

# Life Processes I : Nutrition

## Quick Revision

The process wherein an organism uses food and obtains energy from it in order to carry out its functioning is called nutrition.

**Nutrients** are the substances required for proper growth and maintenance of a living body.

There are two modes of nutrition:

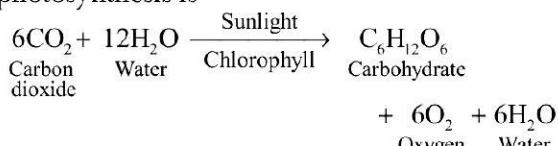
### 1. Autotrophic Mode of Nutrition

- Autotrophic nutrition is performed by the autotrophs that synthesise organic food in the form of carbohydrates from carbon dioxide and water in the presence of sunlight and chlorophyll to convert them into stored forms of energy.

This process of food synthesis is known as **photosynthesis**.

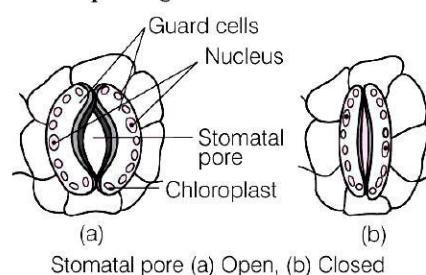
Examples of autotrophs are green plants (producers) and some bacteria.

- General reaction involved in the process of photosynthesis is



- Major events occurring in photosynthesis are
  - (i) **Absorption** of light energy by chlorophyll.
  - (ii) **Conversion** of light energy into chemical energy.
  - (iii) **Splitting** of water molecules into hydrogen and oxygen.
  - (iv) **Reduction** of carbon dioxide to carbohydrates.

- Leaves in green plants have some structures known as **chloroplasts** (containing chlorophyll) which are main site for the process of photosynthesis to occur.
- In leaf, some other structures are also present such as **stomata** (tiny pores present on the surface of the leaf) that participate in gaseous exchange during photosynthesis, but it is also responsible for large amount of water loss. These pores close when there is no need of carbon dioxide for photosynthesis. **Guard cells** are the bean-shaped cells that frame the stomatal openings.



- Each pair of guard cells is meant to control the opening of the stomata and hence control the rate of diffusion of gases and water vapour into and out of the leaf.
- Plants require some raw materials other than water like nitrogen, phosphorus, iron and magnesium that are taken up from the soil.
- Nitrogen is an essential component for the synthesis of proteins and other compounds. It is mainly taken up in the form of inorganic nitrates or nitrites or in organic form (prepared from N<sub>2</sub>).

## 2. Heterotrophic Mode of Nutrition

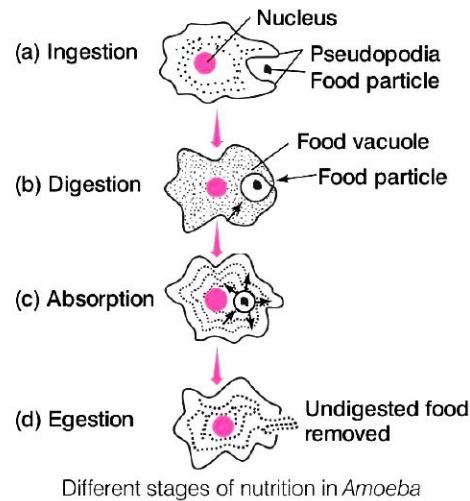
- Heterotrophic nutrition is performed by an organism that cannot make its own food and obtains it from other organisms. Thus, heterotrophs obtain carbon and energy from organic molecules already produced by the autotrophs.  
e.g. Herbivores, carnivores, omnivores, saprotrophs and parasites.
- Heterotrophic mode of nutrition can be of following three types
  - Holozoic nutrition** is the mode of nutrition in which herbivores (plant-eaters), carnivores (meat-eaters) and omnivores (both plant and meat-eaters) take complex molecules which are then broken down into simpler and soluble molecules,  
e.g. *Amoeba*, cow, goat, dog, cat, human being, etc.
  - Saprotrophic nutrition** is the mode of nutrition in which saprotrophs (organisms that have saprotrophic nutrition) feed on dead organic matter by breaking down complex materials outside the body and then absorb it, e.g. yeast and bacteria.
  - Parasitic nutrition** is the mode of nutrition in which parasites (an organism that live either on or into the body of another organism) obtain their nutrition without killing them. e.g. *Plasmodium*, ticks, lice, leech, tapeworm, flatworm, *Cuscuta* (Amarbel), etc.

## 3. Process of Nutrition in Different Organisms

As the food and the way it is obtained is different for different types of organisms, so there is different digestive system in various organisms.

### 4. Nutrition in *Amoeba*

- Amoeba* is a unicellular organism with holozoic mode of nutrition. It takes place with the help of temporary finger-like extensions called **pseudopodia**.
- Different stages of nutrition in *Amoeba* include **ingestion**, **digestion**, **absorption** and **egestion**.



## 5. Nutrition in Human Beings

Digestion is a catabolic process where complex and large components of food are broken down into simpler forms with the help of hydrolytic enzymes which are absorbed by different parts of the body. The digestive system of humans constitutes a long tubular **alimentary canal** and **digestive glands**.

### I. Alimentary Canal

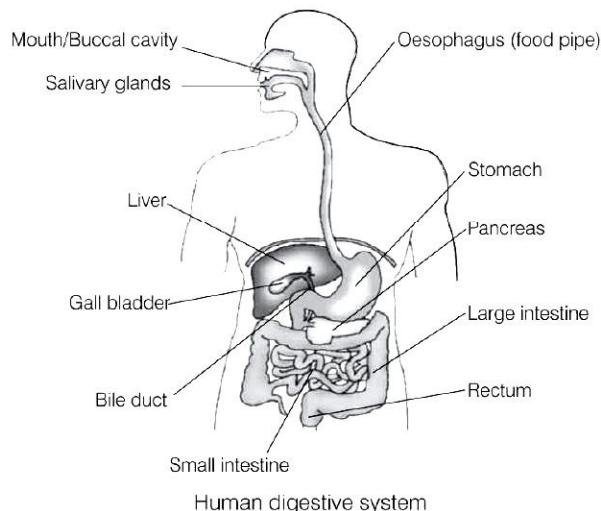
It is a long tube where the entire process of digestion takes place. It is an internal coiled tube, which runs from anterior mouth to the posterior anus.

The complete process of ingestion, digestion, absorption, assimilation and egestion of food material is carried out within the alimentary canal itself. The major portions of alimentary canal are discussed below

- Mouth** It acts as the first part of the digestive system from where the food enters into the alimentary canal. Mouth mainly comprised of two major parts
  - Tongue** It is a highly muscular sensory organ present at floor of buccal cavity. It bears several taste buds for basic taste such as sweet, bitter, salty, sour. Tongue also helps in mixing food with saliva.
  - Teeth** These are hard structures present on the bones of both lower and upper jaw.

Humans have 20 milk teeth and 32 permanent teeth. Four different types of teeth, are **incisors** (for cutting the food), **canines** (for tearing of food), **premolars** and **molars** (for crushing, chewing and grinding of food).

- (ii) **Pharynx** is small and funnel-shaped. It is located behind the oral cavity. It communicates with both oesophagus and trachea.
- (iii) **Oesophagus** It is a thin, long muscular tube that leads into stomach. Its opening is covered by leaf-like cartilaginous structure called epiglottis.
- (iv) **Stomach** It is the most dilated J-shaped part of the alimentary canal. This serves as a storehouse of food where partial digestion takes place through the secretion of gastric glands.
- (v) **Small Intestine** It is the longest part of alimentary canal which is the site of complete digestion of food into different components.
  - Secretions from liver and pancreas enter the intestine to help in the digestion process.
  - Small finger-like projections called **villi** are present and help in nutrient absorption.
  - Herbivores have longer small intestine as plants have cellulose that takes time to digest.
- (vi) **Large Intestine** Although shorter, but is called large intestine because it is wider in diameter than small intestine.
- (vii) **Rectum** It is the last and broad chamber like structure to store faecal matter temporarily.
- (viii) **Anus** It helps in exit of waste material.



## II. Digestive Glands

Various digestive glands are tabulated below.

Digestive Glands and their Position	Secretion	Enzyme	Digested Food
Salivary gland (Oral cavity)	Saliva	Salivary amylase	Starch (converts starch into maltose)
Gastric glands (Stomach)	Gastric juice	Pepsin, rennin and lipase	Protein, milk and lipids
Liver (above stomach)	Bile	None	Emulsify large fat droplets
Pancreas (behind stomach)	Pancreatic juice	Amylase, lipase, trypsinogen, chymotrypsinogen	Carbohydrate, fat, protein
Intestinal glands (Small intestine)	Intestinal juice	Erepsin, maltase, lactase, sucrase, lipase	<ul style="list-style-type: none"> <li>• Breaks down protein into amino acids.</li> <li>• Breaks maltose into 2 molecules of glucose.</li> <li>• Breaks lactose into glucose and galactose.</li> <li>• Breaks sucrose into glucose and fructose.</li> </ul>

## 6. Mechanism of Digestion of Food

Various steps involved in digestion of these nutrients are given below

- (i) **Ingestion** It is the process of food intake by mouth.  
Food moistened by saliva, before swallowing is masticated into smaller particles by teeth.
- (ii) **Digestion** Process of breaking down large organic molecules into smaller ones is called digestion.  
It is done with the help of enzymes.
- (iii) **Absorption of Food** Protein, carbohydrates, nucleic acids and nucleotides are absorbed by blood capillaries present in villi, while fats are absorbed by lymph ducts.

- Digested food is absorbed by small intestine. Lipid molecules are mainly absorbed by small intestine.
- (iv) **Assimilation** It is the distribution of digested food to various cells of the body. The food absorbed by villi reaches every cell of the body and is used to build/repair tissues.
- Peristaltic movements push the undigested food forward from small to large intestine.
- (v) **Egestion** It involves elimination of undigested food through anus. The remaining material after reabsorption of water and ions is stored in rectum temporarily and is then removed *via* anus.

## Objective Questions

### Multiple Choice Questions

- 01.** ..... liberated during photosynthesis comes from water.
- (a) Oxygen
  - (b) Chlorophyll
  - (c) Carbon dioxide
  - (d) Glucose
- 02.** Which of the following equations is the correct summary of photosynthesis?
- (a)  $6\text{CO}_2 + 12\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 + 6\text{H}_2\text{O}$
  - (b)  $6\text{CO}_2 + \text{H}_2\text{O} + \text{Sunlight} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + \text{O}_2 + 6\text{H}_2\text{O}$
  - (c)  $6\text{CO}_2 + 12\text{H}_2\text{O} \xrightarrow[\text{Sunlight}]{\text{Chlorophyll}} \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 + 6\text{H}_2\text{O}$
  - (d)  $6\text{CO}_2 + 12\text{H}_2\text{O} \xrightarrow[\text{Sunlight}]{\text{Chlorophyll}} \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{CO}_2 + 2\text{H}_2\text{O}$
- 03.** From which structure, the free oxygen gas produced during photosynthesis is released?
- (a) Epidermis
  - (b) Stomata
  - (c) Cortex
  - (d) Guard cell
- 04.** The internal (cellular) energy reserve in autotrophs is *(NCERT Exemplar)*
- (a) glycogen
  - (b) protein
  - (c) starch
  - (d) fatty acid
- 05.** Which of the following statements about the autotrophs is incorrect? *(NCERT Exemplar)*
- (a) They synthesise carbohydrates from carbon dioxide and water in the presence of sunlight and chlorophyll
  - (b) They store carbohydrates in the form of starch
- 06.** Which among the following organisms shows parasitic nutrition?
- (a) Cuscuta
  - (b) Bacteria
  - (c) Amoeba
  - (d) Goat
- 07.** In which of the following groups of organisms, food material is broken down outside the body and absorbed?
- (a) Mushroom, green plants, Amoeba
  - (b) Yeast, mushroom, bread mould
  - (c) Paramecium, Amoeba, Cuscuta
  - (d) Cuscuta, lice, tapeworm
- 08.** Select the correct statement. *(NCERT Exemplar)*
- (a) Heterotrophs do not synthesise their own food
  - (b) Heterotrophs utilise solar energy for photosynthesis
  - (c) Heterotrophs synthesise their own food
  - (d) Heterotrophs are capable of converting carbon dioxide and water into carbohydrates
- 09.** The remaining undigested food material is eliminated *via* ..... in case of *Amoeba*.
- (a) absorption
  - (b) digestion
  - (c) egestion
  - (d) ingestion

**10.** In which part of the alimentary canal, food is finally digested?

- |                     |                     |
|---------------------|---------------------|
| (a) Stomach         | (b) Mouth cavity    |
| (c) Large intestine | (d) Small intestine |

**11.** Stomach serves as the storehouse of food where complete digestion takes place.

- |               |                          |
|---------------|--------------------------|
| (a) True      | (b) False                |
| (c) Can't say | (d) Partially True/False |

**12.** Match the Column I with Column II and select the most appropriate one from the options given.

<b>Column I</b>	<b>Column II</b>
A. <i>Amoeba</i>	1. Extensive coiling
B. Trypsin	2. Pseudopodia
C. Liver	3. Pancreatic juice
D. Small intestine	4. Bile

#### **Codes**

A	B	C	D
(a) 1	2	4	3
(b) 2	1	3	4
(c) 2	3	4	1
(d) 2	3	1	4

**13.** An enzyme 'X' that converts starch to simple sugars is also the first enzyme to mix with food in the digestive tract. Identify 'X'.

- |            |                   |
|------------|-------------------|
| (a) Pepsin | (b) Amylase       |
| (c) Lipase | (d) None of these |

### **Assertion-Reasoning MCQs**

**Direction (Q.Nos. 14-18)** For the following question numbers two statements are given, one labelled as Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

- (a) Both A and R are true and R is the correct explanation of A
- (b) Both A and R are true, but R is not the correct explanation of A
- (c) A is true, but R is false
- (d) A is false, but R is true

**14. Assertion** (A) Leaves are the major photosynthetic organs of a plant.

**Reason** (R) They contain chloroplasts.

**15. Assertion** (A) *Amoeba* follows holozoic mode of nutrition.

**Reason** (R) It is unicellular and omnivore.

**16. Assertion** (A) Walls of the intestine has numerous villi.

**Reason** (R) These villi increase the surface area of digestion.

**17. Assertion** (A) Herbivores have longer small intestine.

**Reason** (R) Digestion of cellulose takes time.

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

**Reason** (R) Nutrients provide energy to an organism.

### **Case Based MCQs**

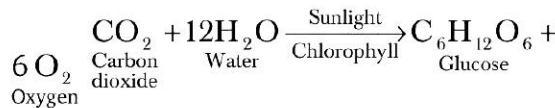
**19.** Read the following and answer questions from (i) to (v).

Green plants are called autotrophs, since they can photosynthesise and prepare their own food. Other organisms which depend on plants for food are heterotrophs.

Photosynthesis is the autotrophic mode of nutrition followed by green plants and some bacteria. In this process, light energy is converted into chemical energy which is later used to fuel cellular activities.

The process of photosynthesis takes place in chloroplasts through photosynthetic pigments like chlorophyll-*a*, chlorophyll-*b*, carotene and xanthophyll.

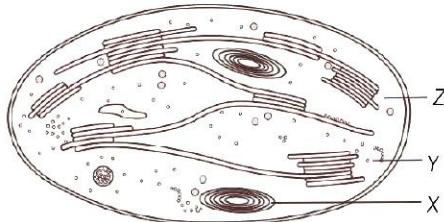
The byproduct of this physio-chemical process is oxygen and the whole reaction can be equated as



Sugars in the form of glucose and fructose are another byproduct of the process.

The first phase of the reaction is directly light driven hence called light reaction whereas the second phase is not directly light driven, but depends on the products of light reaction. This phase is called dark phase.

- (i) Which of the following is produced during light phase of photosynthesis?
  - (a) ATP
  - (b) NADPH
  - (c) Carbohydrate
  - (d) Both (a) and (b)
  
- (ii) Given below is the diagrammatic representation of a section of chloroplast. Identify X, Y and Z in the following diagram by choosing from the options below.



X	Y	Z
(a) Dark reaction	Light reaction	Carbohydrate synthesis
(b) Light reaction	Carbohydrate synthesis	Carbohydrate storage
(c) Light reaction	Carbohydrate storage	Carbohydrate synthesis
(d) Carbohydrate synthesis	Carbohydrate storage	Cytoplasmic inheritance

- (iii) Read the following statements and choose the statement that is incorrect with regard to photosynthesis.

- I. Photosynthesis occurs in all unicellular and multicellular organisms.
- II. It is a reductive process.
- III. Carbon dioxide is evolved as a byproduct in all the organisms capable of photosynthesising.
- IV. Dark reaction occurs in the stroma of the chloroplast.

#### Codes

- |  |             |
|--|-------------|
| (a) II only  | (b) IV only |
| (c) II and III   | (d) II only |
| <b>(iv) In the overall process of photosynthesis, how many sugar molecules are produced?</b> |             |
| (a) 6  | (b) 12      |
| (c) 4  | (d) 1       |
| <b>(v) The table below states few differences between light and dark reactions.</b>          |             |

<b>Light reaction</b>	<b>Dark reaction</b>
I. It is also called biosynthetic phase	It is also called photosynthetic phase
II. Takes place in thylakoids	Takes place in stroma
III. Reaction leads to production of ATP and NADPH	Reaction consumes ATP and NADPH
IV. It depends on light	It depends only on products formed during light reaction

Which of the following is the correct group of differences?

- |                   |                    |
|-------------------|--------------------|
| (a) I, II and III | (b) II, III and IV |
| (c) II and III    | (d) I and IV       |

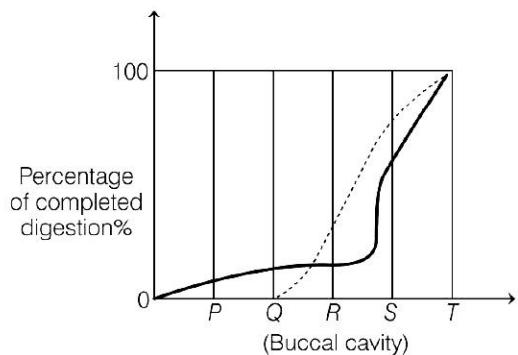
- 20.** Read the following and answer questions from (i to v).

Food is the basic requirement of all living beings. It provides energy and organic materials for cell growth and repair. The major components of food include carbohydrates, fats, proteins, vitamins, water and minerals.

The food that we intake is complex in nature and so, it becomes necessary to convert into simple and absorbable form. This happens by digestion.

The human digestive system consists of gastrointestinal tract plus the accessory organs of digestion. It involves breaking down of food into smaller components until they are absorbed.

Sections *P* to *T* represent different parts of the alimentary canal.



(i) Identify the part of alimentary canal that is *R* and *S*.

- (a) Stomach and gall bladder
- (b) Gall bladder and Oesophagus
- (c) Stomach and small intestine
- (d) Pancreas and stomach

(ii) The table show nutrients present in our foods.

Foods	Carbohydrates	Fat	Protein
<i>P</i>	✓	✗	✓
<i>Q</i>	✗	✗	✓
<i>R</i>	✗	✓	✗
<i>S</i>	✓	✓	✗

Which foods would both be partly digested in the stomach?

- (a) *P* and *Q*
- (b) *P* and *R*
- (c) *Q* and *S*
- (d) *R* and *S*

(iii) Only two of the following statements accurately describe what happens in the mouth?

- I. Amylase breaks down large starch molecules into smaller maltose molecules.
- II. Chewing increases the surface area of food for digestion.
- III. Saliva emulsifies fats into smaller droplets.
- IV. Teeth breakup large insoluble molecules into smaller soluble molecules.

Which statements are correct?

- (a) I and II
- (b) III and IV
- (c) II and III
- (d) I and IV

(iv) When a person eats raw egg white, protein and water enter the stomach.

Which substances are found leaving the stomach and leaving small intestine?

Leaving the stomach	Leaving the small intestine
(a) Amino acid and water	Amino acid and water
(b) Fatty acid, glycerol and water	Fatty acid, glycerol and water
(c) Protein and water	Fatty acid and glycerol
(d) Protein, amino acid and water	Water

(v) If we take food rich in lime juice, then

- (a) action of ptyalin on starch is enhanced
- (b) action of ptyalin on starch is reduced
- (c) action of ptyalin on starch is unaffected
- (d) action of ptyalin on starch is stops

## ANSWERS

### Multiple Choice Questions

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

### Assertion-Reasoning MCQs

14. (a)    15. (b)    16. (c)    17. (a)    18. (b)

### Case Based MCQs

19. (i)-(d), (ii)-(b), (iii)-(c), (iv)-(d), (v)-(b)

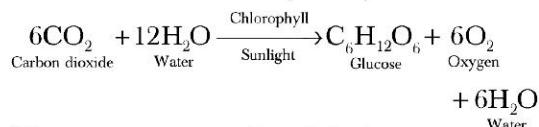
20. (i)-(c), (ii)-(a), (iii)-(a), (iv)-(d), (v)-(b)

## EXPLANATIONS

1. Oxygen liberated during photosynthesis comes from water. The following events occur during photosynthesis

- (i) Absorption of light energy by chlorophyll.
- (ii) Conversion of light energy to chemical energy and splitting of water molecules into hydrogen and oxygen.
- (iii) Reduction of carbon dioxide to carbohydrates, which is used as food for plants.

2. The correct reaction of photosynthesis is



3. The oxygen gas produced during photosynthesis is released into the surroundings through stomata. Stomata are also called site of gaseous exchange.

4. In autotrophs, the cellular energy reserve is starch. However, carbohydrates serve as a major fuel in the cells to provide energy for life processes.

The sugar (glucose) produced that is not used immediately gets stored in the form of starch in plants.

In animals, food is stored in the form of glycogen. These food reserves provide energy as and when required by the organisms.

5. Autotrophs can convert carbon dioxide and water into carbohydrates only in the presence of sunlight.

6. *Cuscuta* is a parasitic plant that obtains its nutrition from other plants by growing on them.

7. Yeast, mushroom and bread mould are fungi having heterotrophic mode of nutrition. They break down the dead organic matter into small particles outside their body and then absorb it.

8. Heterotrophs are those organisms which cannot make their own food from inorganic substances like  $\text{CO}_2$  and water as they do not have chlorophyll to trap solar energy, e.g. all animals, most bacteria and fungi.

They depend on other organisms for their food.

Autotrophs synthesise their own food through photosynthesis by utilising solar energy, e.g. green plants.

9. Egestion involves elimination of remaining undigested food material by rupturing of cell wall at any time.

10. Small intestine is the site of complete digestion of all the nutrients present in food.

11. False; stomach serves as a storehouse of food where partial digestion takes place.

12. Pseudopodia are temporary extensions at the surface of *Amoeba* which facilitates movement. Trypsin is produced by the pancreas.

Liver is responsible for bile production. Small intestines show extensive coiling.

13. Salivary amylase is the first enzyme that mixes with food and converts starch to simple sugars.

- 14.** Both A and R are true and R is the correct explanation of A.

Chloroplasts capture light energy and produce free energy as ATP and NADPH via photosynthesis.

- 15.** Both A and R are true, but R is not the correct explanation of A.

*Amoeba* does not have any specialised organ for nutrition and the entire process of digestion occurs with the help of pseudopodia.

This involves ingestion, digestion and egestion of food material.

- 16.** A is true, but R is false.

All the digested food is taken up by the walls of intestine, which has numerous villi. These increase the surface area for absorption.

- 17.** Both A and R are true and R is the correct explanation of A. Herbivores depend upon plant and grass based food that is formed of cellulose which takes time to digest.

- 18.** Both A and R are true, but R is not the correct explanation of A.

Raw materials needed for photosynthesis are carbon dioxide, water and minerals like nitrogen, phosphorus, iron and magnesium.

Nutrients are the substances required for proper growth and maintenance of a living body as they provide energy to an organism.

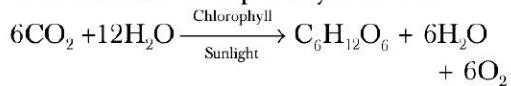
- 19.** (i) In light reaction of photosynthesis, energy rich ATP molecules and reduced coenzyme NADPH are produced.

- (ii) Light reactions of photosynthesis occurs in grana thylakoids.

Dark reaction involving carbohydrate synthesis by  $\text{CO}_2$  fixation occur in stroma of chloroplast. Matrix of chloroplast stores starch temporarily as starch granules.

- (iii) Photosynthesis is a biochemical process with oxygen as its output or byproduct. It is the air that we breathe in and is necessary for our survival.

- (iv) Overall reaction of photosynthesis is



No. of glucose (sugar) molecules produced is 1.

- (v) Statements II, III and IV are correct, whereas I is incorrect and can be corrected as Light reaction is also called photochemical reaction whereas dark phase/reaction occurs in stroma and are called biochemical phase.

- 20.** (i) R represents stomach and S represents small intestine.

- (ii) Foods containing carbohydrate and proteins are digested partially in the stomach. However, their complete digestion occurs in small intestine.

- (iii) Statements I and II are correct, while III and IV are incorrect and can be corrected as Saliva does not emulsify fats into smaller droplets, but does play a role in converting undigested starch to sugar (maltose).

Teeth break the food into smaller pieces or help in chewing the food (mastication) and mix it with saliva in order to make it easily soluble.

- (iv) In stomach, egg white is broken down to amino acid. It contain albumin protein which is not completely broken down. Some of it, is further hydrolysed in intestine from where amino acids are absorbed by blood.

- (v) Amylase also called ptyalin breaks down starch into simpler sugars and works at a pH of 6.7.

If food rich in lime juice is taken the action of ptyalin on starch is reduced as lime juice creates acidic condition and the enzyme does not function in acidic conditions.

# 04(b)

## Life Processes II : Respiration

### Quick Revision

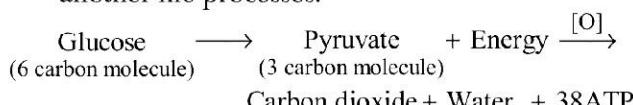
- Respiration is the process of **biochemical oxidation** of nutrients (occurring in cytoplasm of the cell) in the presence of specific enzymes at optimum temperature in the cells to release energy for metabolic activities.
- It is a **catabolic process** in which exchange of gases occurs *viz*, oxygen and carbon dioxide takes place between the body and the outside environment.  
Food + Oxygen → Carbon dioxide + Water + Energy
- Some organisms use oxygen, while some do not. Hence, in both the cases, the first step is the breakdown of glucose (six carbon molecule) into pyruvate (three carbon molecule).

#### 1. Types of Respiration

The conversion of pyruvate into another substance depends on either the presence or absence of oxygen.

- (i) **Aerobic respiration** is defined as the process of release of fairly large amount of energy in the presence of oxygen from the breakdown of the food substances.

The energy released is further utilised for another life processes.



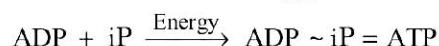
This process starts in the **cytoplasm** of a cell and continues in the **mitochondria**.

- (ii) **Anaerobic respiration** is described as the release of small amount of energy in the absence of oxygen from the breakdown of the food substances. It is also known as **fermentation**.

- This occurs in yeast, bacteria and in the human muscle.
- Anaerobic respiration produces only two molecules of ATP for each glucose molecule.

#### 2. ATP : The Energy Currency

- ATP stands for Adenosine Triphosphate, which is also known as the **energy currency of the cell**.
- It is mainly broken down to provide large amount of energy which can drive the endothermic reaction taking place in the cell.



where, iP = inorganic phosphate

#### 3. Stages of Respiration

Respiration takes place in three steps

- (i) Glycolysis, (ii) Krebs' cycle and (iii) Electron transport chain

#### 4. Respiration in Plants

- Plants exchange gases through stomata and large intercellular spaces.
- Root, stem and leaf of a plant are the parts involved in respiration. It is rapid in meristematic tissue and slower in mature regions.
- In roots of a plant, exchange of gases takes place by the process of **diffusion**.
- In woody plants, gaseous exchange occurs through the small pores in the stems called **lenticels**.
- In leaves, respiration takes place by diffusion of oxygen through **stomata** into the cells of the leaf from where carbon dioxide is released into the atmosphere.

## 5. Respiration in Animals

Some animals respire (i.e. take in oxygen and give out carbon dioxide) through their skin, while some through the organs. These organs are known as **respiratory organs**, which work together to constitute a respiratory system of an organism.

## 6. Respiration in Aquatic and Terrestrial Organisms

- The aquatic organisms (such as fishes etc) utilise the oxygen dissolved in water for respiration. Since, the amount of dissolved oxygen is fairly lower than the amount of oxygen in the air. Therefore, aquatic organisms breathe more rapidly (through mouth) to accumulate more and more oxygen.
- In **terrestrial organisms**, atmospheric oxygen is used for respiration and this oxygen is absorbed by different organs in different animals.

## 7. Respiration in Human Beings

- Process of respiration in human beings like other animals serves to provide fresh oxygen to all body cells and removes harmful carbon dioxide from the body.
- This process which follows the intake of oxygen is known as **inspiration** and giving out of carbon dioxide, known as **expiration**.

## 8. Parts and Functions of Respiratory System

Some parts and their functions are

- Nostrils** Air is taken into the body through nostrils (which filters air by fine hairs and mucus present in them).
- Nasal passage** Air entering from nostrils is led to the nasal passage responsible for conditioning of air.
- Pharynx** It is the common pathway for the air and the food. The flap-like structure, called epiglottis prevents food particles from going into the windpipe.
- Trachea (windpipe)** The air then passes from pharynx and goes into trachea which is a cylindrical tube that provides support and split into two bronchi.

(v) **Bronchi** Trachea divides into two, smaller tubes, called bronchi which extend into lungs.

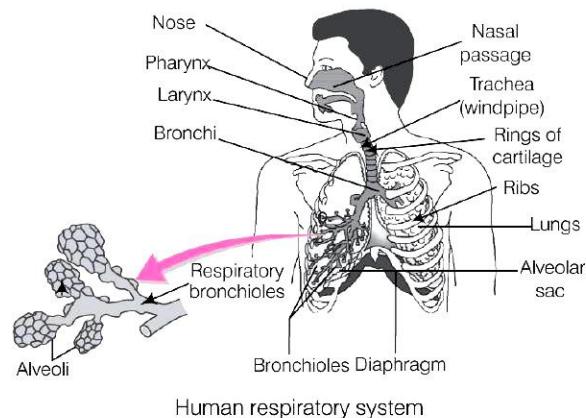
(vi) **Bronchioles** Bronchi is sub-divided into smaller tubes and form structures called bronchioles. Each bronchiole finally terminates into alveoli (balloon-like structure that provide surface for the exchange of gases).

(vii) **Alveoli** These are the air sacs occurring in clusters. Each one of these is surrounded by the networks of capillaries.

(viii) **Lungs** are major respiratory organs located on either side of the chest.

(ix) **Ribs** Lungs and heart are safely placed in it. Movement of intercostal muscles help in breathing.

(x) **Diaphragm** It forms the base of chest cavity and acts as a muscular partition between thorax and abdomen.



Mechanism of gaseous exchange in humans involves inhalation, gaseous exchange in alveoli and exhalation.

## 9. Respiratory Pigment

- Haemoglobin (which has very high affinity for oxygen) is the respiratory pigment in human beings.
- It is mainly responsible to carry oxygen from lungs to tissue, before releasing it. It is also responsible for the red colour of Red Blood Corpuscles (RBCs).

# Objective Questions

## Multiple Choice Questions

**01.** The breakdown of pyruvate to give carbon dioxide, water and energy takes place in (NCERT)

- (a) cytoplasm                                  (b) mitochondria  
(c) chloroplast                                (d) nucleus

**02.** What is observed when air is blown from mouth into a test tube containing lime water?

- (a) Lime water turns milky due to the CO<sub>2</sub> exhaled  
(b) Lime water becomes colourless due to exhaled CO<sub>2</sub>  
(c) Lime water turns milky due to water vapour in blown air  
(d) None of the above

**03.** The correct sequence of anaerobic reactions in yeast is (NCERT Exemplar)

- (a) Glucose  $\xrightarrow{\text{Cytoplasm}}$  Pyruvate  $\xrightarrow{\text{Mitochondria}}$  Ethanol + Carbon dioxide  
(b) Glucose  $\xrightarrow{\text{Cytoplasm}}$  Pyruvate  $\xrightarrow{\text{Cytoplasm}}$  Lactic acid  
(c) Glucose  $\xrightarrow{\text{Cytoplasm}}$  Pyruvate  $\xrightarrow{\text{mitochondria}}$  Lactic acid  
(d) Glucose  $\xrightarrow{\text{Cytoplasm}}$  Pyruvate  $\xrightarrow{\text{Cytoplasm}}$  Ethanol + Carbon dioxide

**04.** Which of the following structures is involved in gaseous exchange in woody stem of a plant?

- (a) Stomata                                      (b) Lenticel  
(c) Guard cell                                 (d) Epidermis

**05.** During vigorous physical exercise, lactic acid is formed from glucose inside the muscle cells because

- (a) there is lack of oxygen  
(b) there is lack of water  
(c) there is excess of carbon dioxide  
(d) None of the above

**06.** How does the exchange of gases occur in roots of a plant?

- (a) Through lenticels  
(b) Through root stomata  
(c) Through root hairs  
(d) None of the above

**07.** The product of alcoholic fermentation is

- (a) ethyl alcohol                                (b) methyl alcohol  
(c) propanol                                    (d) Butane

**08.** Efficient gaseous exchange requires the respiratory surface to be thin-walled.

- (a) True                                        (b) False  
(c) Can't say                                (d) Partially True/False

**09.** Terrestrial organisms use ..... for respiration.

- (a) atmospheric CO<sub>2</sub>                        (b) atmospheric O<sub>2</sub>  
(c) Stored oxygen                            (d) stored CO<sub>2</sub>

**10.** Which among the following is the respiratory pigment found in human body?

- (a) Haemoglobin                                (b) Chlorophyll  
(c) Plasma                                        (d) Trypsin

**11.** Which of the following is the first site for the exchange of inhaled air?

- (a) Blood capillaries of lungs  
(b) Alveoli of lungs  
(c) Left auricle of the heart  
(d) Blood capillaries adjacent to body cells

**12.** Which is the correct sequence of air passage during inhalation?

- (a) Nostrils → Larynx → Pharynx → Trachea → Lungs  
(b) Nasal passage → Trachea → Pharynx → Larynx → Alveoli  
(c) Larynx → Nostrils → Pharynx → Lungs  
(d) Nostrils → Pharynx → Larynx → Trachea → Alveoli

### Assertion-Reasoning MCQs

**Direction** (Q.Nos. 13-17) For the following question numbers two statements are given, one labelled as Assertion (A) and the other labeled as Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

- (a) Both A and R are true and R is the correct explanation of A
- (b) Both A and R are true, but R is not the correct explanation of A
- (c) A is true, but R is false
- (d) A is false, but R is true

**13. Assertion (A)** Alcoholic fermentation takes place in the absence of oxygen.

**Reason (R)** It occurs in yeast.

**14. Assertion (A)** Respiration is a biochemical process opposite to photosynthesis.

**Reason (R)** Energy is released during respiration.

**15. Assertion (A)** In woody plants, gaseous exchange occurs through lenticels.

**Reason (R)** Lenticels are specialised cells found along with stomata on the stem of woody plants.

**16. Assertion (A)** Lungs always contain a residual volume of air.

**Reason (R)** It provides sufficient time for oxygen to be absorbed and for carbon dioxide to be released.

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

**Reason (R)** It transports oxygen in the human body.

### Case Based MCQs

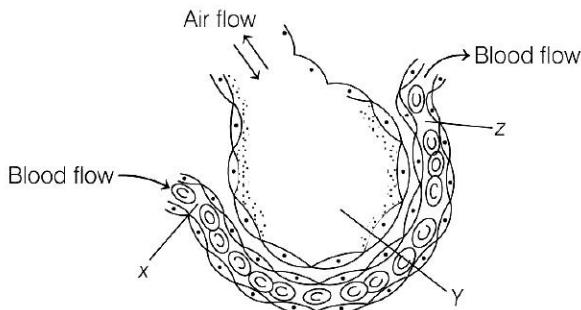
**18.** Read the following and answer any four questions from (i) to (v).

With the lungs, the passage divides into small tubes which finally terminate in

balloon-like structures which are called alveoli. The alveoli provide a surface where the exchange of gases can take place.

The walls of the alveoli contain an extensive network of blood vessels. As we breathe in, we lift our ribs and flatten our diaphragm and the chest cavity becomes large lift.

- (i) The diagram shows a section through an alveolus and a blood capillary.



What are the oxygen concentrations in X, Y and Z?

X	Y	Z
(a) High	Low	High
(b) High	Low	Low
(c) Low	High	High
(d) Low	High	Low

- (ii) Which of the following is characteristic of emphysema?

- (a) Destruction of alveolar walls
- (b) Increase in the growth of lung tissue
- (c) Inflammation of the walls of the bronchi
- (d) Thickening of the artery walls to the lungs

- (iii) Chemicals in tobacco smoke lead to the breakdown of the elastic tissue in the alveoli.

What is the name of this condition?

- (a) Bronchitis
- (b) Emphysema
- (c) Heart disease
- (d) Lung cancer

- (iv) What is the percentage of oxygen in expired air when a person is resting?

- (a) 8%
- (b) 16%
- (c) 12%
- (d) 20%

- (v) What happens during the process of breathing in?

<b>External intercostal muscles</b>	<b>Diaphragm</b>
(a) Contract	Arches
(b) Contract	Flattens
(c) Relax	Arches
(d) Relax	Flattens

- 19.** Read the following and answer any four questions from (i) to (v).

We need energy to perform various activities. This energy is derived from various components of food being catabolised. Proteins, fats, carbohydrates, etc., all catabolise in the presence of oxygen and carbon dioxide is released in the process.

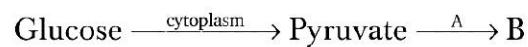
So, the body requires a continuous exchange of gases with oxygen from the atmosphere being taken inside and carbon dioxide being released.

In human beings, respiratory pigment, called haemoglobin present in RBCs has very high affinity for oxygen.

In tissues, gaseous exchange occurs between oxygenated blood and tissue cells.

- (i) People living at sea level have less number of RBCs in their blood when compared to those living at higher altitudes. This is because at high altitude
- (a) people eat nutritious food, so more RBCs are formed
  - (b) people get pollution free air to breathe, more oxygen is available
  - (c) presence of UV radiation in more amount enhances RBC production
  - (d) atmospheric  $O_2$  level is less, more RBCs are required to absorb required amount of  $O_2$  for survival

- (ii) The given equation is incomplete and shows breakdown of glucose into pyruvate and so on when a condition of vigorous exercise is observed. Which among the following products will be obtained?

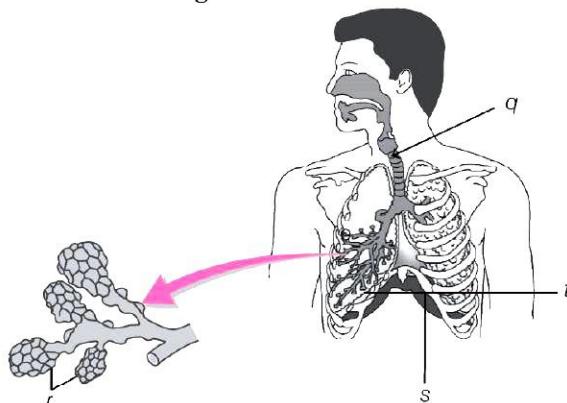


- (a) A-In muscle cells, B-Lactic acid, energy
- (b) A-In mitochondria, B-Lactic acid,  $CO_2$ , water
- (c) A-In muscles cells, B-Ethanol,  $CO_2$
- (d) A-In muscles cells, B-Lactic acid, ethanol

- (iii) Which one of the following is a possibility for most of us, in regard to breathing by making a conscious effort?

- (a) One can breathe out air totally without oxygen
- (b) One can breathe out air by closing both nose and mouth
- (c) Lungs can be made fully empty by forceful exhalation
- (d) One can consciously breathe in and out by moving the diaphragm alone, without any rib movement

- (iv) Refer to the given figure of Human Respiratory System and answer the following



Which of these parts

- I. Are actual sites of gaseous exchange?
- II. Is the common passage for food and air?
- III. Is provided with C-shaped cartilaginous rings?

- IV. Relaxe and get back to its shape during expiration?
- V. moves upward and outward during inspiration?
- (a) I-s, II-p, III-q, IV-r, V-t  
 (b) I-r, II-p, III-q, IV-s, V-t  
 (c) I-t, II-q, III-r, IV-s, V-p  
 (d) I-p, II-q, III-r, IV-s, V-t
- (v) Which of the following sequences is correct to initial inspiration?

- I. Contraction of intercostal muscles raises ribs and sternum.
- II. Volume of thorax increases
- III. Intrathoracic pressure of lungs decreases
- IV. Diaphragm contraction
- V. Air rushes into lungs
- (a)(I)→(II)→(IV)→(V)→(III)  
 (b)(I)→(II)→(III)→(IV)→(V)  
 (c)(I)→(IV)→(II)→(III)→(V)  
 (d)(V)→(I)→(II)→(III)→(IV)

## ANSWERS

### Multiple Choice Questions

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

### Assertion-Reasoning MCQs

13. (b)    14. (b)    15. (c)    16. (a)    17. (a)

### Case Based MCQs

18. (i)-(c), (ii)-(a), (iii)-(b), (iv)-(d), (v)-(b)

19. (i)-(d), (ii)-(a), (iii)-(b), (iv)-(b), (v)-(c)

## EXPLANATIONS

1. The breakdown of pyruvate to give carbon dioxide, water and energy requires the presence of oxygen and takes place in mitochondria.
2. Lime water when reacts with carbon dioxide, exhaled, is turns milky.
3. In yeast, the breakdown of pyruvate takes place in cytoplasm. Pyruvate converts into ethanol and carbon dioxide.
4. In the stems of woody plants, the exchange of respiratory gases takes place through lenticels. These are small openings in the pits of the bark.
5. During vigorous physical exercise, lactic acid is formed from glucose inside the muscle cells because there is lack of oxygen. Muscle cells respire anaerobically to produce lactic acid.
6. Gaseous exchange in roots of a plant occurs via root hair by the process of diffusion. During diffusion, oxygen diffuses in and carbon dioxide diffuses out of the root cells.
7. Ethyl alcohol is obtained as the product of alcoholic fermentation. This process involves release of small amount of energy.
8. For efficient gaseous exchange, respiratory surface should be thin-walled, moist, rich in blood supply and have large surface area.
9. Terrestrial organisms use atmospheric oxygen in order to respire.
10. The respiratory pigment found in human beings is haemoglobin.
11. Exchange of inhaled air occurs initially in the alveoli of lungs.
12. In humans, air passes from nostrils to pharynx, larynx, trachea and then to lungs.
13. Both A and R are true, but R is not the correct explanation of A.  
 Alcoholic fermentation is a type of anaerobic respiration that takes place where there is lack of oxygen. This process occurs in yeast.

- 14.** Both A and R are true and R is the correct explanation of A.

Respiration is defined as the process of biochemical oxidation of nutrients at cellular level. It occurs in the presence of specific enzymes at optimum conditions in the cells to release energy for various metabolic activities. However, it is opposite to photosynthesis where energy is stored in the form of carbohydrates.

- 15.** A is true, but R is false.

In woody plants, gaseous exchange occurs through the small pores found on stems called lenticels. Stomata on the stem aid in gaseous exchange, in herbaceous plants.

- 16.** Both A and R are true and R is the correct explanation of A.

During the breathing cycle, when air is taken in and thrown out, the lungs always contain a residual volume of air. It provides sufficient time for oxygen to be absorbed and for carbon dioxide to be released.

- 17.** Both A and R are true and R is the correct explanation of A. Haemoglobin is the respiratory pigment in human beings. It takes up oxygen from the air in the lungs and carries it to tissues.

- 18.** (i) A high concentration of oxygen in the alveolar air and low concentration in blood create a higher diffusion gradient. Blood leaving the alveoli contain a higher concentration of oxygen.  
(ii) Emphysema is a condition that involves damage of alveolar walls of alveoli of the lungs. These damaged alveoli cannot further support bronchial tubes.  
(iii) Tobacco smoke breathed in by heavy smokers suffering from chronic bronchitis often results in emphysema. The partition walls of the alveoli breakdown due to the intense cough resulting in a reduction in the surface area of alveoli for absorption of oxygen.  
(iv) Oxygen occupies about 20% by volume of air. Oxygen diffuses slowly across the alveoli walls into the blood capillaries. The absorption of oxygen by blood is limited by the diffusion gradient of oxygen and the rate of blood flow.

(v) During inspiration, the diaphragm contracts and flattens. The external costal muscles contract while the internal intercostal muscles relax. This increases the volume of the chest cavity.

- 19.** (i) RBCs count increases in people living at higher altitudes because there is a decrease in atmospheric pressure coupled with decreased oxygen levels. Thus, to carry more oxygen to the cells, RBCs (and thus more Haemoglobin) in higher number are required.

(ii) During vigorous exercise, there is lack of oxygen in the body, thus anaerobic respiration takes place in muscle cells and pyruvate is broken down to lactic acid and the energy is released.

- (iii) There stands no possibility of breathing out air totally without oxygen. The air that we breathe out has a certain percentage of oxygen.

Lungs cannot be made empty as there is always a certain volume of air that remains inside them in order to prevent their collapse. This volume is called residual volume.

The movement of diaphragm is very important during breathing process and it is impossible to breathe in or out without involving rib movement.

Eustachian tube associates the center ear depression and exhalation of air by conscious closure of mouth and nose turns the air towards eustachian tube and it gets out via middle ear.

- (iv) p-Pharynx, q-Trachea, r-Alveoli, s-Diaphragm, t-Rib cage

Alveoli are actual sites of gaseous exchange. Pharynx is a common passage for food and air. Trachea is provided with C-shaped rings. Diaphragm goes back to its original shape during expiration.

Rib cage moves upward and outward during inspiration.

- (v) Correct sequences is

$$\text{I} \rightarrow \text{IV} \rightarrow \text{II} \rightarrow \text{III} \rightarrow \text{V}$$

Firstly, the intercostal muscles raise ribs and sternum leading to contraction of diaphragm. As volume of thorax increases, intrathoracic pressure of lungs decreases and air rushes into lungs.

# 04(c)

## Life Processes III : Transportation

### Quick Revision

Transportation is a life process in which a substance absorbed (or made) in one part of the body of an organism is carried to other parts of the body through the circulating fluids like blood and lymph.

#### 1. Components of Transport System in Humans

The transport system of human beings consists of a circulating fluid called **blood**, which is pumped by a muscular organ known as **heart** and a system of interconnecting tubes, i.e. **blood vessels**.

#### 2. Blood

- It is a red-coloured fluid connective tissue that circulates in our body.
- It supplies nutrients and oxygen, to all living cells and collects waste products and carbon dioxide to be thrown out.
- It helps in regulation of pH and body temperature.

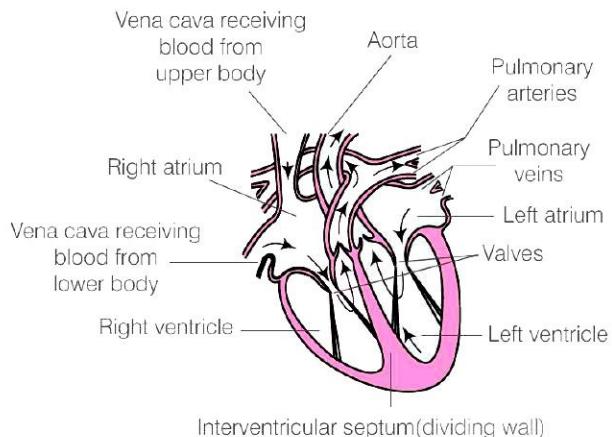
#### 3. Maintenance by Platelets

- It is usually done in case of injury when there is bleeding and loss of blood has to be minimised.
- To prevent leakage, platelet cells in blood circulate around the body and form a mesh-like structure or clot at the site of injury.
- Blood clotting is a mechanism that prevents the loss of blood at the site of an injury or wound by forming a blood clot.

#### 4. Heart

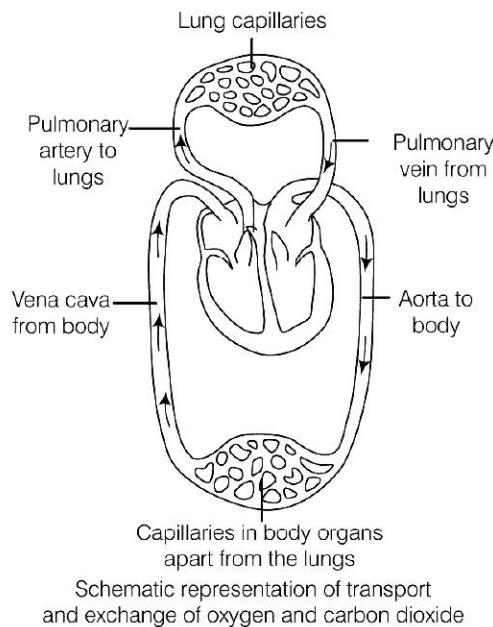
- The heart acts like a pumping machine in our body that pushes out the blood into the blood vessels.
- It is a muscular organ having size as big as our fist.

- The heart is situated between the lungs slightly towards the left side of the chest.
- Human heart is four-chambered (i.e. two **upper atria** and two **lower ventricles**).
- These different chambers are meant to prevent mixing of oxygenated (rich in oxygen) and deoxygenated (rich carbon dioxide) blood.



Schematic sectional view of the human heart

- Oxygen rich blood from lungs comes to thin-walled upper chamber of the heart, left atrium which relaxes (while collecting this blood) and contracts and transfer blood to left ventricle during which it expands, the left ventricle then contracts and blood is pumped to the body parts.
- Deoxygenated blood enters in right atrium and when it contracts, it transfers blood to right ventricle, which again pumps blood to the lungs for oxygenation.
- Ventricles have thick walls than atrium because they have to pump blood into various organs.



## 5. Blood Vessels

There are three types of vessels involved in blood circulation, i.e. arteries, veins and capillaries.

- (i) **Arteries** The arteries have thick, muscular and elastic walls which carry blood at high pressure. They do not have valves. They carry blood away from the heart to various organs of the body.
- (ii) **Veins** The veins have thin walls than arteries which carry blood at low pressure. They have valves to prevent the backflow of blood. They collect the blood from different organs and brings it back to the heart.
- (iii) **Capillaries** They are formed when artery divides into smaller tubes. They have valves to prevent the backflow of blood. The walls of capillaries are one cell thick. Exchange of materials between blood and surrounding thick cells takes place across the thin walls of capillaries.

## 6. Blood Circulation in Animals

- In birds and mammals, heart is four-chambered and oxygenated blood remains separated from deoxygenated blood.

- In fishes, two-chambered heart pumps blood to gills. There is no separation of pure and impure blood.
- In amphibians or reptiles, three-chambered heart is present. They can tolerate some mixing of oxygenated and deoxygenated blood.

## 7. Blood Circulation in Human

The blood circulatory system in human is an example of double circulation.

- (i) **Double circulation** The blood goes through the heart twice to supply blood once around the body. It is a **closed circulatory system**, i.e. blood travels around body inside the blood vessels. The following processes constitute the double circulation.
- (ii) **Pulmonary circulation** The movement of blood from heart to the lungs and back to the heart constitutes the pulmonary circulation.

Movement of blood in pulmonary circulation occurs in the following ways

Right ventricle pumps blood to the lungs for oxygenation via pulmonary artery.

Oxygenated blood then comes back to the left auricle of heart through four pulmonary veins, i.e. two from each lung.

The left atrium then contracts passing the blood to the corresponding expanded left ventricle (in the systemic circulation).

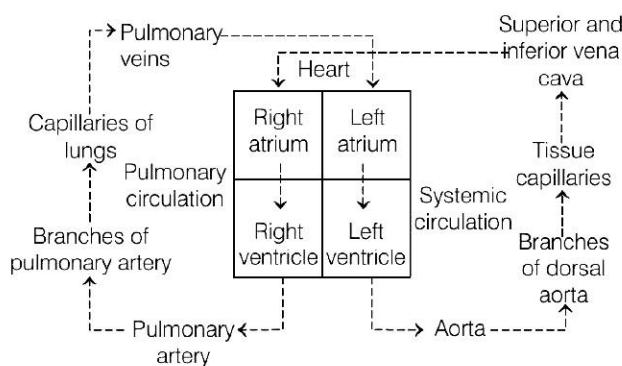
- (iii) **Systemic Circulation** The circulation of blood from heart to different parts of the body except lungs and back to the heart constitutes the systemic circulation. Movement of blood in systemic circulation occurs in the following ways

As the left ventricle fills up, it contracts forcing blood out.

The blood is finally, pumped to the whole body via aorta as the muscular left ventricle contracts.

The deoxygenated blood from the different body parts enters into the right atrium.

As the right atrium contracts, the blood passes into the corresponding lower chamber, i.e. the right ventricle.



## 8. Blood Pressure

- It is the pressure of circulating blood on the walls of blood vessels.
- Blood pressure is maximum during contraction of left ventricle and is known as systolic pressure. It is 120 mm Hg.
- The diastolic pressure is specifically the minimum arterial pressure during relaxation and dilation of the ventricles. It is 80 mm Hg.
- Blood pressure is measured by **sphygmomanometer**.

## 9. Lymph

- Apart from blood, lymph in our body is another type of fluid involved in transportation. This is also called **tissue fluid**.
- It is also meant to transport any digested and absorbed fat from intestine and drains excess fluid from extracellular space back into the blood.
- Lymph drains into lymphatic capillaries from the intercellular spaces, which join to form large lymph vessels that finally open into larger veins.

## 10. Transportation in Plants

- Plants lack a circulatory system. Short distance transport of certain materials occurs *via* diffusion whereas long distance transport requires a proper transportation system.
- Roots absorb raw materials, water and minerals from soil *via* diffusion.
- Plant transport system transports both food and water.
- Xylem** and **phloem** carry substances from one part of the plant body to the another.

- Xylem transports water and minerals obtained from the soil, whereas phloem (vascular tissue) transports products of photosynthesis from the leaves to the other parts of the plant.

## 11. Transport of Water

- Xylem consist of tracheids, xylem fibres, vessels and xylem parenchyma. Vessels and tracheids of the roots, stems and leaves that form continuous system of water conducting channels which reaches to all parts of a plant.
- There is a concentration gradient between roots and soil, so, water moves into roots from soil and creates a water column pushed upwards.
- Transport of water occurs also due to transpirational pull.

## 12. Transpiration

- Transpiration is the loss of water in the form of vapour from the aerial parts (i.e. stem, leaves) of the plant. It takes place through the special pores known as **stomata**.
- Transpiration helps in the absorption and upward movement of water and minerals dissolved in it from roots to the leaves.
- It also functions as a temperature regulator.
- In day time, transpiration pull is the major driving force in the movement of water in the xylem.

## 13. Transport of Food and Other Substances

- Translocation is the phenomenon of transport or movement of soluble products (sugar) from the leaves to the other parts of the plant with the help of phloem.
- Sugar like sucrose is transferred into phloem tissue with the help of energy (ATP).
- It increases the osmotic pressure of the tissue causing material to move according to the plants need.
- Translocation of substances takes place in the sieve tubes with the help of adjacent companion cells both in upward and downward directions (materials move from high pressure to low pressure).

# Objective Questions

## Multiple Choice Questions

- 01.** The blood leaving the tissues becomes richer in  
(a) carbon dioxide      (b) water  
(c) haemoglobin      (d) oxygen
- 02.** ..... surrounds the heart.  
(a) Septum      (b) Pericardium  
(c) Valves      (d) None of these
- 03.** Valves ensure that blood does not backflow inside the heart.  
(a) True      (b) False  
(c) Can't say      (d) Partially True/False
- 04.** In fishes, the heart receives only pure blood.  
(a) True      (b) False  
(c) Can't say      (d) Partially True/False
- 05.** Single circulation, i.e. blood flows through the heart only once during one cycle of passage through the body is exhibited by  
*(NCERT Exemplar)*  
(a) *Labeo, chameleon, salamander*  
(b) *Hippocampus, Exocoetus, anabas*  
(c) *Iyla, Rana, Draco*  
(d) *Whale, dolphin, turtle*
- 06.** Crocodiles have ..... chambered heart.  
(a) two      (b) three  
(c) four      (d) None of these
- 07.** Lymph does not comprise of  
(a) red blood corpuscles  
(b) lymphocytes  
(c) white blood corpuscles  
(d) nitrogenous waste
- 08.** ..... and ..... form a continuous system of water conducting channels that reaches all parts of the plant.  
(a) Xylem, phloem      (b) Phloem, tracheids  
(c) Phloem, vessels      (d) Tracheids, vessels

- 09.** Transpiration helps in regulation of temperature.  
(a) True      (b) False  
(c) Can't say      (d) Partially True/False
- 10.** The process of carrying food from the leaves to other parts of a plant is called  
(a) transpiration      (b) transportation  
(c) translocation      (d) transformation
- 11.** Translocation of substances takes place in the sieve tubes in downward direction only.  
(a) True      (b) False  
(c) Can't say      (d) Partially True/False
- 12.** Which of the following is accomplished in a plant by utilising the energy stored in ATP?  
(a) Transport of food  
(b) Transport of oxygen  
(c) Transport of water and minerals  
(d) Transport of water, minerals and food
- 13.** Match Column I with Column II and select the most appropriate option from the codes given.

Column I	Column II
A. Platelets	1. Size of fist
B. Heart	2. Warm-blooded animals
C. Veins	3. Translocation
D. Birds	4. Valves
E. Sieve tubes	5. Blood clotting

### Codes

A	B	C	D	E
(a) 1	3	5	4	2
(b) 5	1	4	2	3
(c) 5	1	4	3	2
(d) 5	1	4	2	1

- 14.** Match Column I with Column II and choose the most appropriate option from the codes given below.

Column I	Column II
A. Xylem	1. Night
B. Phloem	2. Sucrose
C. Root pressure	3. Necessary evil
D. Transpiration	4. Minerals
E. Translocation	5. Companion cells

Codes

A	B	C	D	E
(a) 5	4	1	3	2
(b) 4	1	3	2	5
(c) 4	2	1	3	5
(d) 4	2	5	3	1

### Assertion-Reasoning MCQs

**Direction** (Q.Nos. 15-19) For the following question numbers two statements are given one labeled **Assertion (A)** and the other labeled **Reason (R)**. Select the correct answer to these question from the codes (a), (b), (c) and (d) as given below

- (a) Both A and R are true and R is the correct explanation of A
- (b) Both A and R are true but, R is not the correct explanation of the A
- (c) A is true, but R is false
- (d) A is false, but R is true

- 15. Assertion (A)** Blood pressure is arterial blood pressure.

**Reason (R)** It is measured by sphygmomanometer.

- 16. Assertion (A)** Interauricular septum separates left atrium from right atrium.

**Reason (R)** Interventricular septum separates left ventricle from right ventricle.

- 17. Assertion (A)** All the arteries carry oxygenated blood from the heart to various organs.

**Reason (R)** Pulmonary vein carries deoxygenated blood to the heart.

- 18. Assertion (A)** Translocation in phloem is mainly achieved by utilising energy.

**Reason (R)** Translocation takes place in sieve tubes.

- 19. Assertion (A)** Transpiration is a necessary evil.

**Reason (R)** It causes water loss but helps in absorption and upward movement of water and minerals.

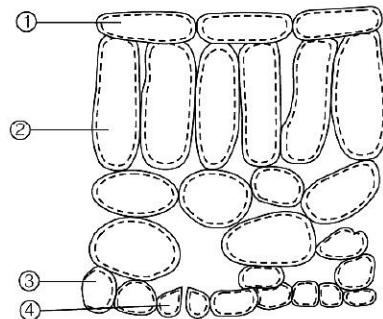
### Cased Based MCQs

- 20.** Read the following and answer questions from (i) to (v).

The general requirement for energy and materials is common in all organisms, but it is fulfilled in different ways. Organisms use simple food material obtained from inorganic sources in the form of carbon dioxide and water these organisms, called as autotrophs, include green plants and some bacteria other organisms utilise complex substances, known as heterotrophs.

The process by which green plants make their food is called photosynthesis which occurs in chloroplast, after that food and minerals are transported to all parts of the plants with the help of xylem and phloem tissue and from various processes like translocation, absorption, osmosis, etc.

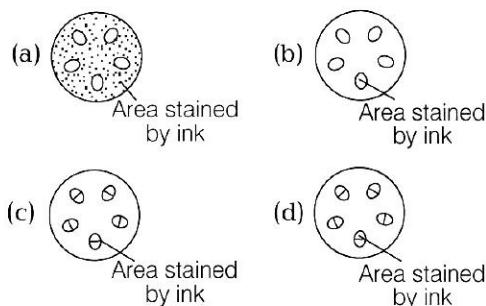
(i) The diagram shows the arrangement of cells inside the leaf of a green plant. Which cells normally contain chloroplast?



- (a) 1 and 3      (b) 2 and 4  
 (c) 1, 4 and 3    (d) All of these

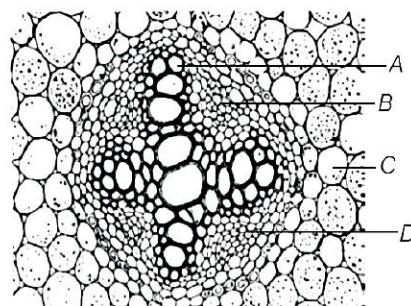
(ii) A plant shoot is left in ink solution for several hours.

A section is cut through the stem. What would you see?



(iii) The diagram shows a transverse section from the middle of a root of a dicotyledonous plant.

In which tissue are sugars and amino acids transported?



- (a) Tissue marked as A  
 (b) Tissue marked as B  
 (c) Tissue marked as C  
 (d) Tissue marked as D

(iv) A young plant may wilt when dug up and re-planted in another place. What causes this?

- (a) The leaves lose less water  
 (b) The roots cannot take up mineral salts  
 (c) The stem cannot transport water  
 (d) The surface area of the root is reduced

(v) What causes water to enter plant roots from the soil?

- (a) Water potential in root hairs and soil is equal  
 (b) Water potential in root hairs and xylem is equal  
 (c) Water potential in roots hair is higher than in the soil  
 (d) Water potential in root hairs is lower than in the soil

## ANSWERS

### Multiple Choice Questions

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

### Assertion-Reasoning MCQs

15. (b)    16. (b)    17. (d)    18. (b)    19. (a)

### Case Based MCQs

20. (i)-(b), (ii)-(d), (iii)-(b), (iv)-(c), (v)-(c)

## EXPLANATIONS

1. The blood leaving the tissues is richer in carbon dioxide because the main artery carries oxygenated blood from heart to various organs from where it is passed through their capillaries and provides oxygen to body cells and at the same time,  $\text{CO}_2$  which is a byproduct of respiration, enters into the blood. Thus, indicating gaseous exchange.  
The deoxygenated blood then leaves the tissues and is passed to lungs for oxygenation.
2. Pericardium is a double-layered membrane that surrounds the heart. It protects the heart and keeps it in place.
3. Valves ensure the backflow of the blood inside the heart does not occur and that the blood flows unidirectionally only.
4. False; Impure blood is received by the heart in case of fishes.
5. The examples and the relation of animal group and heart are as

<b>Animal Group</b>	<b>Heart</b>	<b>Examples</b>
Fishes	2-chambered heart (one atrium and one ventricle) single circulation	<i>Labeo, Hippocampus, Exocoetus, Anabas</i> , etc. Fishes.
Amphibians and Reptiles	3-chambered heart (two atria and one ventricle) mixing of oxygenated and deoxygenated blood.	<i>Salamander, Hyla, Rana</i> (Amphibians) <i>Chameleon, Draco</i> , turtle (Reptiles)
Birds and Mammals	4-chambered heart (two atria and two ventricles) No mixing of blood	Pigeon, parrot (birds), whale, dolphins, humans (Mammals)

According to this chart, 2 chambered heart is present only in fishes and blood flows only once during one cycle. Group (b)-contain fishes, so correct answer is option 'b'.

6. The heart of a crocodile is different from other reptiles because it is four chambered.

The blood sent to the lungs for gaseous exchange from the right ventricle, is pumped to the body *via* left ventricle post for oxygenation.

7. Lymph does not contain RBCs and platelets, but it is rich in lymphocyte or WBC count.
8. Xylem tissues of plants have an inter connected network of vessels and tracheids of stem, roots and leaves, forming a continuous system of water conducting channels throughout the plant.
9. Plants lose water through the process of transpiration. The water that escapes into atmosphere, actually cools down the leaves thereby regulating temperature of the plant.
10. The transport of soluble products (sugar) of photosynthesis from leaves to other parts of the plant is translocation.
11. False, translocation of substances occurs in both upward and downward direction, i.e. bidirectional.
12. Transport of food in a plant is accomplished by using the energy stored in ATP, whereas transport of water and minerals takes place *via* diffusion and transpiration pull.
13. The correct matches are as follows  
Platelets cause clotting of blood.  
The size of the heart is the same as that of our fist.  
Most of the veins have valves to prevent backflow of blood.  
Birds are warm-blooded with a constant body temperature.  
Translocation occurs in sieve tubes with the aid of companion cells.
14. The correct matches are as follows Water and minerals are transferred in plants *via* xylem.  
Sucrose is transferred into phloem using ATP.  
Root pressure is critical during night time.  
Transpiration is a necessary evil as it helps the plant absorb more water.  
Translocation occurs *via* companion cells.

15. Both A and R are true, but R is not the correct explanation of A.

Blood pressure is the pressure exerted by circulating blood upon the walls of blood vessels and is measured within large arteries. The instrument used to measure blood pressure is sphygmomanometer.

16. Both A and R are true but R is not the correct explanation of A.

There are four chambers in the human heart. The left atria and right atria are separated by an interauricular septum. The two inferior chambers of the heart, i.e. right and left ventricles are separated by an interventricular septum.

17. A is false, but R is true.

The arteries carry oxygenated blood from the heart to various organs, except for pulmonary artery. The veins collect deoxygenated blood from different organs and bring it back to the heart, except for pulmonary vein that carries oxygenated blood.

18. Both A and R are true but R is not the correct explanation of A.

Materials are translocated *via* phloem by utilising energy from ATP.

Translocation of substances takes place in sieve tubes with the aid of companion cells, lying adjacent to them, bi-directionally.

19. Both A and R are true and R is the correct explanation of A.

Transpiration is a necessary evil. It is so because water is lost in the form of vapours from the aerial parts of the plant through transpiration.

But, it helps in absorption and upward movement of water and minerals creating a transpiration pull.

20. (i) The palisade mesophyll cell (at (2)) and guard cell (at (4)) possess chloroplasts which absorb sunlight. Most chloroplasts are concentrated in the former area to acquire maximum sunlight in order to photosynthesise.

(ii) When a plant shoot is left in ink solution for several hours, its xylem portion will get stained as it is the water conducting tissue.

(iii) Sugars and amino acids are transported by phloem tissue, here, B. They are found alternating between central core of xylem.

(iv) A young plant may wilt when dug up and re-planted because while digging up, the stem may break which hampers the transportation of water and other nutrients, causing wilting.

(v) Higher water potential in roots as compared to soil, leads to movement of water into roots by osmosis.

The intake of water in roots increases water potential in root xylem, which drives water up.

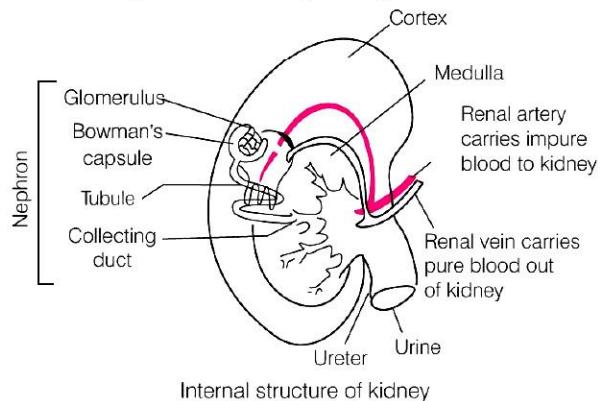
# 04(d)

## Life Processes IV : Excretion

### Quick Revision

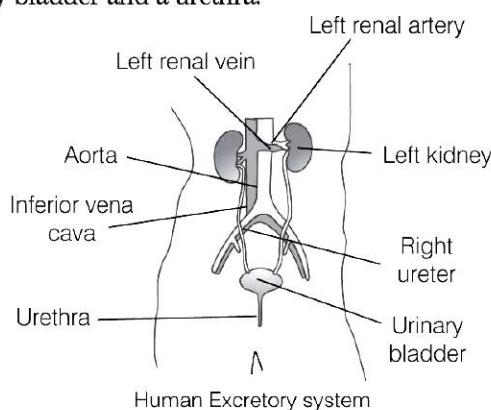
- It is the biological process by which an organism removes the metabolic wastes from the body.
- The mode of excretion is completely different in **unicellular** (animals consisting single cell) and **multicellular** (animals consisting many cells) organisms.
- Unicellular organisms excrete waste by simple process like diffusion, whereas multicellular organisms use specialised organs for the removal of waste products.

- They maintain constant concentration of blood plasma and regulate pH of blood.



### 1. Excretion in Human beings

The main organs involved in the human excretory system are a pair of kidneys, a pair of ureters, a urinary bladder and a urethra.



### 2. Kidney : Structure and Functions

- Kidneys are situated in the abdomen, one on the either side of the backbone.
- Left kidney is placed a little higher than the right one due to the positioning of the liver.
- They are reddish brown and bean shaped.
- Kidneys remove excess of water from the body with nitrogenous wastes from blood as urine.

### 3. Structure of Nephron

- Nephrons are structural and functional units of kidney.
- Nephron has a cup-like capsule called **Bowmani's capsule**, at its upper end and the lower end is tube-like and called **tubule**.
- Bowman's capsule and tubule together form a nephron.
- Blood flows into tubules by blood capillaries called **glomerulus**. It is surrounded by Bowman's capsule.
- A long convulated tubular structure follows the Bowman's capsule and finally leads to collecting duct which collects the filtered urine.
- Each kidney has thousand of tiny tubules called **nephron**, i.e. filtration unit which are closely packed together.

### 4. Formation and Removal of Urine

- The urine is formed to filter out waste products from the blood.

Waste products	Removed from
(i) CO <sub>2</sub>	Blood in the lungs
(ii) Nitrogenous waste (urea or uric acid).	Blood in the kidney

- The blood passes through the tubular part of nephron (where important or useful substances such as glucose, amino acids, fats and a major amount of water are selectively reabsorbed by the tubular part) of the nephron.
- The collecting duct finally gathers all the materials that have not returned to the blood through the tubular membranes.
- The urine formed in each kidney then enters a long tube, the **ureter** (which connects the kidneys with the urinary bladder).
- Urine is stored in the **urinary bladder** for sometime before eliminating through urethra (an opening by which urine passes out).
- Pressure of the expanded bladder leads to the urge to pass it out through the urethra.
- As the bladder is muscular, it is under the control of nervous system hence, we can usually control the urge to urinate.

## 5. Haemodialysis

- Artificial kidney is a device used to remove nitrogenous waste from blood through dialysis.
- It is different from natural kidney as the process of reabsorption does not occur in artificial kidney.

## 6. Excretion in Plants

- Plants give off gaseous wastes like carbon dioxide and oxygen through stomata and lenticels during **respiration** and **photosynthesis**.
- Plants also get rid of excess of water by the process of **transpiration** and can also store waste substances in old xylem such as resins and gums.
- Some plants store waste substances in the **cell vacuoles** and get rid of them by dropping their leaves, e.g. deciduous plants. While, other plants also excrete some solid waste substances into the soil around them.
- However, some plants like oak, store their excretory products as tannins, essential oils, gums, etc.

# Objective Questions

## Multiple Choice Questions

- 01.** Which of the following organisms are ammonotelic?
- (a) Birds    (b) Humans  
(c) Reptiles    (d) Aquatic animals
- 02.** The right kidney is placed a little higher than the left kidney to adjust in the abdominal cavity.
- (a) True    (b) False  
(c) Can't say    (d) Partially True/False
- 03.** An adult human on an average produces
- (a) 1-2 L of urine per day                                      (NCERT Exemplar)  
(b) 1-5 L of urine per day  
(c) 2-5 L of urine per day  
(d) 4-5 L of urine per day

- 04.** Choose the correct path of urine in our body. *(NCERT Exemplar)*

- (a) Kidney → Ureter → Urethra → Urinary bladder  
(b) Kidney → Urinary bladder → Urethra → Ureter  
(c) Kidney → Ureter → Urinary bladder → Urethra  
(d) Urinary bladder → Kidney → Ureter → Urethra

- 05.** The dialyser works as kidney except does not perform ..... .

- (a) osmoregulation  
(b) tubular secretion  
(c) selective reabsorption  
(d) ultrafiltration

**06.** Match the following columns and select the most appropriate options from the codes given below.

Column I	Column II
A. Nephridia	1. Glomerulus
B. Bowman's capsule	2. Kidney
C. Osmoregulation	3. Dialysis
D. Kidney failure	4. Pale yellow
E. Urine	5. Earthworm

Codes

A	B	C	D	E
(a) 5	1	2	3	4
(b) 1	2	5	4	3
(c) 2	4	3	1	5
(d) 5	2	4	3	1

**07.** Match the Column I with Column II and select the most appropriate option from the codes given below.

Column I	Column II
A. Kidneys	1. Urea
B. Renal vein	2. No nitrogenous wastes
C. Liver	3. Aquatic animals
D. Dialysing fluid	4. Impure blood
E. Ammonia	5. Birds and humans

Codes

A	B	C	D	E
(a) 5	4	1	2	3
(b) 5	2	4	1	3
(c) 1	4	3	2	5
(d) 2	4	1	3	5

**08.** Dialysing unit (artificial kidney) contains a fluid which is almost same as plasma except that it has

- (a) high glucose                          (b) high urea
- (c) no urea                                (d) high uric acid

**09.** Plants release gaseous waste like  $\text{CO}_2$  at ..... time and others like ..... through stomata and lenticels.

- (a) day,  $\text{O}_2$                                 (b) day,  $\text{CO}_2$
- (c) night,  $\text{O}_2$                                 (d) night,  $\text{CO}_2$

**10.** The liquid waste product of plants formed due to oxidation of various essential oil is

- (a) gums                                      (b) latex
- (c) resins                                    (d) tannins

**11.** The major gaseous excretory product of plants is

- (a) carbon dioxide                        (b) oxygen
- (c) alkaloids                                (d) gums

**12.** Excretory product of oak is used in leather treatment.

- (a) True                                     (b) False
- (c) Can't say                                (d) Partially True/False

**13.** Match Column I with Column II and choose the right answer from the codes options given below.

Column I	Column II
A. Initial filtrate	1. Respiration
B. Carbon dioxide	2. 180 L
C. Urine	3. Tannin
d. Latex	4. Rubber
E. Oak	5. 1-2 L per day

Codes

A	B	C	D	E
(a) 2	1	5	4	3
(b) 2	1	4	5	3
(c) 2	3	1	4	5
(d) 2	1	3	5	4

### Assertion-Reasoning MCQs

**Direction** (Q.Nos. 14-18) For the following question numbers two statements are given one labelled as Assertion (A) and the other labelled as Reason (R). Select the correct answer to these question from the codes (a), (b), (c) and (d) as given below

- (a) Both A and R are true and R is the correct explanation of A
- (b) Both A and R are true but, R is not the correct explanation of the A
- (c) A is true, but R is false
- (d) A is false, but R is true

**14. Assertion** Excretion is the biological process by which harmful wastes are removed from an organism's body.

**Reason** The mode of excretion is completely same in both unicellular and multicellular organisms.

**15. Assertion** Glomerular filtration requires expenditure of energy by Kidney.

**Reason** It occurs due to pressure difference in glomerular capillaries and Bowman's capsule.

**16. Assertion** Artificial kidney is a device used to remove nitrogenous waste products from the blood through dialysis.

**Reason** Reabsorption does not occur in artificial kidney.

**17. Assertion** Plants excrete various waste products during their life processes.

**Reason** They produce urea just like humans.

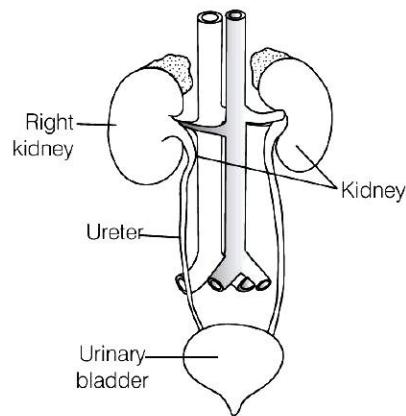
**18. Assertion** Excretion is a biological process.

**Reason** Gaseous products in plants are excreted *via* lenticels in stem.

### Case Based MCQs

**19.** Read the following and answer questions from (i) to (v).

The excretory system is a passive biological system that removes excess, unnecessary materials from the body fluids of an organism, so as to help maintain internal chemical homeostasis and prevent damage to the body.



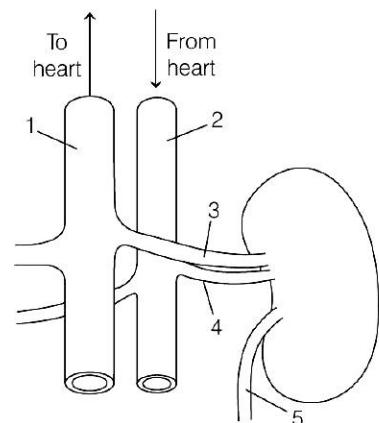
(i) Which among the following is the storage organ for urine?

- (a) Urter                      (b) Kidney  
 (c) Urinary bladder        (d) Urethra

(ii) The main function of ureter is

- (a) contain urine till it is released out  
 (b) carry urine from kidney to urinary bladder  
 (c) guard the urethra  
 (d) passage through which urine is excreted out of the body

(iii) The diagram shows a kidney and its associated vessels.



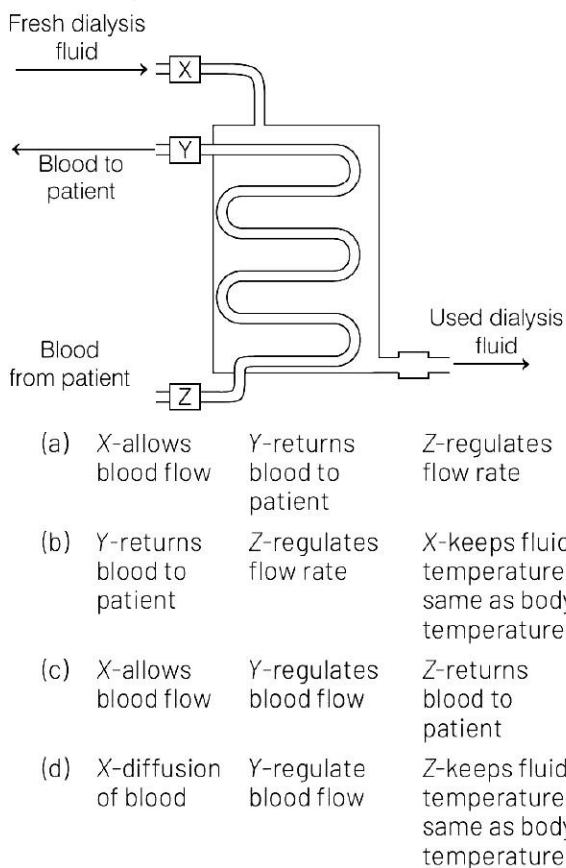
Which structure have the most and least urea concentration?

	Most	Least
--	------	-------

- |     |   |   |
|-----|---|---|
| (a) | 1 | 2 |
| (b) | 4 | 1 |
| (c) | 4 | 3 |
| (d) | 5 | 3 |

- (iv) If Henle's loop were absent from mammalian nephron, which one of the following to be expected?
- There will be no urine formation
  - There will be hardly any change in the quality and quantity of urine formed
  - The urine will be more concentrated
  - The urine will be more dilute

- (v) Identify X, Y, Z and match with their respective functions..



## 20. Read the following and answer questions from (i) to (v).

The organs of our excretory system help in releasing waste from our body. If these wastes are not removed, we may fall sick. Hence, wastes built up from cell activities and digestion need to be removed. The excretory system of humans consists of a pair of kidneys, pair of ureter, a urinary bladder and urethra.

Kidneys are located in abdomen, one on other side of the backbone. Urine produced in kidneys passes through the ureter into the urinary bladder where it gets stored for sometime and then is released through urethra.

Each kidney is made up of one million nephrons and each nephron consists of a cup-shaped upper end called Bowman's capsule containing a bunch of capillaries called glomerulus.

The Bowman's capsule leads to proximal convoluted tubule, loop of Henle and distal convoluted tubule which joins the collecting duct.

- (i) Which among the following is the least toxic form of excretory product?
- Urea
  - Uric acid
  - Ammonia
  - $\text{CO}_2$

- (ii) An outline of principal events of urination is given below in a random manner.

I. Stretch receptors on the wall of the urinary bladder send signals to CNS.

II. Bladder fills with urine and become distended.

III. Micturition

IV. CNS passes on motor messages to initiate contraction of smooth muscle of bladder and simultaneous relaxation of urethral sphincter.

The correct sequence of events is

- I → II → III → IV
- IV → III → II → I
- II → I → IV → III
- III → II → I → IV

- (iii) A person with no/less food and beverage intake, will have ..... in urine.

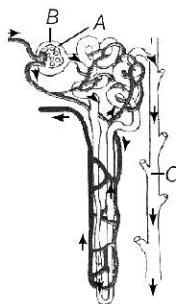
- little glucose
- less urea
- excess urea
- little fat

- (iv) Glomerular filtrate is first collected by

- distal convoluted tubule
- proximal convoluted tubule
- Bowman's capsule
- Loop of Henle

(v) The figure given alongside figure represents a single nephron from a mammalian kidney.

Identify the labelled parts by selecting the most appropriate option.



	A	B	C
(a)	Bowman's capsule	Glomerulus	Collecting duct
(b)	Renal artery	Collecting duct	Bowman's capsule
(c)	Collecting duct	Glomerulus	Bomwan's capsule
(d)	Glomerulus	Bomwan's capsule	Collecting duct

## ANSWERS

### Multiple Choice Questions

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

### Assertion-Reasoning MCQs

14. (c)    15. (d)    16. (b)    17. (c)    18. (b)

### Case Based MCQs

19. (i)-(c), (ii)-(b), (iii)-(d), (iv)-(d), (v)-(b)

20. (i)-(b), (ii)-(c), (iii)-(b), (iv)-(c), (v)-(d)

## EXPLANATIONS

1. Aquatic animals are ammonotelic. They secrete waste in the form of ammonia.
2. False; The left kidney is placed a little higher than the right kidney to adjust in the abdominal cavity.
3. An adult human on an average produces 1-2 L of urine in 24 hours. This volume depends of intake of fluids, physical activities, etc.
4. The correct path of urine in our body is Kidney→Ureter→Urinary bladder→Urethra.
5. The dialyser functions as kidney but does not perform selective reabsorption.
6. The correct matches are as follows  
Nephridia are responsible for removal of waste from the body of an earthworm.  
Renal corpuscle constitutes Bowman's capsule and glomerulus.  
Osmoregulation is the process wherein osmotic pressure of a mammal is regulated *via* filtration and purification with the help of kidneys.  
Dialysis is the procedure followed to remove excess fluid and waste from body when kidneys do not work properly.  
Urine is pale yellow in colour.
7. The correct matches are as follows  
Kidneys are present in birds and humans. Renal vein carries impure (deoxygenated) blood.  
Urea is produced in liver.  
Dialysing fluid does not contain nitrogenous waste.  
Aquatic animals are ammonotelic, i.e. secrete ammonia as waste product.
8. The dialysing fluid has the same composition as that of blood plasma except that it is devoid of nitrogenous waste such as urea.
9. Plants release gaseous wastes like carbon dioxide at night and oxygen produced during photosynthesis at daytime through stomata and lenticels.
10. The liquid waste product of plants formed due to oxidation of various essential oils is resins. It protects the plants from pathogens.
11. The only major gaseous excretory product of plants is oxygen. Other excretory products of plants include resins, gums, alkaloids, etc.
12. Plants like oak store their excretory products as tannins in their trunks. This is used in the treatment of leather.

- 13.** The correct matches are as follows  
 Volume of initial filtrate is 180 L, i.e 180 L of filtrate is given out everyday by kidney.  
 $\text{CO}_2$  is exhaled during respiration.  
 Around 2L of urine is passed each day.  
 Natural rubber is obtained as latex—a milky, white fluid.  
 Tannins are excretory products of Oak trees.
- 14.** A is true, but R is false.  
 Excretion is the biological process by which harmful metabolic wastes are removed from an organism's body.  
 The mode of excretion is completely different in unicellular and multicellular organisms. In unicellular organisms, waste products are diffused into surrounding water through body surface. While, in multicellular organisms, specialised organs perform the function of excretion.
- 15.** A is false, but R is true.  
 Glomerular filtration occurs as the pressure of blood flowing in glomerular capillaries is higher than that of filtrate. The process takes advantage of pressure, hence doesnot require energy expenditure by kidney cells.
- 16.** Both A and R are true, but R is not the correct explanation of A.  
 Kidney failure can be managed by artificial kidney. It is a device used to remove nitrogenous waste products from the blood through dialysis.  
 Artificial kidney is different from natural kidney as the process of reabsorption does not occur in artificial kidney.
- 17.** A is true, but R is false.  
 Like human beings and other organisms, plants also excrete various waste products during their life processes. The waste products include gums,  $\text{CO}_2$ ,  $\text{O}_2$ , resins, rubber, etc.  
 Plants do not produce urea.
- 18.** Both A and R are true but R is not the correct explanation of A.  
 Excretion is a biological process by which harmful wastes are removed from the body of an organisms.  
 Plants excrete out gaseous products like  $\text{CO}_2$  and water vapour via stomata in leaves and lenticels in stems.
- 19.** (i) The storage organ for urine is urinary bladder. However urine is stored there fore a certain time period i.e. temporarily.  
 (ii) The main function of ureter is that it carries urine from kidney to bladder which is the storage organ.  
 (iii) Structure 5 (ureter) has high concentration of urea since it carries urine. Structure 3 (renal vein) has least amount of urea.  
 (iv) If Henle's loop were absent from mammalian nephron, the counter current mechanism would not have taken place, the urine would not be hypertonic. Thus, will be more diluted.  
 (v) X is needed to keep the temperature of dialysis fluid at body temperature, before it enters dialysis machine. Bubble trap Y, must be just before the blood is returned to patient.  
 The pump Z helps the blood flow through dialysis and can also regulate flow rate.
- 20.** (i) Uric acid is less toxic than ammonia and urea, hence, only small amount of water is needed for it removal.  
 (ii) The correct sequence of events is as follows  
 II. Urinary bladder becomes distended post getting filled with urine.  
 I. Stretch receptors present on the walls of the bladder send signals to the CNS.  
 IV. After receiving the signal, the CNS passes the signal to initiate the contraction of smooth muscles of bladder and a simultaneous relaxation of sphincter.  
 III. After the smooth muscles of urinary bladder have contracted, the relaxation of sphincter causes micturition.  
 (iii) Urea is a nitrogenous compound that is produced by protein metabolism. Urea is then filtered in kidneys to form urine.  
 As the person has low/no food or beverage intake, his protein intake will be zero/less, thus producing less urea.  
 (iv) Bowman's capsule first collects Glomerular filtrate.  
 (v) A represents Glomerulus that filters the blood.  
 B represents Bowman's capsule that carries out ultrafiltration.  
 C is collecting duct that collects urine from nephron.