plants and trees, lenticels (cracks in the bark) are present in place of stomata by which the exchange of gases occurs.



(a) (b)

Fig. 14: (a) Lenticels on the Bark of the Tree, (b) Lenticel Inner Structure

Gaseous Exchange between the Alveoli and Tissues

The alveoli is lined by very thin blood vessels referred to as capillaries which carries blood in them. So, the oxygen of air diffuses out from the alveoli walls into the blood. The oxygen is carried through blood to all the parts of the body. This oxygen is carried by a red coloured, iron containing respiratory pigment known as haemoglobin present in red blood cells. As the blood passes through the tissues of the body, the oxygen present in it, diffuses into the cells. This take place due to its higher concentration in the blood. This oxygen reacts with the glucose present in the cells to generate energy. Carbon dioxide gas is produced as a waste product during respiration in the cells of the body tissues. This carbon dioxide diffuses into the blood (due to its higher concentration in body tissues). Blood carries the carbon dioxide back to the lungs where it diffuses into the alveoli. When we breathe out air, the diaphragm and the muscles attached to the ribs relax and as a result, the chest cavity contracts and becomes smaller. This contraction of the chest pushes carbon dioxide out from the alveoli of the lungs into the trachea, nostrils and then out of the body into air. By this, gaseous exchange completes in the human respiratory system.

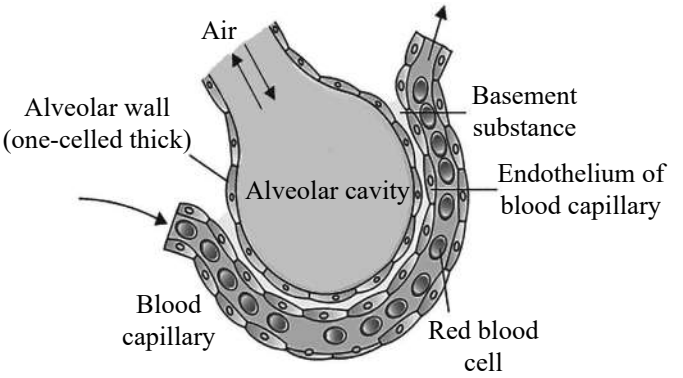


Fig. 20: A diagram of a section an alveolus with a pulmonary capillary

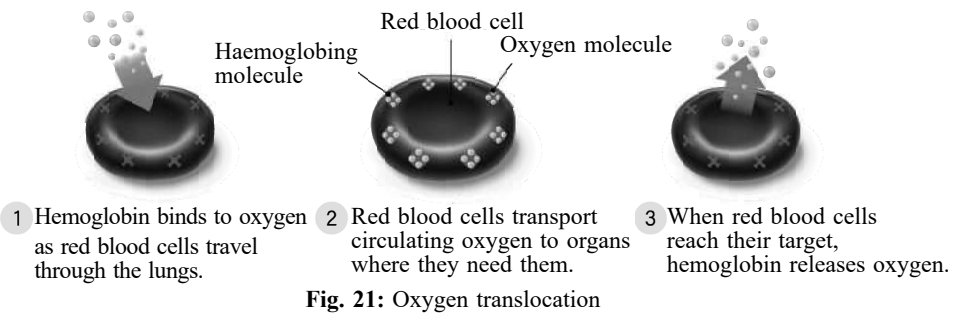


Fig. 21: Oxygen translocation

Respiration and Breathing

Breathing is simply intake of fresh air (oxygen from atmosphere) and removal of foul air (CO_2 produced by the cells) from body.

Table-3: Dissimilarities between respiration and breathing

Respiration	Breathing
It is the process of breaking down of glucose to generate energy, which is then utilized by cells to perform other activities.	It involves the process of inhaling oxygen (from atmosphere) and exhaling carbon dioxide (produce by the cell).
Respiration is an involuntary biochemical process.	Breathing is an involuntary as well as a voluntary physical process. (For example, breathing during sleep is involuntary. Voluntary breathing is mainly seen when we sing, swim, speak or for relaxation techniques).
Respiration occurs at the cellular level.	Breathing takes place through respiratory organs, including the nose, lungs, etc.
Various enzymes are used in this process.	No enzyme is used in this process.
Energy is produced and released in the form of ATP.	Energy is not produced.
As it takes place inside cells, it is called the intracellular process.	As it takes place outside the cells, it is called the extracellular process. (takes place between the organism and the external environment).

Difference between Combustion and Respiration

Table-4: Dissimilarities between Combustion and respiration

Combustion	Respiration
It is not a cellular process.	It is a cellular process.
It is an uncontrolled physio-chemical process.	It is biochemical process under biological control.
Energy is released in a single step of reaction.	Energy is released in various stages as chemical bonds are broken down step-wise.
It is a non-enzymatic process.	Different enzymes are required, one for each step.

Activity-5

Aim: To show that carbon dioxide is produced during respiration.

Method: Take two test tubes (a) and (b). Pour some freshly prepared lime water in each tube. Pass air through lime water in test tube (a) with the help of a syringe and observe Now, blow air in tube (b) through the lime water with the help of a glass tube and observe.

Observation and Conclusion: The lime water in tube (b) turns milky showing that we exhale carbon dioxide. On the other hand, the lime water in tube (a) takes a long time to turn milky. The lime water is a solution of calcium hydroxide, it combines with CO_2 to form a white precipitate of calcium carbonate. This also shows that expelled air contains more CO_2 concentration than the atmospheric air (0.04%)

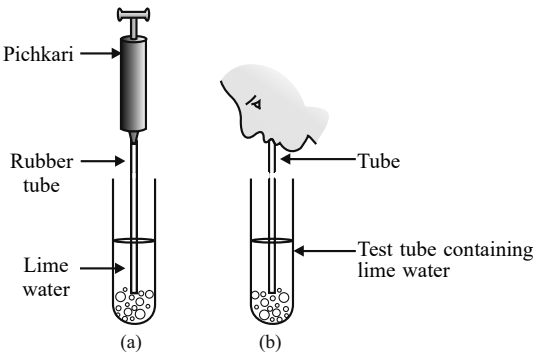


Fig. 22: (a) Air being passed into lime water with a pichkari/ syringe, (b) air being exhaled into lime water

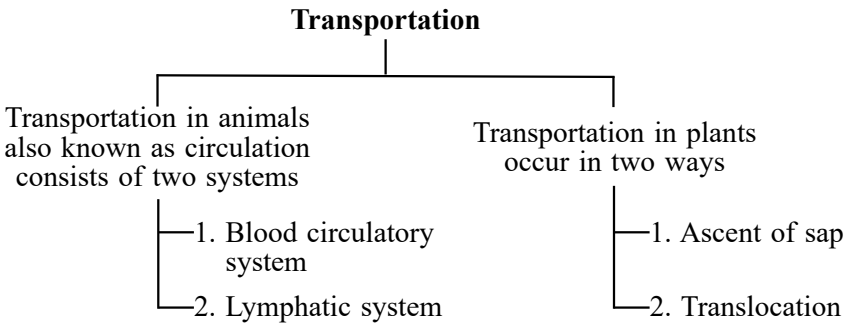
Transportation

In unicellular organisms, a single cell carries out all the life processes.

As explained previously, unicellular living organisms can transport substances using diffusion. But multicellular organisms need effective mechanisms for long-distance transport as diffusion is a slow process.

To sustain life, living organisms, either plant or animal require water, oxygen and food in every cell of its different tissue. The process of transportation is basically defined as transportation of material from one region to another, mainly from the region of their availability to the region of their usage, storage or elimination.

In animals, the transportation of digested food, oxygen, hormones, and excretory products to particular organs and tissues is done by a well-defined organ system referred to as the circulatory system. The circulatory system consists of blood, heart and blood vessels. Also, in higher plants, transport of minerals with water and food materials is performed by a well-defined vascular system having conducting tissues, xylem and phloem respectively.



- **Blood vessels:**
  - Superior and inferior venacava supply deoxygenated blood to the right atrium.
  - Pulmonary artery takes deoxygenated blood from right ventricle of the heart to the lungs for oxygenation/ purification.
  - Pulmonary vein brings the oxygenated blood from the lungs to the left atrium of the heart.
  - Left ventricle has the thickest muscular wall and aorta distributes oxygenated blood from the left ventricle of the heart to the body.

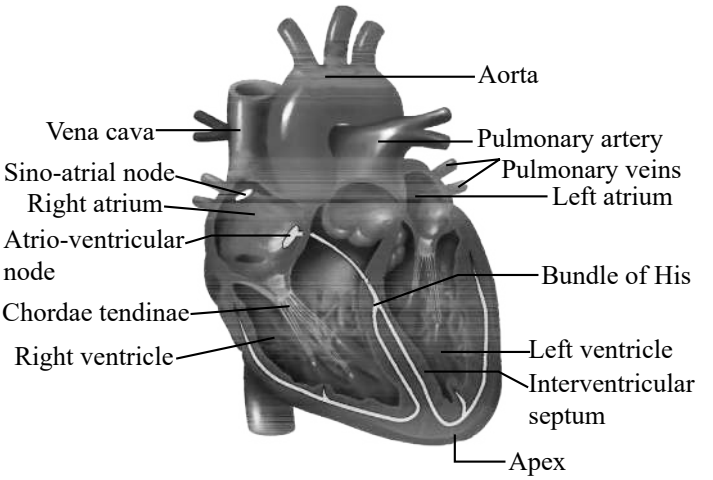


Fig. 28: Section of a human heart

- **Valves in the heart:**
  - Between the right atrium and right ventricle have valve: the **tricuspid valve** (with 3 cusps).
  - Between the left atrium and left ventricle: **bicuspid valve** (with 2 cusps), also called as **mitral** valve.
  - Two semi-lunar valves guard the opening of the pulmonary artery and aorta, which leave the right and left ventricle, respectively.
- Valves in the heart ensure that the blood does not flow backwards when the atria or ventricles contract.
- Human heart is myogenic, i.e., it can initiate its own contractions and relaxations, although brain and hormones can regulate it.

Working of Human Heart

1. It starts with the contraction of the two atria. The ventricles at this time are relaxing and are empty. Therefore, the blood from the atria passes into ventricles easily.
2. Venacava, largest veins of the body brings deoxygenated blood (blood deficient in oxygen as tissue has consumed it) to the right atrium.
3. When the right atrium contracts, the deoxygenated blood is pushed into the right ventricle.
4. When the right ventricle contracts, blood is pushed into the pulmonary artery which delivers it to lungs for oxygenation. **(Pulmonary artery is an exception which carries deoxygenated blood despite being an arterty).**
5. Oxygenated blood returns to the left atrium via pulmonary vein.

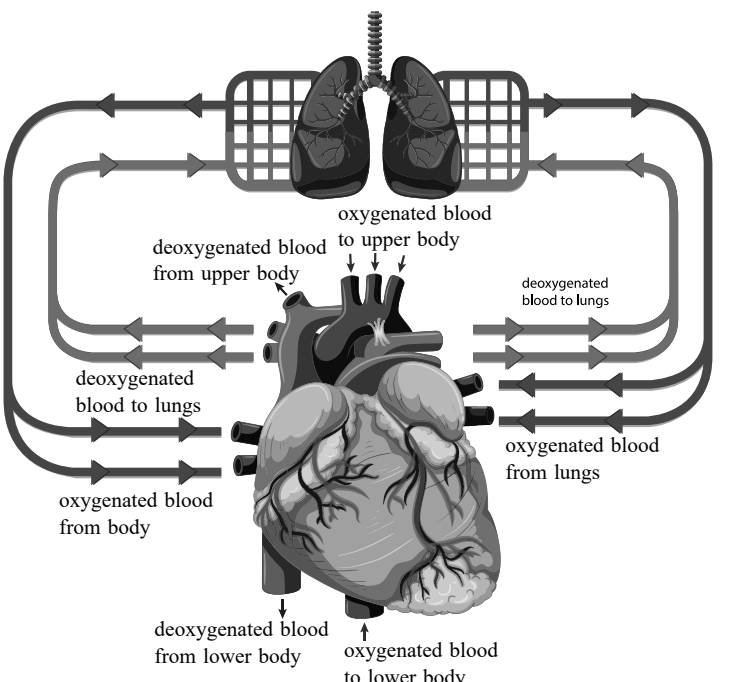


Fig. 29: Blood flow in Human beings

6. Left atrium contracts to push the oxygenated blood into the left ventricle.
7. Left ventricle contracts to push oxygenated blood into the aorta which delivers it to the whole body.

- The separation of oxygenated and deoxygenated blood between the left and right chambers of the heart respectively prevents their mixing. This allows a highly efficient supply of oxygen to the body. This is useful in animals with high energy needs which constantly use energy to maintain their body temperature. They have a four-chambered heart. For example, birds and mammals.
- Some animals have three-chambered heart and they can tolerate some mixing of oxygenated and deoxygenated blood. e.g., amphibians and many reptiles.

- Some animals have two-chambered hearts. e.g., fishes have only two chambers and the blood is pumped to the gills, for oxygenation, and then passed directly to the rest of the body. Thus, blood goes only once through the heart in the fish during one cycle of passage through out the body.

Double circulation in mammals

In double circulation, the blood is transported twice in a single cycle through the heart to supply blood to the body.

(*i*) **Systemic circulation**

Oxygenated blood from lungs → heart → aorta → systemic arteries → body parts → systemic veins → heart

(*ii*) **Pulmonary circulation**

Deoxygenated blood from the body → heart → pulmonary arteries → lungs → pulmonary veins → heart.

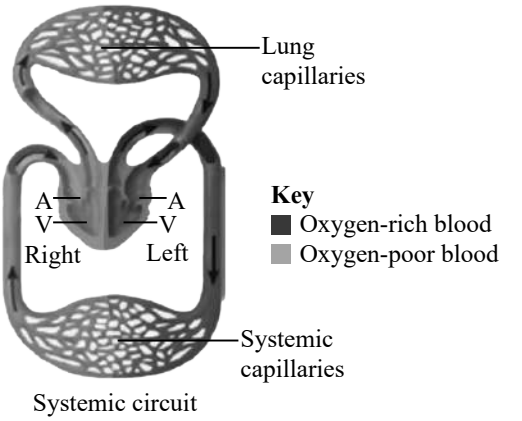
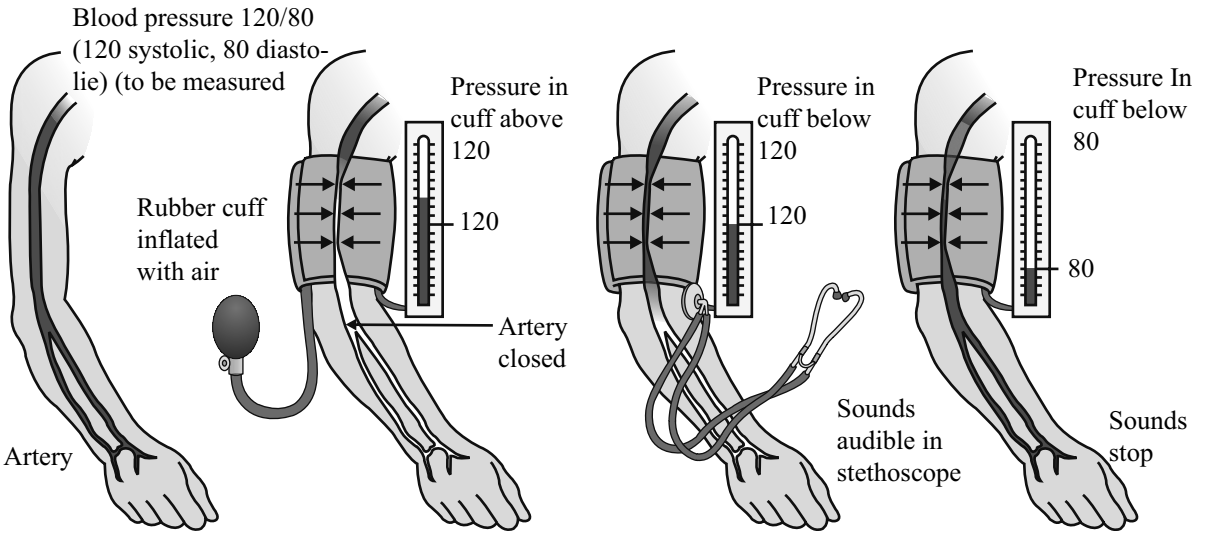


Fig. 30: Double Circulation: Mammal

Blood Pressure

Blood pressure is the force that blood exerts against the wall of a vessel. This pressure is much higher in arteries as compared to veins. The pressure of blood in the artery during ventricular systole (contraction) is referred as **systolic pressure** and pressure in artery during ventricular diastole (relaxation) is defined as **diastolic pressure**. The normal systolic pressure is around 120 mm of Hg and diastolic pressure is around 80 mm of Hg.

Blood pressure is measured with the help of an instrument called a **sphygmomanometer**. The rise in the blood pressure more than 140 mm Hg (systolic) and 90 mm Hg (diastolic), is called as **high blood pressure.** High blood pressure is also referred to as hypertension and is caused due to the constriction of arterioles, which results in an increased resistance to blood flow. It can cause rupture of an artery and can lead to internal bleeding.



Measurement of blood pressure

Heart Beat

Heartbeat is defined as the one complete cycle of contraction and relaxation of heart. An **electrocardiogram (ECG)** provides information about heartbeats. Normal heartbeat is around 68-72 per minute.

Lymph

- When blood flows into thin capillaries, some amount of plasma filters out of thin capillaries. This fluid is called **interstitial fluid** or **tissue fluid** or **lymph**. As it bathes the cells and lies outside the cells, lymph is also called **extracellular fluid**.
- It is colourless and contains lymphocytes. Unlike blood, it does not contain red blood corpuscles, platelets and plasma proteins.
- Lymph flows only in one direction, that is from tissues to heart.

- From the intercellular space, lymph drains into lymphatic capillaries, which join to form large lymph vessels that finally open into larger veins.
- Lymph vessels along with lymph nodes and lymph tissues constitute **lymphatic system**.
- The functions of lymph are:
  - It transports fatty acids and glycerol from small intestine to blood.
  - Lymphocytes present in it destroy harmful pathogens.
  - It drains excess tissue fluid from intercellular sapces back into the blood. It carries lymphocytes and antibodies from lymph nodes to the blood.
  - Lymph nodes localise the infection and prevent it from spreading to other body parts.

Constituents of Lymph

- **Water**
- **Soilds:** The solid content found in the lymph is as follows:
  - Carbohydrates
  - Fats
  - Proteins: For example, albumin, globulin and fibrinogen.
- **Other constituents:** Creatinine, urea, inorganic phosphorus, chlorides, enzymes, calcium and antibodies.

Importance of Lymph

(i) It transports oxygen and nutrition to those parts of the body where blood cannot reach.
(ii) It drains excess tissue fluids.
(iii) Lymph returns proteins to the blood from the tissue spaces.
(iv) Fats from the intestine are also absorbed via the lymph.
(v) The monocytes and lymphocytes of lymph act as defensive cells of the body.
(vi) The lymph also destroy bacteria from tissues.

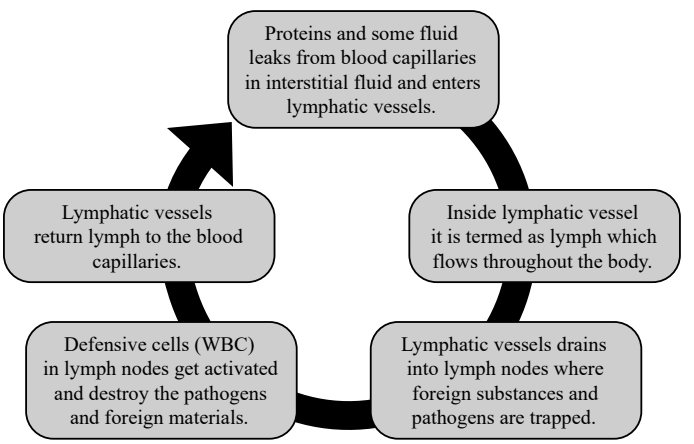
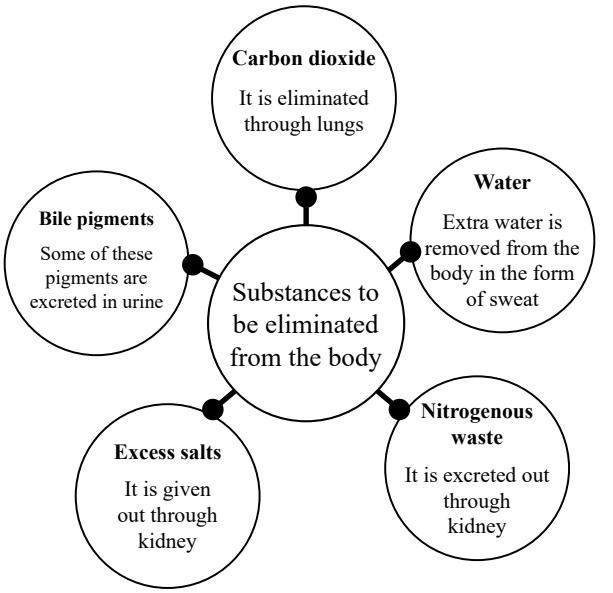


Fig. 31: Relationship between Circulatory system and Lymphatic system

S.No.	Lymph	Blood
1.	It is a colourless fluid.	It is a red coloured fluid.
2.	Formed when interstitial fluid gets collected through lymph capillaries. Moves in body in single direction.	Produced in bone marrow and flows circularly in body by single or double circulation
3.	Composed of calcium, blood proteins, lymphocytes and some water.	RBC, WBC, Plasma, platelets are major components.
4.	It transports WBC within lymph nodes, fights against infectious bacteria.	Regulate body temperature, maintain pH and perform clotting mechanism to prevent loss of blood.
5.	Carries less oxygen and proteins.	Carries large proportions of oxygen and proteins.

Excretion

Excretion is the removal of metabolic wastes from the body. Animals accumulate ammonia, urea and uric acid, CO_2, water and ions like Na^+, K^+, Cl^-, phosphate, sulphate, etc either by metobolic activities or by other means like ingestion. These substances have to be removed totally or partially. Ammonia, urea and uric acid are the major forms of nitrogen wastes excreted by animals.



Excretion in Animals

In unicellular organisms, waste products are discharged directly through the surface of the cell. Wastes from the body must be accumulated at one place and then released out. Multicellular organisms use more complex excretory methods. For example, higher plants eliminate gases through the stomata on the surface of leaves. In animals, particular excretory organs are present.

Excretory Organs/Structures in Animals

Animals	Flatworm	Earthworm	*Amoeba*	*Hydra*	All chordates	Insects e.g., cockroach
Excretory structures	Protonephridia (flame cells)	Nephridia	Cellular surface	Body surface	Kidneys	Malpighian tubules

Excretory Products

The waste products of organisms body can be divided into two types:

- **Organic waste product:** It is mainly carbon dioxide which is a by product of respiration. In aquatic animals, it is diffused out in the water through general surface of the body or through respiratory surface while in terrestrial animals, it is diffused out in the air.
- **Nitrogenous waste product:** These substances contain nitrogen in them. The aquatic animals excrete ammonia while terrestrial animals mostly excrete urea or uric acid. Out of the three nitrogenous waste products, ammonia is the most toxic, followed by urea. Uric acid is least toxic.

Excretion in Human Beings

Human Excretory System

Human excretory system comprises of:

- a pair of **kidneys:** primary excretory organ that makes the urine.
- a pair of **ureters**: collects urine from the kidneys.
- a **urinary bladder**: stores urine temporarily.
- a **urethra**: discharges urine out of the body.

Structure of Kidney

Kidneys are the main excretory organ of our body. Resting on top of each kidney is an adrenal gland (also called the suprarenal gland).

Shape – Bean shaped

Colour – Dark red

Summary

Different types of movement can be taken as an indication of life. The major characteristic which is used to decide whether something is living or dead is movement. The movement in animals is fast and can be observed easily but the movement in plants is slow and observed with difficulty. Animals can move from one region to another or they can move their body parts. The plants can only move parts of their body such as leaves, flowers, roots and shoots. Life processes are processes undergoing in living organisms to sustain life like respiration, nutrition, transport of materials within the body and removal of waste products. Organisms need the energy to perform various activities. The energy is supplied by the nutrients. Organisms need various raw materials for growth and repair. These raw materials are provided by nutrients. Autotrophic nutrition involves the use of simple inorganic materials like carbon dioxide, water and sunlight as the energy source to synthesize complex high-energy organic material (carbohydrates). Heterotrophic nutrition involves the utilization of complex material prepared by other organisms or autotrophs. Different organisms utilize different nutritional processes as it depends upon the source of carbon from where the food is taken. Some organism feed on dead and decaying organic matter. Some organisms feed on the expense of another organism and in turn causing it harm. This is called parasitic mode of nutrition. Nutrition in humans involves various steps. Food is taken by mouth and is broken down by various steps along the alimentary canal. The breakdown of complex food into simpler ones is known as digestion. The digested food is absorbed in the small intestine and excess of water is absorbed by the large intestine. After this, the waste products are removed from the body through the anus. Respiration may be aerobic (in the presence of oxygen) or anaerobic (in the absence of oxygen). Aerobic respiration provides more energy to the organism. Respiration involves gaseous exchange, ie., intake of oxygen from the atmosphere and release of carbon dioxide and cellular respiration, i.e., breakdown of complex organic compounds such as glucose to provide energy in the form of ATP. Mitochondria are the region of cellular respiration. When someone runs too fast, he may experience throbbing pain in the leg muscles. This occur due to anaerobic respiration taking place in the muscles. The deposition of lactic acid causes pain in the leg muscles. The pain subsides after taking rest for some time. The human respiratory system involves the nasal cavities, nose, pharynx, larynx, trachea/ windpipe, bronchioles, bronchi, and alveoli. The walls of the alveoli contain an extensive network of blood-vessels where the exchange of gases takes place. Since the amount of oxygen dissolved in water is comparatively lower than that in air, the aquatic animals have to breathe rapidly to take in sufficient oxygen. Thus, the rate of breathing in aquatic organisms is higher than the terrestrial organisms. Plants have stomata (present in leaves) and lenticels (present in stems) which are involved in the exchange of gases. Transportation in humans is done by the circulatory system. It is responsible for the transport of oxygen, nutrients, removal of carbon dioxide and other excretory products. The circulatory system in humans mainly consists of blood, blood vessels and heart. Since ventricles have to pump blood into various organs, they have thicker muscular walls than that of atria. In the human heart, blood passes through the heart twice in one cardiac cycle. This type of circulation is called double circulation. It ensures complete segregation of oxygenated and deoxygenated blood which is necessary for optimum energy production in warm-blooded animals. In highly differentiated plants, transport of water, minerals, food and other materials is a function of the vascular tissue which consists of xylem and phloem. Transpiration is the loss of water in the form of water vapour from the aerial parts of the plant, helps in the absorption and upward movement of water and minerals dissolved in it from roots to the leaves. The harmful metabolic wastes from the body are removed by the process of excretion. Excretory system of humans consists of a pair of kidneys, a pair of ureters, urinary bladder and urethra. In human beings, excretory products in the form of soluble nitrogen compounds are removed by the nephrons. Nephron is the structural and functional unit of kidney. Any problem in the activity of kidney leads to accumulation of poisonous wastes in the body, which can even lead to death. In such situation, an artificial kidney can be used. Plants use a variety of techniques to get rid of waste material. Carbon dioxide, excess water and nitrogenous compounds are the major excretory products in plants. Waste products may be stored in leaves falls off. Other waste material may be stored in the cell-vacuoles or as resins.

NCERT Corner

1. Why is diffusion insufficient to meet the oxygen requirements of multicellular organisms like humans?

Ans. In multicellular organisms such as humans, all the body cells are not in direct contact with the external environment. Therefore, every cell of the body will not get enough oxygen as per need by the process of diffusion as it is a slow process.

2. What criteria do we use to decide whether something is alive?

Ans. There are some features of living organisms which are used to decide whether something is alive or not. These are as follows:

1. Movement
2. Growth
3. Metabolism
4. Nutrition
5. Respiration
6. Transportation
7. Excretion

3. What are outside raw materials used by an organism?

Ans. Oxygen, water, and food are examples of external raw materials used by organisms.

Plants obtain their raw materials from the environment in the form of carbon dioxide, water, and sunlight.

These are used to synthesize their food in the presence of chlorophyll, a green color pigment.

Animals use basic materials in the form of food, water, and oxygen from the environment.

4. What processes would you consider essential for maintaining life?

Ans. The maintenance function of living organisms must go on even when they are not doing anything particular. The various processes essential for maintaining life are nutrition, respiration, transportation, excetion, control and coordination. In absence of any one of these, the life would become difficult.

5. What are the differences between autotrophic nutrition and heterotrophic nutrition?

Ans. Differences between autotrophic and heterotrophic nutrition are as follows:

	Heterotrophic nutrition	Autotrophic nutrition
(i)	Organisms cannot make their own food from simple inorganic matter and depend on other organisms for their food.	Organisms use simple inorganic materials like carbon dioxide and water and synthesise their food in presence of sunlight.
(ii)	All the animals, most of the bacteria and fungi shows this mode of nutrition.	All green plants and some algae shows this mode of nutrition.

6. Where do plants get raw materials required for the process of photosynthesis? (CBSE 2020)

Ans. (i) Carbon dioxide: It is obtained from atmosphere.
(ii) Water: Plants absorb water from the soil through roots and transport to leaves.
(iii) Sunlight: Sunlight comes from the sun.
(iv) Chlorophyll: It is present in chloroplast found in green plants.

7. What is the role of the acid in our stomach?

Ans. Role of acid in the stomach is:
(i) to kill harmful bacteria that enter with food in body.
(ii) to make acidic medium which is required for the activation of the enzyme pepsin.
(iii) it also help in digestion of proteins.

8. What is the function of digestive enzymes?

Ans. The food we eat is very complex in nature, because it comprises of complex molecules. Digestive enzymes break down these complex molecules into smaller simpler molecules, so that they can be easily absorbed by the walls of the intestine.

9. How is the small intestine designed to absorb digested food?

Ans. The small intestine has folds which increase surface area. These folds have finger-like projections known as villi which further increases surface area. The villi consist of many blood vessels which takes the absorbed food to each and every cell of the body.

NCERT Exercise

1. The kidneys in human beings are a part of the system for:

(*a*) nutrition (*b*) respiration

(*c*) excretion (*d*) transportation

Ans. (*c*)

2. The xylem in plants are responsible for:

(*a*) transport of water

(*b*) transport of food

(*c*) transport of amino acids

(*d*) transport of oxygen

Ans. (*a*)

3. The autotrophic mode of nutrition requires:

(*a*) carbon dioxide and water

(*b*) chlorophyll

(*c*) sunlight

(*d*) All of the above

Ans. (*d*)

4. The breakdown of pyruvate to give carbon dioxide, water and energy occurs in _____.

(*a*) cytoplasm (*b*) mitochondria

(*c*) chloroplast (*d*) nucleus

Ans. (*b*)

5. How are fats digested in our bodies? Where does this process take place?

Ans. Digestion of fats occurs mainly in the small intestine.

Bile juice produced by the liver enters in the small intestine along with pancreatic juice. The bile salts present in the bile juice emulsify the large globules of fats into smaller globules to provide larger surface area to act upon by the enzymes.

Pancreatic juice and intestinal juice has lipase enzyme which catalyzes the conversion of fats into fatty acids and glycerol.

6. What is the role of saliva in the digestion of food?

Ans. Saliva has salivary amylase enzyme that converts starch into sugars like maltose.

$$\underset{\text{(Complex Molecule)}}{\text{Starch}} + \text{Salivary amylase} \longrightarrow \underset{\text{(Simpler Molecule)}}{\text{Maltose}}$$

Saliva also moistens the food that help in chewing and breaking down the larger pieces of food into smaller ones.

7. What are the necessary conditions for autotrophic nutrition and what are its by-products?

Ans. The most essential conditions for autotrophic nutrition are:

(i) Sufficient sunlight.

(ii) Sufficient supply of carbon dioxide.

(iii) Presence of chlorophyll.

(iv) Sufficient transport of water to green plants or cells of the plant.

Carbohydrates and oxygen are the by-products of autotrophic nutrition.

8. What are the differences between aerobic and anaerobic respiration? Name some organisms that use the anaerobic mode of respiration.

Ans. The differences between anaerobic and aerobic respiration are as follows:

Anaerobic respiration	Aerobic respiration
It occurs in the absence of oxygen.	It occurs in the presence of oxygen.
Partial breakdown of food takes place.	Complete breakdown of food take place.
Much less energy is produced in anaerobic respiration. (2 ATP)	More energy is generated. (38 ATP)
The end products of anaerobic respiration are carbon dioxide and ethanol (as in yeast) or lactic acid (as in animal muscles cells).	The end products of aerobic respiration are carbon dioxide and water.

Some organisms which use anaerobic mode of respiration are yeast, bacteria etc.

9. How are the alveoli designed to maximise the exchange of gases?

Ans.

(i) Alveoli have balloon-like structure. Thus, provides maximum surface area for exchange of gases.

(ii) The alveoli are thin walled and have network of blood vessels to allow exchange of gases between blood and the air filled in alveoli.

10. What would be the consequences of a deficiency of haemoglobin in our bodies?

Ans. The oxygen carrying capacity of blood reduces due to the deficiency of haemoglobin in blood. As a result, the production of energy by oxidation will become slower. Therefore, an individual can fall sick and would feel fatigue and nausea.

11. Describe double circulation in human beings. Why is it necessary?

Ans. In our heart, blood is circulated twice in a single cycle. The deoxygenated blood from the body is brought to the right atrium through vena cava from where it is sent to right ventricle. From right ventricle, the blood is pumped to the lungs for oxygenation through pulmonary artery. Again, the oxygenated blood from lungs enters the left atrium of the heart through pulmonary veins. From left atrium, it is carried to the left ventricle, from where this oxygenated blood is pumped to different parts of body through the aorta. Through this, the blood flows from the heart two times, and thus, it is called 'double circulation'.

Double circulation is very important in our body as the right side and the left side of the human heart are essential to separate deoxygenated and oxygenated blood and prevents mixing. This type of separation of oxygenated and deoxygenated blood ensures an efficient supply of oxygen to the body. This is useful for humans as they constantly require energy to regulate their body temperature.

12. What are the differences between the transport of materials in xylem and phloem?

Ans. The differences between the transport of materials in xylem and phloem are given below:

Phloem	Xylem
Phloem allow the transport of prepared food material from leaves to other regions of plant in dissolved form bidirectionally.	Xylem transports water and dissolved minerals from roots to leaves and other parts of the plants unidirectionally.

13. Compare the functioning of alveoli in the lungs and nephrons in the kidneys with respect to their structure and functioning.

Ans.

Nephron	Alveoli
A kidney has around 1 million nephrons.	A mature lung has around 300 million alveoli.
Functional unit of kidney.	Functional unit of lungs.

Quick Recall

Fill in the Blanks

1. Ninety percent of the water lost by the plants during transpiration is through _____ the of the leaf.
2. _____ involves the intake of complex material prepared by other organisms.
3. Complete photosynthesis units of plants is _____.
4. Starch changes blue in _____ solution.
5. _____ movements take place along the gut.
6. _____ from stomach digests proteins.
7. _____ help in emulsification of fats.
8. Gaseous exchange in lungs takes place in units called _____.
9. The _____ prevents the entry of food into the respiratory tract.

10. Contraction of diaphragm contributes to _____.

11. Yeast undergoes _____ fermentation.

12. The major function of the _____ blood cells is to transport oxygen.

13. Pressure in the arteries during ventricular relaxation is referred as _____ pressure.

14. Transport through phloem is an _____ process.

15. _____ veins pour _____ blood into heart.

16. The chamber of heart that pumps oxygenated blood to the whole body is _____.

17. In humans, primary nitrogenous waste is _____.

18. _____ is the functional unit of the mammalian kidney.

19. _____ step of urine formation ensures no nutritive material is wasted in urine.

20. _____ stores urine temporarily before releasing it.

True and False Statements

1. Light energy is directly used in the synthesis of carbohydrates.

2. Guard cells have chloroplast.

3. Ball of food that descends into stomach is called chyme.

4. During day, respiration does not take place, only photosynthesis happens.

5. In humans, protein digestion starts in the mouth.

6. Villi perform digestion of lipids.

7. Heart muscle can perform lactic acid fermentation during heavy exercise.

8. Aerobic respiration gives 38 ATP.

9. Most of the gaseous exchange takes place through stomata in plants.

10. Oxygen largely travels in blood dissolved in the blood plasma.

11. Xylem transports water and minerals.

12. We have a four chambered heart which can contract because of brain signals.

13. Translocation transports sugar as glucose.

14. WBCs help in preventing blood clotting.

15. The exchange of nutrients and waste products between the blood and cells occurs within the arteries.

16. Bowman's capsule is a part of nephron.

17. Plant throw all their waste products.

18. Urine formation includes filtration of blood.

19. Kidneys also perform the job of osmoregulation.

20. Urine is a concentrated solution of urea.

Match the Following

1. Match the processes given in column-I with their definition given in column-II and choose the correct option.

Column-I		Column-II	
P.	Nutrition	(*i*)	The increase in cell size and/ or number
Q.	Anabolism	(*ii*)	The movement of materials within the cell or within the organism.
R.	Growth	(*iii*)	The process of obtaining food.
S.	Transport	(*iv*)	Combining small molecules to create larger more complex molecules.

(*a*) P-(*iv*), Q-(*ii*), R-(*i*), S-(*iii*)
(*b*) P-(*iii*), Q-(*iv*), R-(*ii*), S-(*i*)
(*c*) P-(*iii*), Q-(*iv*), R-(*i*), S-(*ii*)
(*d*) P-(*iii*), Q-(*i*), R-(*iv*), S-(*ii*)

2. Match the given columns and mark the correct option.

Column-I		Column-II	
P.	*Cuscuta*	(*i*)	Parasite
Q.	Bread mould	(*ii*)	Holozoic
R.	*Amoeba*	(*iii*)	Insectivorous
S.	Pitcher plant	(*iv*)	Saprophyte

(*a*) P-(*i*), Q-(*iv*), R-(*i*), S-(*iii*)
(*b*) P-(*i*), Q-(*ii*), R-(*iii*), S-(*iv*)
(*c*) P-(*iii*), Q-(*iv*), R-(*i*), S-(*ii*)
(*d*) P-(*iii*), Q-(*i*), R-(*iv*), S-(*ii*)

3. Match column-I with column-II and choose the option.

Column-I		Column-II	
P.	Trypsin	(*i*)	Pancreas
Q.	Salivary amylase	(*ii*)	Gastric glands
R.	Bile	(*iii*)	Liver
S.	Pepsin	(*iv*)	Saliva

(*a*) P-(*i*), Q-(*iv*), R-(*ii*), S-(*iii*)
(*b*) P-(*iv*), Q-(*i*), R-(*ii*), S-(*iii*)
(*c*) P-(*i*), Q-(*iv*), R-(*iii*), S-(*ii*)
(*d*) P-(*i*), Q-(*ii*), R-(*iv*), S-(*iii*)

4. Match column-I and column-II and choose the correct option.

Column-I		Column-II	
P.	Xylem	(*i*)	Carries blood away from the heart
Q.	Nephron	(*ii*)	Translocation of minerals
R.	Arteries	(*iii*)	Clotting of blood
S.	Platelets	(*iv*)	Excretion

(*a*) P-(*ii*), Q-(*i*), R-(*iv*), S-(*iii*)
(*b*) P-(*i*), Q-(*ii*), R-(*iv*), S-(*iii*)
(*c*) P-(*ii*), Q-(*i*), R-(*iii*), S-(*iv*)
(*d*) P-(*ii*), Q-(*iv*), R-(*i*), S-(*iii*)

5. Match the processes given in column-I with their definition given in column-II.

Column-I		Column-II	
P.	Regulation	(*i*)	The removal of metabolic waste from an organism.
Q.	Reproduction	(*ii*)	The chemical process of oxidizing organic molecules to release energy.
R.	Respiration	(*iii*)	The production of new individuals of the same kind.
S.	Excretion	(*iv*)	The control and coordination of chemical processes within the organism.

(*a*) P-(*iv*), Q-(*ii*), R-(*i*), S-(*iii*)
(*b*) P-(*iv*), Q-(*iii*), R-(*ii*), S-(*i*)
(*c*) P-(*iii*), Q-(*iv*), R-(*i*), S-(*ii*)
(*d*) P-(*iii*), Q-(*i*), R-(*iv*), S-(*ii*)

Multiple Choice Question

1. Transportation in unicellular organisms usually occurs by:
(*a*) transporting organs
(*b*) DNA
(*c*) diffusion
(*d*) They do not need any transport

2. If a plant is being irrigated with water containing a radioactive isotope of oxygen, very likely the _____ molecule will also be radioactive.
(*a*) hydrogen
(*b*) carbon dioxide
(*c*) oxygen
(*d*) carbohydrates

3. In desert plants, intake of carbon dioxide takes place:
(*a*) during day
(*b*) during night
(*c*) during both day and night
(*d*) they do not intake carbon dioxide; they totally depend on carbon dioxide produced from respiration.

4. Which of the following cells are usually rich in chloroplasts?
(*a*) Mesophyll cells (*b*) Epidermis cells
(*c*) Root cells (*d*) Xylem cells

5. The contraction and expansion movement of the walls of the food pipe is called:
(*a*) pulse (*b*) peristalsis
(*c*) mastication (*d*) micturition

6. Which of the following statements is incorrect?
(*a*) ATP cannot be produced without mitochondria.
(*b*) ATP can be produced in mitochondria.
(*c*) ATP can be produced in the cytoplasm.
(*d*) ATP can be consumed in the cytoplasm.

7. The dough for making cakes rises due to:
(*a*) production of alcohol.
(*b*) production of lactic acid.
(*c*) production of carbon dioxide.
(*d*) production of water.

8. Bronchi most specifically, has the role of:
(*a*) exchange of gases.
(*b*) conduction of air.
(*c*) storage of air.
(*d*) oxygenation of blood.

9. Breathing is inefficient in humans because:
(*a*) oxygen cannot be isolated from air.
(*b*) we live in oxygen-deficient atmosphere.
(*c*) we have common path for inhalation and exhalation.
(*d*) we lack oxygen specific transport proteins.

10. If plant xylems are blocked, the plant will:
(*a*) suffer from water shortage only.
(*b*) suffer from water and carbohydrate shortage.
(*c*) suffer from water and mineral shortage.
(*d*) suffer from water, mineral and carbohydrates shortage.

11. If the phloem is blocked, the plant will:
(*a*) suffer from food shortage only.
(*b*) suffer from mineral shortage.
(*c*) suffer from water and food shortage.
(*d*) suffer from water and food shortage.

12. The advantage of a four-chambered heart is:
(*a*) increased blood-carrying capacity.
(*b*) increased blood storage capacity.
(*c*) increased blood production capacity.
(*d*) increased blood oxygen-carrying efficiency.

13. We can assume four-chambered heart:
(*a*) will be suitable in cold blooded animals.
(*b*) will be suitable in warm blooded animals.
(*c*) will be suitable in both.
(*d*) will be suitable in none.

14. Which of the following blood vessel brings oxygenated blood into the heart?
(*a*) Vena cava (*b*) Pulmonary artery
(*c*) Pulmonary vein (*d*) Aorta

15. Primary nitrogenous waste in humans that is thrown out is:
(*a*) carbon dioxide (*b*) ammonia
(*c*) urea (*d*) amino acids

16. Absence of which of these processes would have wasted a lot of glucose?
(*a*) Filtration (*b*) Reabsorption
(*c*) Secretion (*d*) None of these

Assertion & Reason Type Questions

Direction: In the following questions, the Assertion and Reason have been put forward. Read the statements carefully and choose the correct alternative from the following:

(*a*) Both **Assertion (A)** and **Reason (R)** are true and **Reason (R)** is the correct explanation of **Assertion (A)**.

(*b*) Both **Assertion (A)** and **Reason (R)** are true but **Reason (R)** is not the correct explanation of **Assertion (A)**.

(*c*) **Assertion (A)** is true but **Reason (R)** is false.

(*d*) **Assertion (A)** is false but **Reason (R)** is true.

1. **Assertion (A):** Raw materials needed for photosynthesis are carbon dioxide, water and minerals.

Reason (R): All nutrients provide only energy to an organism.

2. **Assertion (A):** Autotrophic nutrition occurs in green plants.

Reason (R): Green plants self-manufacture their food from inorganic carbon source.

3. **Assertion (A):** Pyruvate is a six-carbon molecule.

Reason (R): It is prepared in the cytoplasm as the first step to cellular respiration.

4. **Assertion (A):** Haemoglobin is the respiratory pigment in human beings.

Reason (R): It transport oxygen in the human body

5. **Assertion (A):** Strenuous physical exercise may cause fatigue due to accumulation of CO_2 in the blood.

Reason (R): Lactic acid has a toxic effect on cells, which causes muscle fatigue.

6. **Assertion (A):** Pulmonary veins and venacava both are veins.

Reason (R): Concentration of oxygen is higher in the pulmonary vein compared to venae cavae as it carries oxygenated blood to the systemic circuit, unlike other veins which carry deoxygenated blood.

7. **Assertion (A):** The translocation of food and other substances takes place by xylem.

Reason (R): Translocation occurs with the help of adjacent companion cells.

8. **Assertion (A):** Artificial kidney is a device used to remove nitrogenous waste products from the blood through dialysis.

   Reason (R): Reabsorption does not occur in artificial kidney.

9. **Assertion (A):** Excretion is the biological process of removing nitrogenous waste from the body.

   Reason (R): The mode of excretion is the same in both unicellular and multicellular organisms.

Statement Type Questions

Read the following statements and select the correct options.

(*a*) Both **Statement-I** and **Statement-II** are correct.

(*b*) Both **Statement-I** and **Statement-II** are incorrect.

(*c*) **Statement-I** is correct & **Statement-II** is incorrect.

(*d*) **Statement-I** is incorrect & **Statement-II** is correct.

1. **Statement-I:** Photosynthesis occurs only in eukaryotes.

   Statement-II: Prokaryotes do not have photosensitive pigments.

2. **Statement-I:** Protein digestion cannot begin until acidic environment is created in stomach.

   Statement-II: Mucus is activated by acidic environments.

3. **Statement-I:** Plants have structures that take in gases distributed throughout their body.

   Statement-II: They need huge amount of energy.

4. **Statement-I:** Fishes have higher breathing rates.

   Statement-II: Oxygen is less available to them.

5. **Statement-I:** Humans have double circulation.

   Statement-II: They have blood cells which are all efficient in carrying oxygen.

6. **Statement-I:** Guttation is droplet exudation, whereas transpiration is the evaporation of water from the plant surface.

   Statement-II: Waste products in the form of oil are also stored in some plants like Jasmine, *eucalyptus* and orange.

7. **Statement-I:** Plants do not produce wastes.

   Statement-II: Plant lacks specialised excretory structures.

8. **Statement-I:** Donation of a kidney may be made without the consent of the donor and his/her family.

   Statement-II: People can survive on one kidney.

Subjective Questions

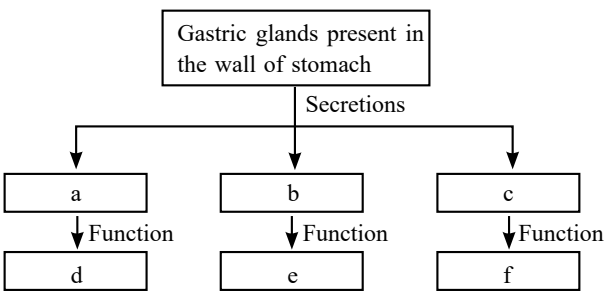
Very Short Answer Type Questions

1. How desert plants perform photosynthesis if their stomata remain closed during the day?
2. 'X' is a key step in photosynthesis. 'X' happens in thylakoids in the chloroplast. What is "X" here?
3. Most of the digestion and absorption of the food takes place in the:
   (*i*) small intestine.
   (*ii*) liver.
   (*iii*) stomach.
   (*iv*) large intestine.
4. What is the role of sphincters in digestion?
5. Describe an analogy between how energy is stored within ATP and between two similar poles of magnet.
6. What is the function of alveoli in the lungs.
7. What happens to the rate of breathing during vigorous exercise and why?
8. Define which one of the following statements is correct about the human circulatory system?
   (*a*) Blood transports only oxygen and not carbon dioxide.
   (*b*) Human heart has five chambers.
   (*c*) Valves ensure that the blood does not flow backwards.
   (*d*) Both oxygen-rich and oxygen-deficient blood gets mixed in the heart.

9. Name the tissue which transports soluble products of photosynthesis in a plant.
10. How does transport of water occur at night in the absence of transpiration?
11. How are nitrogenous wastes formed in the body?
12. Justify plants biological wastes are sometimes rich for humans.

Short Answer Type Questions

1. Write four sequential steps of the procedure of the experiment "Preparing a temporary mount of a leaf peel to show stomata."
2. Complete the following flow chart as per the given instructions:



3. What will happen if the gastric glands do not secrete mucus?
4. Explain the process of nutrition in *Amoeba*.
5. (*a*) Why does a piece of bread taste sweet when chewed for some time?
   (*b*) Cellulose acts as a roughage in man but serves as a source of nutrients in cow. Justify the statement
6. Describe the function of trachea? Why do the walls not collapse even when there is less air in it?
7. Why is diffusion not sufficient to meet oxygen requirement of all the cells in multicellular organisms?
8. Name three kinds of blood vessels of the human circulatory system and write one function of each in a tabular from.
9. (*a*) What is translocation? Why is it essential for plants?
   (*b*) Where do the substances in plants reach as a result of translocation?
10. (*a*) What will happen to guard cells and the stomatal pore when water flows into guard cells.
    (*b*) How do plants transmit information from cell to cell?
11. Give reasons for the following:
    (*a*) The two ventricles have thicker muscular walls than the two atria in human heart.
    (*b*) The capillaries have walls which are one-celled thick.
12. How do artificial kidneys work?

Long Answer Type Questions

1. Name the organ and site of photosynthesis in green plants. What are the raw materials essential for this process? How are they obtained by green plant?
2. Draw a labelled diagram of cross-section of a leaf.
3. (*a*) Write the function of the following in the human alimentary canal:
   (*i*) Saliva
   (*ii*) HCl in stomach
   (*iii*) Bile juice
   (*iv*) Villi
   (*b*) Write one function each of the following enzymes:
   (*i*) Pepsin
   (*ii*) Lipase
4. In the experiment of preparing a temporary mount of a leaf peel to observe stomata, we use two liquids other than water. Name these two liquids and state when and why these liquids are used.

   List four precautions in proper sequence which we observe while preparing a temporary mount of a leaf peel.
5. Draw a diagram to show the human alimentary canal and label on it the following: Gall bladder, stomach. Name the longest part of the alimentary canal.
6. Draw a diagram of human respiratory system and label – pharynx, trachea, lungs, diaphragm and alveolar sac on it.
7. (*a*) Write the correct sequence of steps followed during journey of oxygen rich blood from lungs to various organs of human body.
   (*b*) What happens when the system of blood vessels develop a leak?
8. (*a*) Mention any two components of blood.
   (*b*) Plants can sustain slower transport needs. Justify.
   (*c*) Write the function of valves present in between atria and ventricles.

9. (*a*) Define excretion.

(*b*) Name the basic filtration unit present in the kidney.

(*c*) Draw excretory system in human beings and label the following organs of excretory system which perform following functions:

(*i*) forms urine.

(*ii*) is a long tube which collects urine from kidney.

(*iii*) store urine until it is passed out.

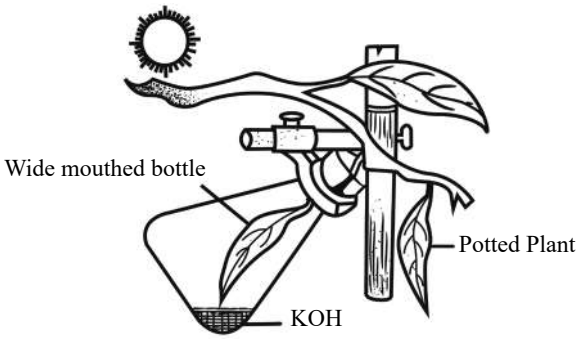
10. (*a*) Name the organs that form the excretory system in human beings.

(*b*) Describe in brief how urine is produced in human body.

Case-Based Type Questions

Case Study-I

The diagram given below represents an experiment to prove the importance of a factor in photosynthesis. Answer the question that follow:



1. Which factor is being studied here?

2. What is the purpose of keeping KOH in the flask?

3. Explain the term photosynthesis.

4. What will you observe when the leaf is tested for starch?

5. Write a well-balanced chemical equation for the process of photosynthesis.

Case Study-II

The diagram given here represents the relationship between a mouse and a physiological process that occur in green plants. Study the diagram and answer the question that follows. (2017)

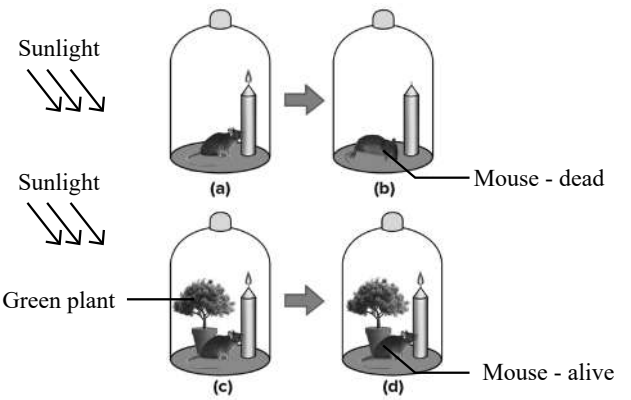
1. Name the physiological process occurring in the green plants that have kept the mouse alive.

2. Explain the physiological process mentioned above.

3. Why did the mouse die in the bell jar B?

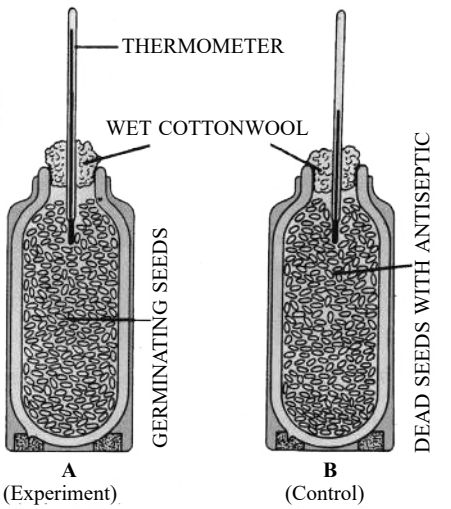
4. What is the significance of the process as stated in (1) for life on earth?

5. Reframe the above-mentioned physiological process in the form of a chemical equation.



Case Study-III

Look at the experiment setup A and B showing that heat is evolved during respiration when germinating seed are kept in the thermos flask.

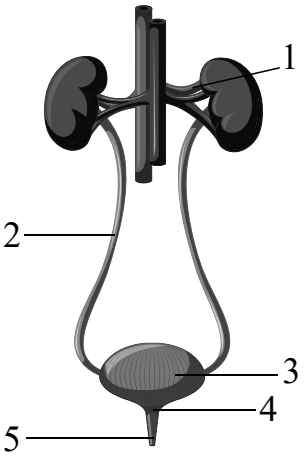


1. Why germinating seeds produce heat in the thermos flask A but not in B?

2. What will happen if we keep dry seeds in thermos flask B?

Case Study-IV

The diagram given below represents an organ system in the human body. Study the same and answer the questions that follow:

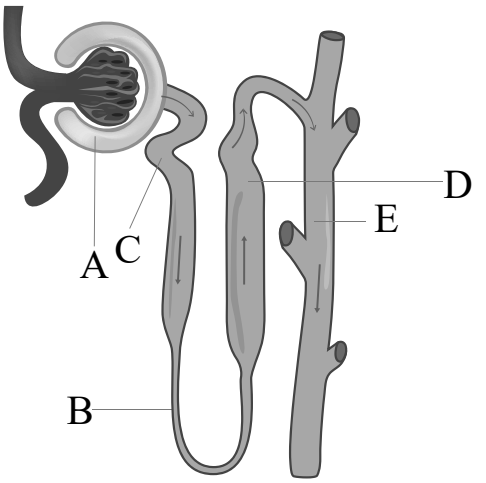


1. Identify the system.
2. Label the parts marked 2 and 4. Mention the function of part 5.
3. Name the structural and functional units of the part marked 1.
4. What is the fluid that accumulates in part 3?
5. What is the main nitrogenous waste present in it?

Case Study-V

1. The given figure depicts a single nephron from a mammalian kidney. Identify the labelled parts (A-E) and match them with the options (I-IV) given below.

(I) The site of ultrafiltration.
(II) Collection and concentration of urine.
(III) The main area for the reabsorption of glucose and amino acids.
(IV) Mainly responsible for the maintenance of the pH of blood.



(*a*) (I)-A, (II)-E, (III)-C, (IV)-D
(*b*) (I)-A, (II)-B, (III)-C, (IV)-A
(*c*) (I)-B, (II)-A, (III)-C, (IV)-E
(*d*) (I)-E, (II)-B, (III)-D, (IV)-A

Competitive Level

Life Processes?

1. How life on the Earth depends on carbon based molecules?

Life on Earth is fundamentally dependent on carbon-based molecules, and carbon is a key element in the organic compounds that form the building blocks of living organisms. Here are several ways in which life on Earth relies on carbon-based molecules:

✦ **Organic Molecules:**

Carbon is unique in its ability to form diverse and complex molecules due to its tetravalent nature, allowing it to bond with up to four other atoms. This property is crucial for the formation of organic molecules, including carbohydrates, lipids, proteins, and nucleic acids—the fundamental components of living cells.

✦ **Cellular Structure:**

The structural framework of living organisms is composed of carbon-containing molecules. Carbohydrates provide energy and serve as structural components, lipids form cell membranes, proteins perform various functions within cells, and nucleic acids (DNA and RNA) carry genetic information.

✦ **Energy Storage:**

Carbon-based molecules, such as glucose and other carbohydrates, serve as energy storage molecules in the living organisms. Through processes like cellular respiration, organisms can break down these carbon compounds to release energy for various cellular activities.

Table-5 Comparison of Heart Sounds- Lubb and Dubb.

S.No.	Lubb	Dubb
1.	Sound lubb is low pitched.	Sound dubb is sharp and high-pitched.
2.	Occurs for longer duration i.e., for 0.15 seconds.	Occurs for duration of 0.12 seconds.
3.	It occurs due to closure of bicuspid valve and tricuspid valve during contraction of ventricles.	It occurs due to closure of semilunar valve during ventricular diastole.

Heartbeat

- The heart shows regular contraction and relaxation.
- In a child, the heart beat varies from 90 to 100 times a minute. In an adult, heart beat varies from 70-72 times per minute.
- Heartbeat increases when you do some extra work, such as running, cycling or when you are excited or under stress, This can be felt as an increase in the thumping or throbbing of the heart.
- Heart beat originates at the **Sino-Atrial Node** or **S.A Node** which is a modified part of the muscular wall of the right atrium chamber.
- Since, sino-atrial node initiates and regularizes the heartbeat, it is also called the pacemaker. The **pacemaker** is influenced by nerves, hormones, CO_2 and O_2 content of blood, heat, etc.
- The device that amplifies the sound of a person's heart beat is called a stethoscope and consists of a chest piece that holds a sensitive diaphragm.
- **The electrocardiograph (ECG)** is a machine that records the electrical activity of the heart over a period of time using electrodes placed on skin.

Cardiac Cycle

- One complete contraction (**systole**) and relaxation (**diastole**) of the heart is called a heartbeat. The sequence of events which takes place during the completion of one heartbeat is called the **cardiac cycle**.

Steps of cardiac cycle:

- **Joint diastole:** During the time when the muscles of all four chambers of the heart are relaxed, the blood return to the heart under low pressure and enters the two atria. Blood from large veins, called **vena cava**, pours into right atrium. This blood comes from head, upper body parts and lower body parts where oxygen has been used up and the blood is free from oxygen, i.e., deoxygenated. At the same time, the pulmonary vein from lungs pours oxygenated blood into the left atrium. Thus, the oxygenated blood enters the left atrium.
- **Atrial systole:** As the right and left atria fill with blood, pressure in them rises so that the valves between left atrium and left ventricle **(bicuspid valve)** and between right atrium and right ventricle (**tricuspid valve**) open and the atria contract. Atrial contraction forces pumping of deoxygenated blood from right atrium into the right ventricle through tricuspid valve and oxygenated blood from left atrium into left ventricle through bicuspid valve.
- **Ventricular systole:** It involves contraction of ventricles. During contraction of ventricles, the deoxygenated blood from right ventricle flows to the lungs through pulmonary artery and the oxygenated blood from left ventricle is distributed to all the parts of the body through the largest artery, called **aorta**.

Knowledge Hub

Heart Attack

Heart attack is a medical condition when the supply of blood gets blocked due to blood clot or any other blockage. Many times cholesterol get deposited within the blood vessels, supplying blood towards heart and clog the pathway of blood. This condition is commonly called **coronary heart disease (CHD)**. CHD is a common cause for heart attack to happen.

Heart failure means the state of heart when it is not pumping blood effectively enough to meet the needs of the body. It is sometimes called congestive heart failure because congestion of the lungs is one of the main symptoms of this disease. Heart failure is not the same as **cardiac arrest** (when the heart stops beating) or a **heart attack** (when the heart muscle is suddenly damaged by an inadequate blood supply).

Multiple Choice Questions

1. The internal (cellular) energy reserve in autotrophs is called _____.

(*a*) glycogen (*b*) starch

(*c*) protein (*d*) fatty acid

2. The first step in photosynthesis is:

(*a*) conversion of light energy into chemical energy.

(*b*) reduction of carbondioxide.

(*c*) absorption of light energy by chlorophyll.

(*d*) formation of carbohydrates.

3. Which of the following events in the mouth cavity will be affected if salivary amylase is absent in the saliva?

(*a*) Starch hydrolysis into sugars.

(*b*) Proteins hydrolysis into amino acids.

(*c*) Absorption of vitamins.

(*d*) Fats breaking down into fatty acids and glycerol.

4. From the options given, identify the event that doesn't occur in the photosynthesis.

(*a*) Oxidation of carbon to carbon dioxide.

(*b*) Absorption of light energy by the chlorophyll.

(*c*) Reduction of carbon dioxide to carbohydrates.

(*d*) Conversion of light energy into chemical energy.

5. In which order do these events occur in human nutrition?

(*a*) Digestion → ingestion → absorption → assimilation

(*b*) Digestion → ingestion → assimilation → absorption

(*c*) Ingestion → digestion → absorption → assimilation

(*d*) Ingestion → digestion → assimilation → absorption

6. The enzymes pepsin and trypsin are secreted respectively by:

(*a*) stomach and pancreas.

(*b*) salivary gland and stomach.

(*c*) liver and pancreas.

(*d*) liver and salivary gland.

7. Which of the following is not a component of pancreatic juice

(*i*) Amylase

(*ii*) Hydrochloric acid

(*iii*) Mucus

(*iv*) Trypsin

(*a*) (*i*) and (*ii*) (*b*) (*i*) and (*iv*)

(*c*) (*ii*) and (*iii*) (*d*) (*i*) and (*iii*)

8. When a few drops of iodine solution are added to rice water, the solution turns blue- black in colour. This indicates that rice water contains:

(*a*) fats (*b*) glycogen

(*c*) starch (*d*) simple proteins

9. Which of the following statements are correct.

(*i*) Saliva has salivary amylase to digest protein.

(*ii*) The pH of human saliva is 3.8.

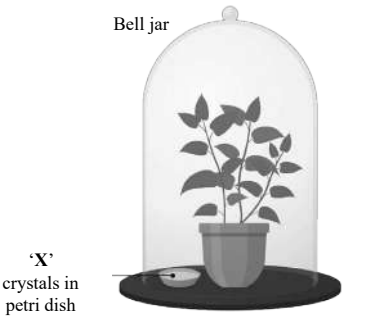
(*iii*) Fats get digested completely in the small intestine.

(*iv*) The pH of human saliva is 6.5 to 6.8 PH.

(*a*) (*i*) and (*iv*) (*b*) (*i*) and (*ii*)

(*c*) (*i*) and (*iii*) (*d*) (*iii*) and (*iv*)

10. The given figure is a demonstration of an experiment to show that carbon dioxide is essential for photosynthesis. What is the substance "X" , kept in petri dish?



(*a*) Potassium hydroxide

(*b*) Sodium bicarbonate

(*c*) Sodium carbonate

(*d*) Potassium sulphate

11. The diagram shows an experiment to investigate the balance between respiration and photosynthesis.

In which tube are photosynthesis and respiration taking place at the same time?

22. Which of the following is correct regarding capillaries?

(*a*) Thick walled blood vessels that carry blood from the heart to all the parts of the body.

(*b*) Thin walled blood vessels and are extremely narrow tubes which connect arteries to veins.

(*c*) Thin walled blood vessels which carry blood from all the parts of body to the heart.

(*d*) Thick walled blood vessels which carry blood from all the parts of body to the brain.

23. Agranulocytes are:

(*a*) Lymphocytes, Monocytes

(*b*) Lymphocytes, Basophils

(*c*) Eosinophils, Basophils

(*d*) Eosinophils, Monocytes

24. Your blood alternates between your body's pulmonary circuit and systemic circuit through various vessels and chambers. Below is a list of vessels and structures that are associated with your heart. What is the correct order for the flow of blood entering from the systemic circulation?

1. Right atrium
2. Left atrium
3. Right ventricle
4. Left ventricle
5. Vena cava
6. Aorta
7. Pulmonary trunk
8. Pulmonary veins

(*a*) 1, 7, 3, 8, 2, 4, 6, 5

(*b*) 1, 2, 7, 8, 3, 4, 6, 5

(*c*) 5, 1, 3, 8, 7, 2, 4, 6

(*d*) 5, 1, 3, 7, 8, 2, 4, 6

25. Which among the following procedures is used for cleaning the blood of a person by separating the waste substance from it?

(*a*) Kidney transplant (*b*) Blood transfusion

(*c*) Dialysis (*d*) Hydrolysis

26. The waste materials in plants are stored in the form of:

(*a*) water (*b*) gums and resins

(*c*) minerals (*d*) carbohydrates

27. What is the correct pathway of transport of urine in our body.

(*a*) Kidney → ureter → urethra → urinary bladder

(*b*) Kidney → urinary bladder → urethra → ureter

(*c*) Kidney → ureter → urinary bladder → urethra

(*d*) Urinary bladder → kidney → ureter → urethra

28. What is the function of the glomerulus and Bowman's capsule of the nephron?

(*a*) Filtration of blood

(*b*) Re-absorption of ions from blood

(*c*) Re-absorption of hormones from blood

(*d*) Re-absorption of water from blood

29. Which substances out of the following in the dialysis fluid should be at a lower concentration than in the blood of patient?

(*a*) Salt and urea

(*b*) Glucose and amino acid

(*c*) Glucose and urea

(*d*) Glucose and salts

Competitive Corner

1. Identify the correct statements related to dark reaction of photosynthesis. **[2017 Kerala]**

(*i*) Takes place in the stroma of chloroplasts

(*ii*) Formation of ATP

(*iii*) Formation of glucose

(*iv*) Evolution of oxygen

(*a*) (*i*) and (*ii*)

(*b*) (*ii*) and (*iii*)

(*c*) (*i*) and (*iii*)

(*d*) (*ii*) and (*iv*)

2. Mode of nutrition in *cuscuta* is: **[Haryana 2018]**

(*a*) saprophytic

(*b*) autotrophic

(*c*) parasitic

(*d*) insectivorous

3. By whom was dark reaction of photosynthesis discovered? **[Orrisa 2018]**

(*a*) Calvin (*b*) Hill

(*c*) Johnson (*d*) Mitchell

Explanations

School Level

Quick Recall

Fill in the Blanks

1. Stomata **2.** Heterotrophy
3. Chloroplast **4.** Iodine
5. Peristalsis **6.** Pepsin
7. Bile **8.** Alveoli
9. Epiglottis **10.** Inhalation
11. Alcoholic fermentation
12. Red **13.** Diastolic
14. Active **15.** Pulmonary, oxygenated
16. Left ventricle **17.** Urea
18. Nephron **19.** Reabsorption
20. Urinary bladder

True and False Statements

1. False **2.** True **3.** False
4. False **5.** False **6.** False
7. False **8.** True **9.** True
10. False **11.** True **12.** False
13. False **14.** False **15.** False
16. True **17.** False **18.** True
19. True **20.** False

Match the Following

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

Multiple Choice Questions

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

Assertion & Reason Type Questions

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

Statement Type Questions

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

Subjective Questions

Very Short Answer Type Questions

1. Desert plants absorb carbon dioxide during night when stomata opens. It is stored as an acidic intermediate. This intermediate is broken down during the day to release carbon dioxide. Reduction of carbon dioxide is done during the day when chemical energy is created by using light energy.

2. 'X' is Photolysis of water

3. Small intestine

4. Sphincters are the muscles that control the passage of food between parts of the alimentary canal. They open and close in a regulated fashion which ensures that food is exposed to actions of a part of the gut for the required time.

5. ADP contains 2 phosphate groups which make ADP negatively charged. So, there will be repulsions between ADP and phosphate like between similar poles of magnets. But, energy can keep these poles together just like energy can keep ADP and a third phosphate together as ATP.

6. Alveoli is the site of exchange of gases. Oxygen from inhaled air diffuses across the membrane to the blood where it is carried by hemoglobin.

7. During vigorous exercise oxygen is consumed rapidly which makes our blood deficient. Brain can detect this and increase breathing and heart rate. Increased breathing brings more oxygen supply and the heart supplies it to the body where it is needed.

8. (*c*) Valves ensure that the blood does not flow backwards.

9. Phloem

10. At night transpiration is negligible but absorption of water from roots continues. This creates a root pressure that pushes water through the xylem and allows transport.

12. Blood from the patient is pumped into a machine which has membranes. The membrane separated the chamber of blood from the chamber of dialysing fluid. The fluid is low in urea whereas blood has a higher concentration. This allows urea to be removed. The fresh dialysing solution continuously gets in and waste is thrown out. Purified blood is returned to the body using pipes.

Long Answer Type Questions

1. Photosynthesis happens in leaves. The mesophyll cells in leaves are rich in chloroplasts where photosynthesis happens.

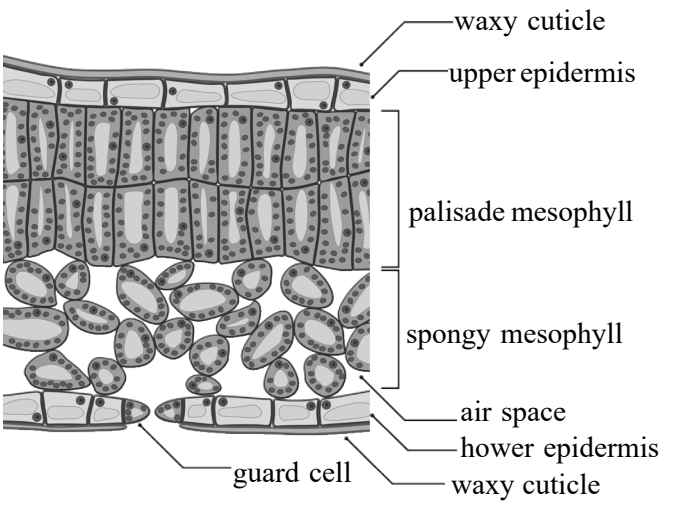
(i) Carbon dioxide: It is obtained from atmosphere.

(ii) Water: Plants absorb water from the soil through roots and transport to leaves.

(iii) Sunlight: Sunlight comes from the sun.

(iv) Chlorophyll: It is present in chloroplast found in green plants.

2.



3. (*a*) (i) Saliva moistens the food and also contains salivary amylase which digests starch partially

(ii) HCl activates pepsin and is anti-bacterial

(iii) Bile juice has bile salts which emulsify fat. They also neutralize the acidity due to HCl.

(iv) Villi increases the surface area of absorption and has a rich supply of blood vessels that carry the absorbed food away from the gut.

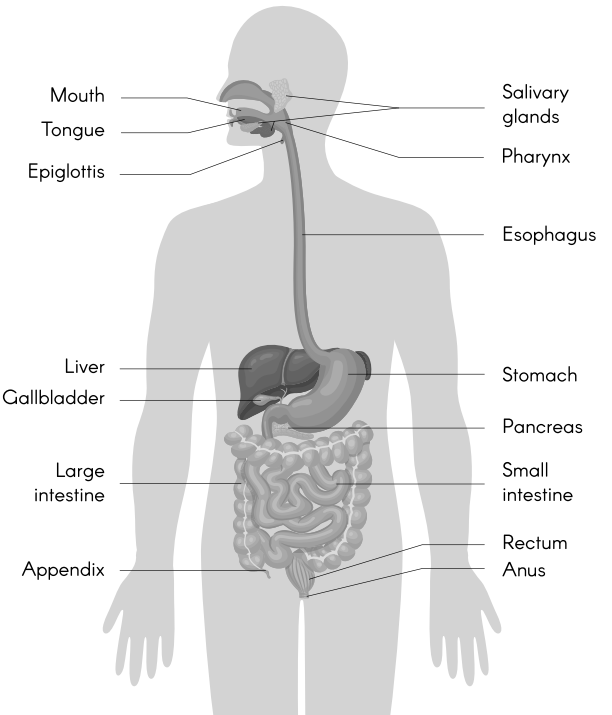
(b) (i) Pepsin digests proteins

(ii) Lipase digests fats

4. We use safranin to stain the cells so as to improve their visibility under microscope. We use glycerine to prevent drying of the cells. We must take the following precaution. Avoid folding the leaf too much. The peel should be snipped to a proper size.

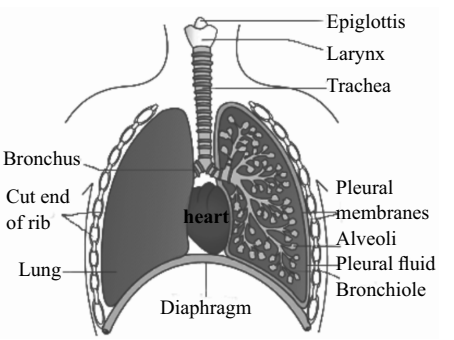
1. We should place the peel at the centre of the slide and the slides should be held from the sides.
2. Staining should be optimum.
3. We should use a brush to handle the peel to avoid damaging the cells.
4. Glycerins should be used in order to prevent drying of the peel.
5. Coverslip needs to be placed in such a way that air bubbles are avoided.

5.



Longest part of an alimentary canal is small intestine.

6.



7. (*a*) **Circulation**

(i) Circulation is the orderly movement of blood through the blood vessels.

(ii) It is pumped up by the heart, and the flow of blood is in a cyclic manner.

Steps followed during circulation are:

(i) The pulmonary veins carry the oxygenated blood from both the lungs to the left atrium.

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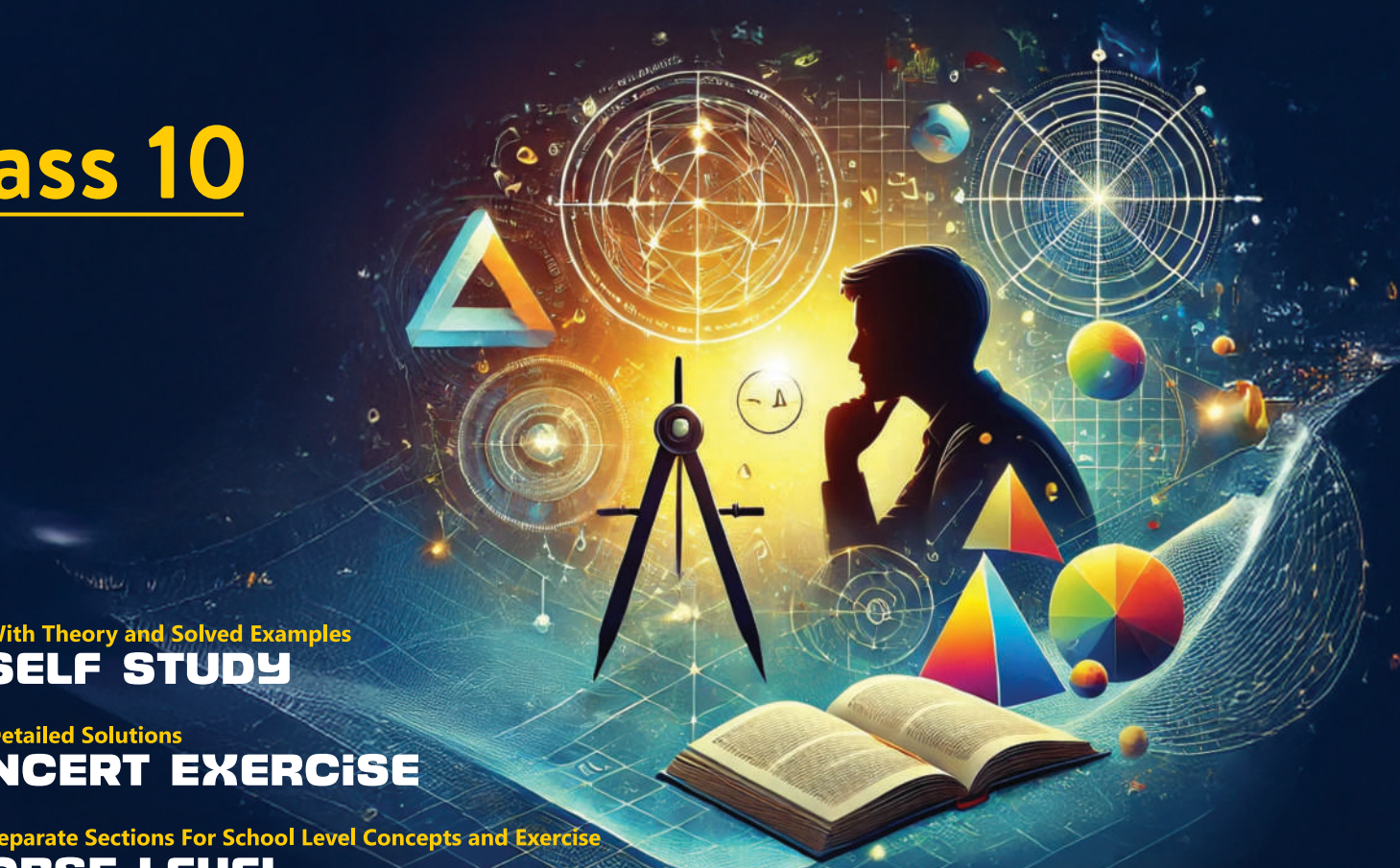

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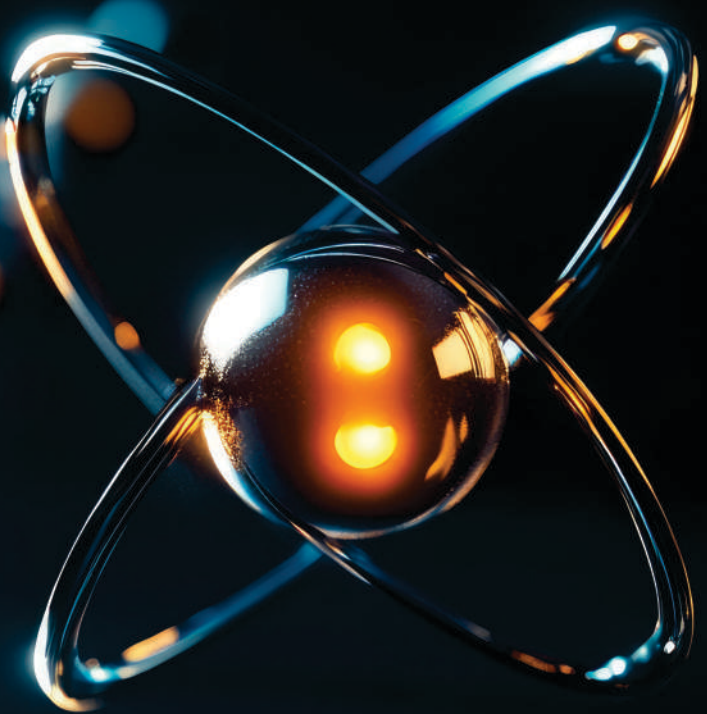

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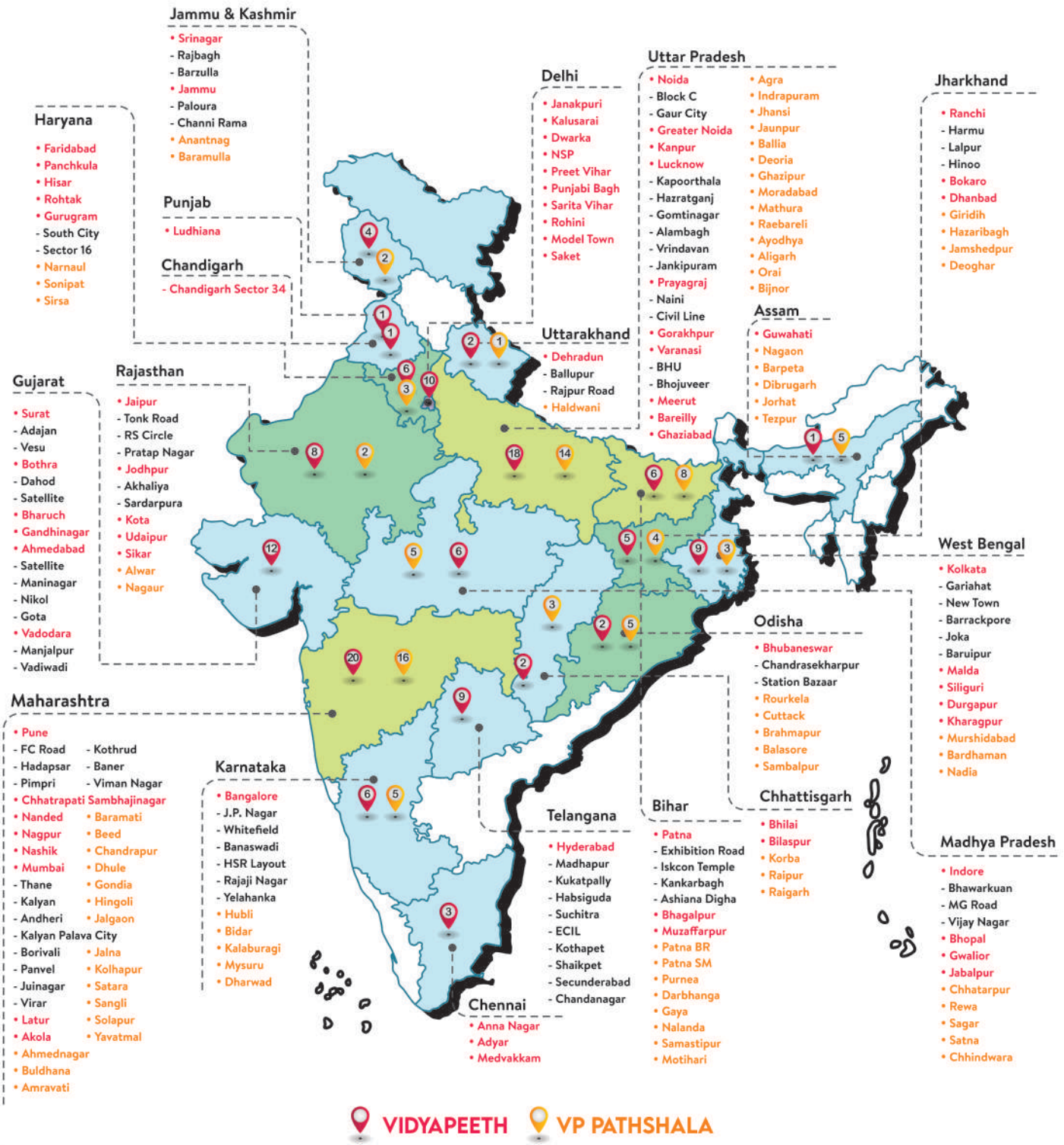

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