1

NUTRITION IN ORGANISMS

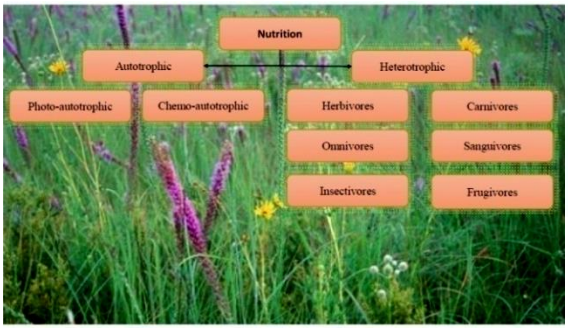
Introduction

- All organisms need food. They need food for obtaining energy and to get materials required for growth, development and repair of damaged cells and tissues. Though different organisms eat different kinds of food but one thing is common in all food types, that is, all food items contain nutrient.

- **"Nutrients** are the substances that a body needs to live and grow. The energy form nutrients is the fuel that allows the body to carry out all functions — run, jump, walk and swim. Nutrients also provide material for the repair of tissues. They also keep the body healthy." To use nutrients, the body must first get food and then the food must be broken down to provide energy. The process by which the body obtains food and utilizes the nutrients present it is called nutrition.

Modes of Nutrition

- There are several modes of nutrition on the basis of which organisms are classified as follows:



(a) Autotrophic : (Auto = self, trophic = food)

It is a mode of nutrition in which organisms prepare their own food. Inorganic molecules like CO_2 & H_2O are converted into organic molecules like carbohydrates in the presence of sunlight & chlorophyll. E.g. Green plants.

- Autotrophs are further categorized as:

(i) Photoautotrophs: Those which utilize sunlight for preparing their food
e.g. all green plants, Blue green algae.

(ii) Chemoautotrophs: Those which utilize chemical energy for preparing their food e.g. H_2S for sulphur bacteria.

(b) Heterotrophic (Hetero = different ; trophic = food)

It is a mode of nutrition in which organisms derive their food from some other animals or plants. They cannot prepare their own food
e.g. human being. Heterotrophs are further categorized depending on the nature of food they consume:

(i) Herbivores: Animals which eat only plants, e.g. Cow, goat.

(ii) Carnivores: They feed on flesh of other animals, e.g. Lion , Tiger.

(iii) Omnivores: They feed on plants and animals both, e.g. Dog, human.

(iv) Detritivores: Feed on detritus or dead organic remains, e.g. Earthworm.

(v) Sanguivorous: Feed on blood, e.g. Leech, female mosquito.

(vi) Frugivorous: Feed on fruits, e.g. Parrot.

(vii) Insectivores: Feed on insects, e.g. Bats, House sparrow, Pitcher plant, Venus flytrap.

Pitcher plant

Venus Flytrap

On the Basis of Mode of Feeding:

- **Heterotrophic Organisms are Categorised As:**

(i) Holozoic: They ingest mostly solid but sometimes liquid food. Digestion of food takes place inside the body of the organism with the help of digestive enzymes. E.g. Amoeba, Human.

Fungi

(ii) Saprotrophic: They absorb organic matter from dead and decaying organisms with the help of their enzymes (Extracellular Digestion). E.g., Bacteria, fungi.

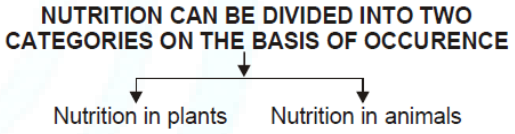
(iii) Parasitic: They derive their nutrition from other living plants or animals. E.g. Plasmodium, Round worms, Cuscuta plant.

Knowledge Booster
Cuscuta (Dodder/Amarbel) is a parasitic plant which grow on other plant (Host). It wraps itself around the hos plant and get nutrition from it by using sucking apparatus called haustra.

Cuscuta

- **Symbiotic Association:** Two organism that live in close physical association and are of mutual benefit to each other, are called symbionts. This condition is known as symbiosis. The common example of symbionts are lichens (association between algae and fungi) and mycorrhiza (association between fungi and the roots of some higher plants).

Lichen



FUNDAMENTAL UNLOCKED- (FU#1)

Q.1 Does insectivorous plants show photosynthesis?

Q.2 What is the difference between autotropic and heterotropic mode of nutrition?

Q.3 In chemoautotrophs why chlorophyll is absent?

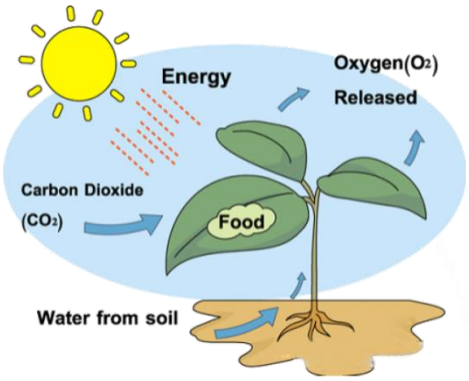
Q.4 Name the organisms which feed on blood?

Q.5 Explain how lichens show symbiosis?

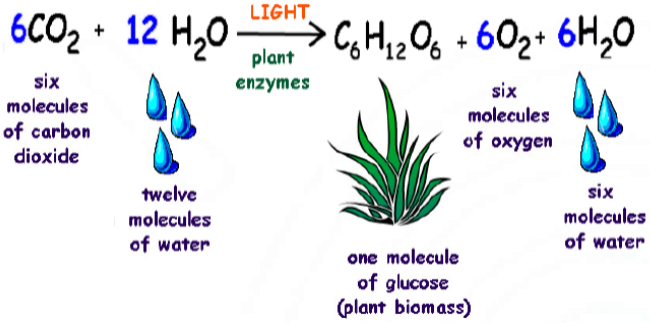
Q.6 In chemoautotrophs why chlorophyll is absent?

Nutrition In Plants (Photosynthesis)

- The synthesis of organic compounds like glucose from simple inorganic molecules like CO_2 and H_2O by the cells of green plants having chlorophyll in the presence of sunlight is called as photosynthesis.



Process of Photosynthesis



Equation of Photosynthesis

(a) Requirements Of Photosynthesis :

(i) Sunlight: Sun is the ultimate source of energy for all living organism.

(ii) Chlorophyll: These are the green pigments present in chloroplast. They are found in green leaves in a maximum amount as well as in other green aerial parts of plant.

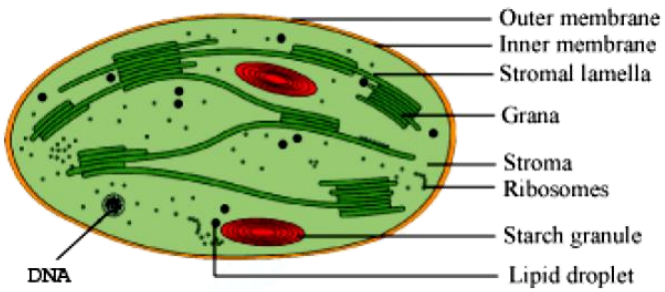
Site of photosynthesis-Chloroplast: Pigments containing double membrane bounded cell organelle is called chloroplast.

- Chloroplast is also called as green plastid.
- Chloroplast also have variable shapes, for example cup shaped, ribbon shaped etc. in algae while it is discoidal in higher plants.

Each chloroplast is double membranous cell organelle and consists of two parts:-

(A) Grana: It constitutes the lamellar system. These are bound layered on top of each other, these stacks are called as Grana.

- Each granum of the chloroplast is formed by superimposed closed compartments called Thylakoids.



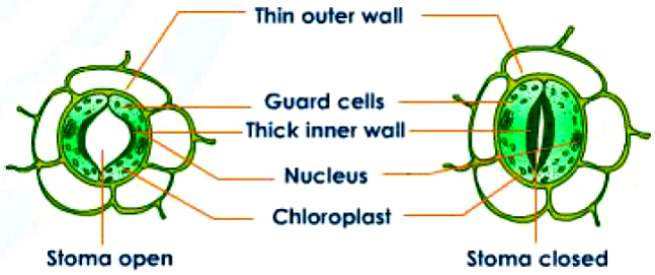
Ultra Structure of Chloroplast

(B) Stroma: It is a granular transparent substance present in chloroplast also called as matrix.

- Grana are embedded in it. Besides grana, they also contain lipid droplets, starch grains, ribosomes etc.

(iii) Raw Materials of Photosynthesis:

(A) Carbon dioxide: Terrestrial plants obtain carbon dioxide from the atmosphere through the small openings present on leaves called as stomata. 'Stomata' are the small pores present on the surface of leaves. They help in exchange of gases and water vapour. Stomatal opening is guarded by the presence of guard cells (kidney shaped).



Process of Photosynthesis

Aquatic plants obtain CO_2 dissolved in water through their general body surface so they perform more photosynthesis than terrestrial plants.

(B) Water: Plants absorb water from the soil by the process of osmosis. This water is transported to leaves by a special type of tissue called as xylem.

(iv) Factors affecting photosynthesis :

(i) Light: Normally plants utilize sunlight but marine algae can perform photosynthesis even in the moon light. Plants can also perform photosynthesis in the artificial lights.

Highest rate of photosynthesis in red, minimum photosynthesis in green light.

(ii) Temperature: Optimum range = 25º to 30º C are used for photosynthesis.

(iii) Carbon dioxide: The atmospheric concentration of CO_2 $\propto$ rate of photosynthesis.

(iv) Chlorophyll: Chlorophyll content is directly proportional to rate of photosynthesis.

Significance of Photosynthesis: It has following significance :

(i) Production of food material.

(ii) Atmospheric control and purification of air.

Nutrition in Animals

- In unicellular organisms a single cell is responsible for carrying out all the vital activities.
- In multicellular organisms a well develop digestive system is present.
- Digestion in animals consist of following steps :

(i) Ingestion: The process of intake of food.

(ii) Digestion: It is the breakdown of large and complex molecules into simpler, smaller and soluble forms.

(iii) Absorption: Taking up of the digested food through intestinal wall to blood.

(iv) Assimilation: In this process absorbed food is taken by body cells.

(v) Egestion: The process by which undigested matter is expelled out.

(a) Nutrition in Amoeba:

- It is a unicellular organism living in water.
- Mode of nutrition is holozoic.
- The process of obtaining food is by phagocytosis. (cell eating)
- Steps involved in digestion of food in amoeba are:

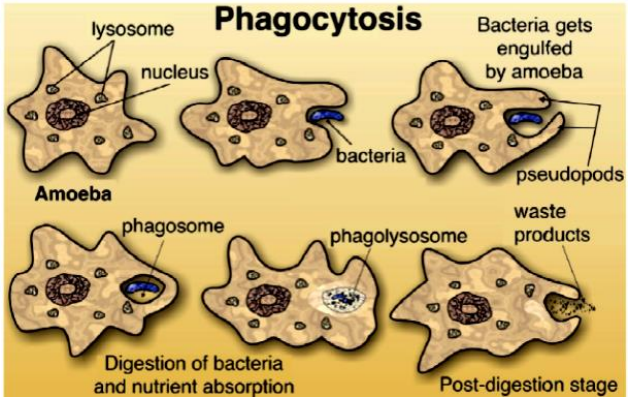
(i) Ingestion: Since it is unicellular so a single cell is responsible for carrying out all the vital activities. Food is ingested with the help of pseudopodia. Amoeba engulfs the food particle lying near it by forming pseudopodia around it and forming a food vacuole which is considered as its temporary stomach.

(ii) Digestion: The enzymes from surrounding cytoplasm enter the food vacuole and break down the food into smaller & soluble form.

(iii) Absorption: The digested food is now absorbed by cytoplasm by simple diffusion and then food vacuole disappears.

(iv) Assimilation: The food absorbed in amoeba is used to obtain energy from respiration for its growth and development.

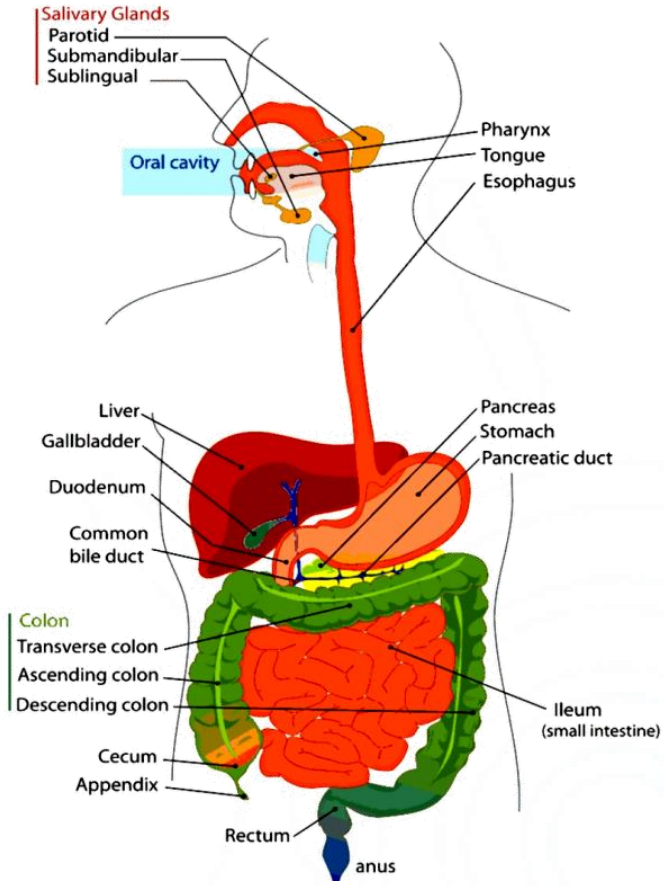
(v) Egestion: Undigested food is thrown out from the body.



Nutrition in Amoeba

(b) Nutrition in Humans:

- Humans have highly evolved and complicated digestive system consisting of an alimentary canal & different types of digestive glands.



Human Digestive system

(i) Alimentary Canal: Long, hollow, tubular structure consisting of various organs for digestion. Alimentary canal consists of following organs:

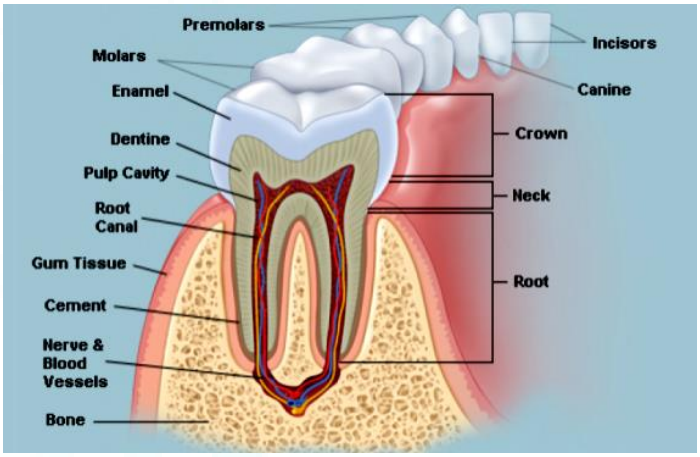
(A) Mouth: It is a small slit through which food is ingested.

(B) Buccal Cavity: Mouth opens into a chamber called as buccal cavity. Roof of buccal cavity is called hard palate. At the floor of this cavity thick muscular structure is present called **tongue**. It helps in chewing, swallowing, and speaking. Human tongue having taste buds for taste of food.

Location of Taste Buds on tongue

(C) Teeth:

- These are hard bony structure which helps in chewing. Human have four different types of teeth which are fixed in jaw.
- Jaws present in buccal cavity are provided with four different types of teeth:
  - Incisors : For cutting
  - Canines : For tearing
  - Premolars : For grinding
  - Molars : For grinding



Teeth

Dental formula of humans:

- Milk teeth → These are temporary, arise at 6 – 11 month age, 20 in number.

$$\frac{\text{Half upper jaw}}{\text{Half lower jaw}} = \frac{2102}{2102}$$

- Permanent teeth → arise at 6 – 12 years, 32 in number.

$$\frac{\text{Half upper jaw}}{\text{Half lower jaw}} = \frac{2123}{2123}$$

- Three pairs of salivary glands are found in mouth which release their secretions into the buccal cavity. They secrete salivary amylase for starch digestion. So digestion of starch starts from mouth.

(D) Pharynx : It is the part where mouth and nose meets in buccal cavity.

(E) Oesophagus : It is also called as food pipe. It leads the food from mouth to stomach. Oesophagus has highly muscular walls, no digestion occurs here.

(F) Stomach : It is a 'J' shaped bag present on left side of abdomen. It contains several glands present on the inner surface of its wall, which secrete gastric juice.

(G) Intestine :

Small Intestine: It is a coiled and narrow tube which is 6.5 m long having 3 regions : duodenum, jejunum, ileum.

- On the inner wall of small intestine numerous finger like projections are found which are called as villi, they increase the surface area of absorption.

Large Intestine: Small intestine opens into large intestine which is wider and shorter and is above 1.5 m in length. From here the undigested food material is passed to anus through rectum.

It is divided into three parts:

- **Caecum**
- **Colon**
- **Rectum**

(H) Anus : Last part of digestive system which is helpful in egestion.

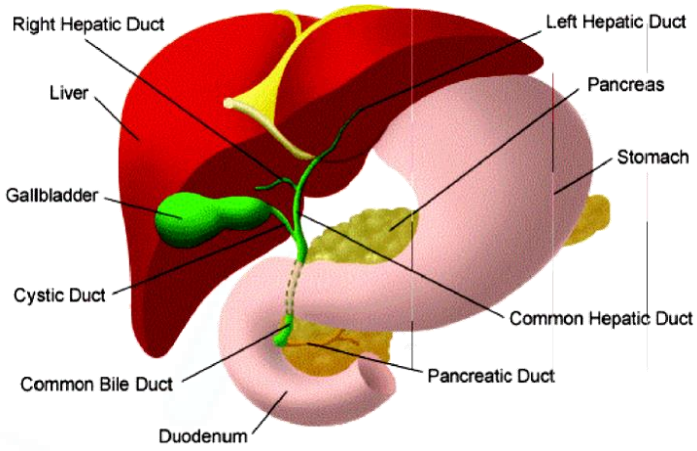
(ii) Digestive Glands : These glands secrete enzymes and hormones which help in the process of digestion. These digestive glands include:

(A) Salivary Glands : 3 pairs of salivary glands are found in mouth cavity which secrete saliva. Saliva contains an enzyme Salivary Amylase or ptyalin which helps indigestion of starch in mouth.

(B) Gastric Glands: These are present in stomach and secrete hydrochloric acid (HCl), protein digesting enzymes and mucus.

(C) Liver: It is the largest gland of body. It secretes bile juice into small intestine which helps in emulsification of fats.

(D) Pancreas: It lies just below the stomach. It secretes pancreatic juice into small intestine. Pancreatic juice contains trypsin and pancreatic amylase which is released into the duodenum by a common duct along with bile. Besides these 2 enzymes pancreas secretes 2 hormones also i.e :– Insulin and glucagon so it has both exocrine as well as endocrine functions.



Liver and pancreas

FUNDAMENTAL UNLOCKED- (FU#2)

Q.1 What is the mode of nutrition in Amoeba and how food is ingested ?

Q.2 Why we feel any taste on whole tongue, when taste buds are at limited area for particular taste ?

Q.3 Why human cannot digest cellulose ?

Q.4 Write the name and function of different types of teeth ?

Q.5 What is the common passage for food and air ?

Q.6 What is the role of villi present in the small intestine ?

Q.7 Why is small intestine longer than large intestine ?

Nutrition Process

- **This system involves following processes:**

(a) Ingestion :

Intake of food is done through mouth, food is then chewed and masticated and sent to oesophagus through pharynx by swallowing.

(b) Digestion :

Saliva secreted in buccal cavity starts digestion of starch into maltose. This partially digested food is then passed to stomach by oesophagus through peristaltic movement. Food is churned in stomach for about three hours and broken down into smaller pieces. Due to presence of hydrochloric

acid, medium of stomach becomes acidic. In acidic medium protein digesting enzyme pepsin breaks down proteins into peptones. Gastric lipase is also secreted here which partially breaks down lipids.

- Duodenum receives the secretion from liver and pancreas through a common duct they are bile and pancreatic juice, and alkaline in nature. So the digestion and emulsification of fats occurs at this place.
- Here in the duodenum fats are emulsified by bile, remaining proteins are digested by trypsin and starch by pancreatic amylase.
- This partially digested food now enters in the ileum where intestinal juice i.e. "Succus entericus" is secreted. At this place digestion is completed.

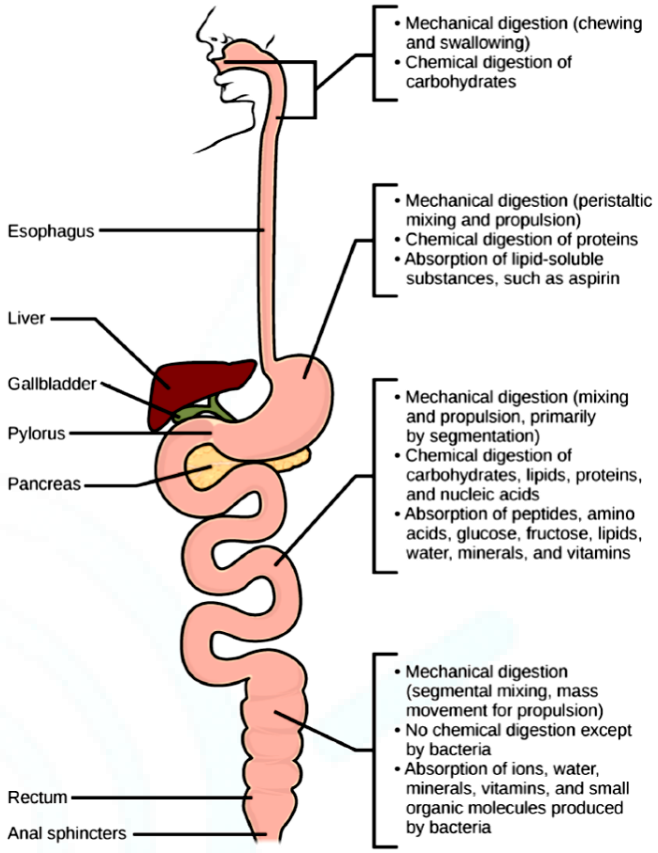
  Carbohydrates $\longrightarrow$ Glucose

  Proteins $\longrightarrow$ Amino acids

  Fats $\longrightarrow$ Fatty acids and glycerol

(c) Absorption of Digested Food :

- **Absorption of Food in Small Intestine:** The digested food is absorbed mainly in small intestine. For efficient absorption of nutrients, the intestine has the following features:
- Intestine is very long.
- The lining of intestine is thin to allow rapid entry of substances.
- The inner wall of intestine contains numerous finger-like projections called villi (Sing. villus).
- The villi increase surface area of intestine to about five times for the absorption of digested food.
- Each villus is supplied with an arteriole, a venule and blood capillaries, a lymph vessel or lacteal and lymph capillaries.
- **Absorption in Large Intestine:** Large intestine is about 1.5 metres long. It absorbs water and some salts from undigested food.



Process of Digestion

(d) Assimilation or The fate of Absorbed Nutrients:

The absorbed nutrients are passed into the blood vessels and transported to different parts of the body. Inside the body cells, these nutrients are utilised for different activities. This is called assimilation. The future of absorbed nutrients is as follows:

- Glucose is used as a source of energy by the body. It is burned (oxidised) to release energy inside the cells. Excess of glucose is stored in the cells of liver as glycogen.
- The amino acids are used to build new living material of the cells.
- Fats are stored in the fatty tissues in various parts of the body.

(e) Egestion of Undigested Food :

The undigested food is then collected in large intestine where water is absorbed and remaining waste is expelled out or egested through anus. The semisolid undigested food is pushed out of

the anus. This is called egestion or defecation. The undigested food residue that enters the rectum from large intestine is called the feces. This feces defecate out by anus.

FUNDAMENTAL UNLOCKED- (FU#3)

Q.1 Where is ptyalin secreted and what is its role in digestion?

Q.2 What is the function of Gall bladder ?

Q.3 Why length of small intestine is more than that of large intestine?

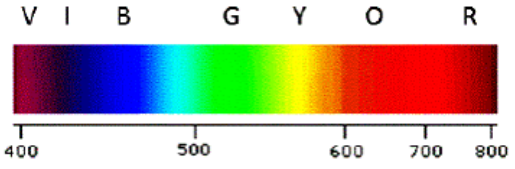
Q.4 Why humans cannot digest cellulose?

Q.5 Name the hormones secreted by pancreas?

Q.6 How are various nutrients assimilated after absorption?

Add to Your Knowledge

- **Nutrients for Plants:** Plants need some elements for their growth and development, which are called plant nutrient. All these plant nutrients are derived form air, water, and soil. Out of 30 to 40 elements that are found in plants, only 16 elements are essential for growth and development. Some of them are carbon, oxygen, hydrogen, phosphorus and potassium. The plant nutrients are classified into two categories based on the quantity in which they are required by plants. They are macronutrients and micronutrients.
- Macronutrients are used by the plants in relatively large quantities, for example, nitrogen, phosphorus and potassium.
- Micronutrients are those, utilized by plants in small quantities, for example iron, copper and so on.
- Photosynthesis can occur in visible light.



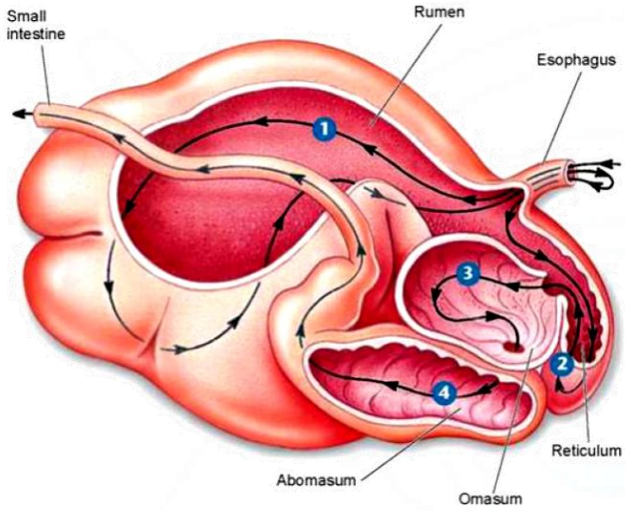
Visible spectrum

- Maximum photosynthesis occurs in Red and Blue region.
- There is minimum photosynthesis in Green region.
- Euglena, a unicellular animal has dual mode of nutrition. It is green and autotrophic in presence of light. But in absence of light it becomes heterotrophic.
- **Emulsification:** The process in which bile juice mix with fat to convert into small droplets, so that its easier to digest by the action of lipase.
- **Ruminant stomach:** Ruminants are mammals that are able to acquire nutrients from plant-based food by fermenting it in a specialized stomach prior to digestion, principally through microbial actions. The process typically requires the fermented ingesta (known as cud) to be regurgitated and chewed again. The process of rechewing the cud to further break down plant matter and stimulate digestion is called rumination. The word "ruminant" comes from the Latin ruminare, which means "to chew over again" The primary difference between a ruminant and non-ruminant is that ruminants have a four-compartment stomach. The four parts are the rumen, reticulum, omasum, and abomasum. In the first two chambers, the rumen and the reticulum, the food is mixed with saliva and separates into layers of solid and liquid material. Solids clump together to form the cud or bolus. The cud is then regurgitated and chewed to completely mix it with saliva and to break down the particle size. Fibre, especially cellulose and hemicellulose, is primarily broken down in these chambers by microbes (mostly bacteria, as well as some protozoa, fungi and yeast) into in small and non-structural carbohydrate (pectin, sugars, and starch) are also fermented.

- **Chloroplast:** The organelle, or “mini organ,” in plant cells and a few other eukaryotic cells that carries out photosynthesis, or the conversion of CO_2 & H_2O into food. Chloroplast contain chlorophyll, the magical green pigment that absorbs light and is found in all plants, algae, and

cyanobacteria. Photosynthesis cannot happen without chlorophyll. ATP : Adenosine triphosphate. ATP is a major energy molecule in cells.

- **Carbohydrates:** The term carbohydrate refers to any one of a huge group of compounds that contain the elements carbon (C), oxygen (O) and hydrogen (H) and have the general formula $Cn(H_2O)y$. Examples of carbohydrates include sugars and starch. It is the main energy source of living organisms.



Stomach of ruminant (cow)

- **Proteins:** Protein are a category of compounds formed from the elements carbon (C), hydrogen (H), Oxygen (O) and Nitrogen, and in some cases also Sulphur (S) and Phosphorus (P).
- **Peptones:** Peptones are large protein fragments that result from the action of enzymes on proteins in the initial stages of breaking-up proteins.
- **Enzyme:** Enzymes are proteinaceous that increase the rate of biological reactions without being used-up in the reactions themselves. That is enzymes can act as catalysts. Enzymes form within living cells and may act either within the cell or outside it.
- **Peristalsis:** Peristalsis is a wave-like movement (motion) that progresses along some of the hollow tubes of the body that have circular and longitudinal muscles, such as the intestine. Peristalsis happens involuntarily.

KEY POINT

Aim: Chlorophyll is Necessary for Photosynthesis.

Apparatus. A destarched pottes plant of Croton. Pothos (Money Plant) or Coleus having variegated leaves, (with green and non-green parts), rice paper, Soft pencil, Beaker, Petridishes, Buner or spirit lamp, spirit (or 70 % alcohol), iodine's solution, water, forceps.

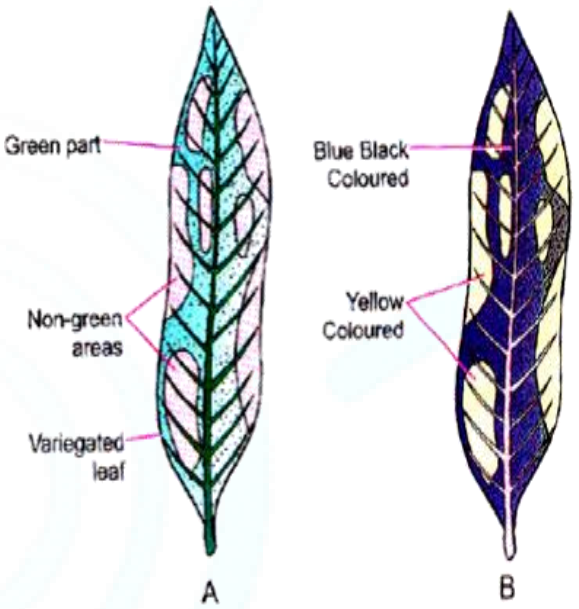


Fig. Chlorophyll is necessary for photosynthesis.

Procedure. Destarch a potted plant of Croton or Pothos (Money Plant) having variegated leaves by keepin it in complete darkness for 2-3 days. Expose the destarched potted plant to sunlight for 2–6 hours. Pluck a variegated leaf. Place a rice paper over it. Draw the outline of grteen 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 boling water for 5–10 minutes. Boling kills the leaf. Dip the leaf in spirit of alcohol kept at 50°–60° C with the help of a water bath. After 30–45 minutes, the leaf will be decolourise completely. Take out the decolourised leaf, dip in hot water for softening the same. Spread the leaf in a petri minutes, rinse off excess ioding and observed.

Observation.

The leaf has two types of patches, bluish black and yellowish. The bluish black areas are the ones which

have starch. The bluish black colour is due to reaction of iodine with starch. The yellow area are without starch. Compare the bluish black and pale are with green and non-green areas sketched on rich paper. Bluish-Black area are the ones which were green previously while non-green areas remain pale coloured.

KEY POINT

Aim: To test light is necessary for photosynthesis.

Procedure. Take any potted plant with broad leaves and keep it in a dark room for two days. This is done to make the leaves starch free as no photosynthesis will take place in the dark room. Cover a part of the leaf on both sides with a black paper. Now keep the plant in sunlight. Remove the leaf after 5–6 hour s and test it for the presences of starch as described in the earlier activity (Fig.) Which part of the leaf will show the presence of starch ? Will the portion covered by the black paper show the presence of starch ? Try and give reasons for your answer.

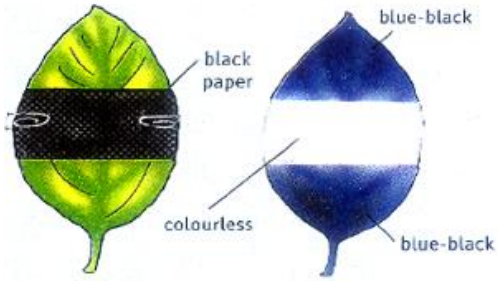


Fig. Light is necessary for photosynthesis.

Results. These experiment shows light is necessary for photosynthesis.

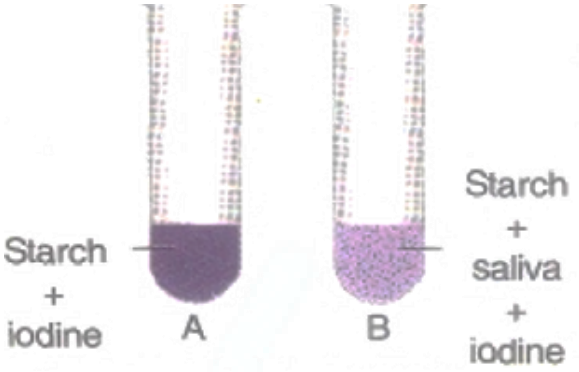
KEY POINT

Aim: To show that saliva breaks down starch into sugar

Materials required Two test tubes, marker pen, boiled rice, water, spoon and iodine solution.

Procedure Take two test tubes. With a marker, mark them as A and B. Put one teaspoonful of boiled rice in test tube A. Chew one teaspoonful of boiled rice for 2 minutes and put them into test tube

B. Add about 3mL of water and 3 drops of iodine solution in each test tube.



Observation The iodine becomes blue-black in test tube A but remains unchanged in test tube B.

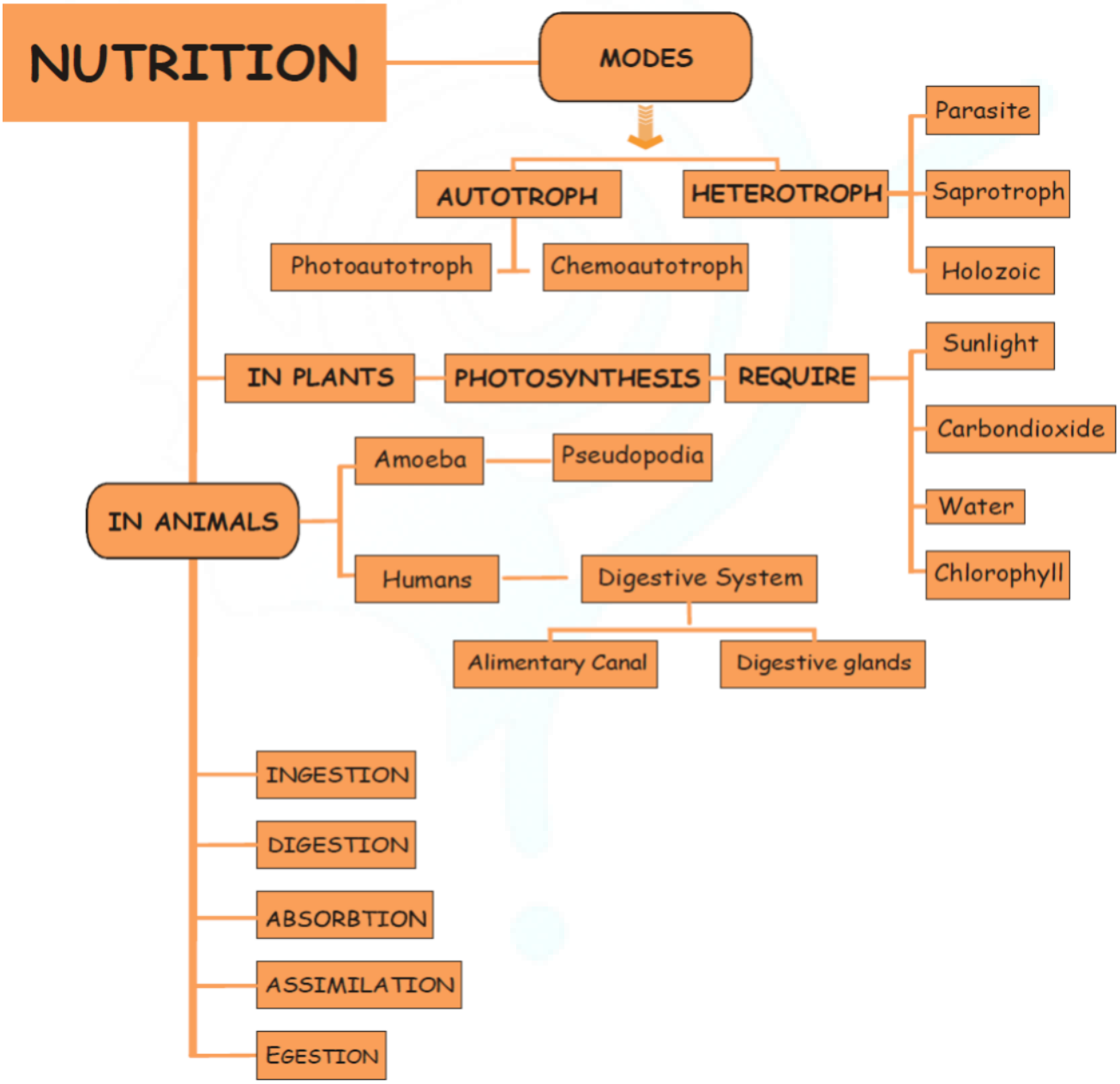
Explanation Test tube A contains starch and starch makes iodine blue-black. In test tube B, starch of rice is broken down into sugars (maltose) by saliva in buccal cavity. Due to the absence of starch, the iodine solution in test tube B remains unchanged.

Summary / What We Learned So Far ?

- All organisms take food and utilise it to get energy for growth and maintainance of body functions.
- There are various modes of nutrition which vary with different organisms.
- **Autotrophs:** An organism that can use light energy and the photosynthetic process to produce organic food (containing carbon and hydrogen) from inorganic molecules.
- **Heterotrophs:** An organism that consume organic matter created by auto trophs. Autotrophs produce organic compounds from inorganic molecules using either photosynthesis or chemosynthesis (chemical reactions using inorganic molecules).
- Heterotrophs cannot fix carbon and only use organic carbon to grow.
- Fungi are saprotrophs which depend on dead, decaying matter. Plants like Cuscata are parasites which take food from host plant.
- Green plants are autotrophs and prepare their own food with the help of photosynthesis.
- Chlorophyll and sunlight are essential requirements for photosynthesis.
- The products of photosynthesis are complex carbohydrates and O_2.

- Nutrition is a complex process involving:
  (i) ingestion
  (ii) digestion
  (iii) absorption
  (iv) assimilation
  (v) egestion.
- Animal nutrition includes nutrient requirement, mode of intake of food and its utilization in the body.
- The human digestive tract consists of alimentary canal and digestive glands.
- Digestion of carbohydrates, begins in the buccal cavity. The digestion of proteins starts in the stomach while digestion of fats takes place in small intestine.
- The absorbed substances are transported to different parts of the body. Water and some salts are absorbed from the undigested food in the large intestine.
- the undigested and unabsorbed residues are expelled out of the body as feces through the anus.

Chapter Map



EXERCISE - I

SINGLE CORRECT TYPE QUESTIONS

1. Which organisms feed on blood ?
(A) Omnivores (B) frugivorous
(C) Sanguivorous (D) Insectivores

2. Heterotrophs are organisms which depend on:-
(A) Living host (B) Dead matter
(C) Sunlight (D) Both (A) and (B)

3. Insectivorous plant is -
(A) Mustard (B) Cuscuta
(C) Nepenthes (D) Neem

4. Identify the odd one out:
(A) Neem (B) Amaranthus
(C) Rose (D) Cuscuta

5. Organisms who work together for mutual benefit for food and habitat:
(A) Symbiotic (B) Parasitic
(C) saprophyte (D) Autotrophic

6. Animals which feeds upon dead organic matter are known as:
(A) Omnivores (B) Carnivores
(C) Detritivores (D) Herbivores

7. Plants are –
(A) autotrophic (B) heterotrophic
(C) saprophytic (D) holozoic

8. Cuscuta is:
(A) Endoparasite of sheep
(B) Endoparasite of human beings
(C) A parasitic plant
(D) A parasite on fishes

9. The phenomenon which converts light energy to chemical energy is –
(A) respiration (B) photosynthesis
(C) transpiration (D) none of these

10. Element which is a component of chlorophyll ?
(A) Fe (B) Zn (C) Cl (D) Mg

11. Chlorophyll absorbs –
(A) red light only (B) blue light only
(C) red and blue light (D) green light only

12. Most of the photosynthesis (80%) which takes place on this earth is carried on by
(A) green plants on land
(B) algae present in fresh water
(C) algae found in ocean
(D) algae present in ocean and fresh water sources

13. The role of chlorophyll in photosynthesis is to –
(A) absorb water and minerals
(B) absorption of CO_2
(C) absorption of light and photolysis of water
(D) absorption of light

14. Which one of the following is the best equation representing photosynthesis ?
(A) energy + $6CO_2 + 6H_2O \xrightarrow{\text{Chloropyll}} C_6H_{12}O_6 + 6O_2$
(B) energy + $CO_2 + H_2O \longrightarrow CH_2O + O_2$
(C) Energy + $6CO_2 + 12H_2O \xrightarrow[\text{chlorophyll}]{\text{light}} C_6H_{12}O_6 + 6H_2O + 6O_2$
(D) energy + $12\ CO_2 + 6H_2O \xrightarrow[\text{chlorophyll}]{\text{light}} C_6H_{12}O_6 + 6H_2O + 6O_2$

15. Chlorophyll is present in –
(A) grana (B) stroma
(C) leucoplast (D) chromoplast

16. In which light, plants show maximum rate of photosynthesis ?
(A) Green (B) Red
(C) Orange (D) Violet

17. The raw materials for photosynthesis are –
(A) CO_2 & O_2
(B) sunlight and CO_2
(C) water and chlorophyll
(D) CO_2 and water

18. What is not necessary for the process of photosynthesis:
(A) carbon dioxide (B) Nitrogen
(C) Water (D) Sunlight

19. Plants are green in colour because –
(A) they absorb green light only
(B) they reflect green light
(C) none of the above are correct
(D) they absorb green light but reflect all other lights

20. Chlorophyll is present in –
(A) Chloroplast (B) Ribosome
(C) Leucoplast (D) Chromoplast

21. In amoeba the digestion of food is –
(A) extracellular (B) intracellular
(C) intercellular (D) none of the above

22. In amoeba absorption of the digested nutrients occurs in –
(A) cytoplasm
(B) plasma membrane
(C) contractile vacuole
(D) pseudopodia

23. Teeth involved in cutting of food material are called –
(A) canines (B) incisors
(C) molars (D) premolars

24. Dental formula of adult human is:
(A) $\frac{2122}{2122}$ (B) $\frac{2114}{2114}$ (C) $\frac{2123}{2124}$ (D) $\frac{2123}{2123}$

25. Total number of canines in permanent dental set of human is–
(A) 4 (B) 6 (C) 2 (D) 12

26. In human being number of stomach is-
(A) 1 (B) 2 (C) 3 (D) 4

27. Digestion of starch starts from
(A) stomach (B) intestine
(C) oesophagus (D) mouth

28. Number of permanent teeth in humans is:
(A) 28 (B) 30 (C) 32 (D) 34

29. Which of the following is a part of small intestine ?
(A) Caecum (B) Colon
(C) Rectum (D) Duodenum

30. Oesophagus opens into
(A) Caecum (B) Stomach
(C) Duodenum (D) Ileum

31. In human being gastric juice is secreted by –
(A) Liver (B) Stomach
(C) Pancreas (D) Small intestine

32. Enzyme which breaks up starch into sugar is –
(A) hydrolase (B) amylase
(C) lipase (D) nuclease

33. The folds present in small intestine which increase the area of absorption are called as –
(A) Cristae (B) Villi
(C) Cilia (D) Flagella

34. Main function of bile juice is to –
(A) Digest protein
(B) Digest vitamins
(C) help in fat digestion
(D) digest carbohydrates

35. The main organ for digestion and absorption of food is –
(A) large intestine (B) small intestine
(C) stomach (D) liver

36. Digestion is completed in
(A) Duodenum (B) Ileum
(C) Stomach (D) Large Intestine

37. Where is bile stored in the human body ?
(A) Liver (B) Gall bladder
(C) Spleen (D) Blood

38. Maximum digestion occurs in
(A) Small intestine (B) Oesophagus
(C) large intestine (D) Stomach

39. Which is not a protein digestion enzyme ?
(A) Trypsin (B) Amylase
(C) Pepsin (D) Rennin

40. The process of covering large fat droplets into small ones is called
(A) Egestion (B) Assimilation
(C) Emulsification (D) None of these

41. Which of the following is insectivorous ?
(A) Mushroom (B) Cuscuta
(C) Mucor (D) Nepenthes

42. Which of the following statements is true about croton plants ?
(A) Croton plants do not contain chlorophyll.
(B) Croton plants are dark red in colour Hence they depend on other plants for food.
(C) Croton plants have chlorophyll but it is hidden by dark red colour pigments.
(D) Croton plants are parasites

43. Which of the following statement is/are true about photosynthesis ?
P. Carbon dioxide is essential for photosynthesis to take place.
Q. The products of photosynthesis are simple sugars.
R. Photosynthesis occurs in the green leaves of plants.
S. Sunlight is not used as an energy source by plants to make food during photosynthesis.
(A) P and S only (B) Q, R and S only
(C) P, Q and R only (D) P, Q, R and S

44. What is the aim of the given experiment ?

(A) To show that air is a basic need of plants.
(B) To show that food is a basic need of plants.
(C) To show that water is a basic need of plants
(D) To show that sunlight is a basic need of plants.

45. The equation given below represents photosynthesis.

$$X + \text{Water} \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} \text{Glucose} + Y$$

Which of the following is represented by X and Y in the given equation ?
(A) X - Carbon dioxide, Y - Oxygen
(B) X - Oxygen, Y- Carbon
(C) X - Carbon dioxide, Y - Hydrogen
(D) X - Oxygen, Y - Carbon dioxide

46. How does photosynthesis help to maintain the percentage of oxygen and carbon dioxide in the atmosphere?
(A) By giving off carbon dioxide and absorbing oxygen.
(B) By giving off oxygen and absorbing carbon dioxide.
(C) By releasing oxygen and carbon dioxide.
(D) By absorbing oxygen and carbon dioxide.

47. Which part of the leaf controls the rate of loss of water in the air ?
(A) Midrib (B) Stomata
(C) Vascular bundles (D) Veins

48. What role does the insect play in the insectivorous plant ?
(A) Fertilization process.
(B) Provides nutrients to the plant.
(C) Dispersal of seeds.
(D) Provides carbon dioxide to the plant.

49. What is the role of the bacteria in leguminous plants ?
(A) Convert oxides of nitrogen into soil nitrates.
(B) Convert atmospheric nitrogen gas into soil nitrates.
(C) Convert soil nitrates into gaseous nitrogen
(D) Convert plant proteins into ammonia.

50. Which of the following is true about parasitic plants ?
(i) They absorb food from their host.
(ii) They compete with the host for sunlight.
(iii) They kill the host plant eventually.
(A) (i) and (ii) only (B) (i) and (iii) only
(C) (ii) and (iii) only (D) (i), (ii) and (iii)

51. Chlorophyll and melanin are both:
(A) Proteins (B) Carbohydrates
(C) Nucleic acids (D) Pigments

52. Out of total solar energy reaching earth, the amount utilized by the green plants is
(A) 0.5% (B) 1.0%
(C) 2.5 % (D) 5.0%

53. On Saturday, Sumit after having his lunch, forgot his lunch box in the school. When he opened it on Monday, he found that it had some blackish-brown, cottony stuff in it. Which of the following organisms can it most likely be ?
(A) Mushroom (B) Amoeba
(C) Rhizopus (D) Either (A) or (C)

54. Match column - 1 with column - II and select the correct option from the codes given below.

Column - I	**Column - II**
(a) Chlorophyll	(i) Rhizobium
(b) Symbiosis	(ii) Starch
(c) Insectivorous plant	(iii) Lichen
(d) Nitrogen fixing organism	(iv) Mistletoe
(e) Partial parasite	(v) Pitcher plant

(A) (a) - (i), (b) - (iv), (c) - (iii), (d) - (ii), (e) - (v)
(B) (a) - (iii), (b) - (v), (c) - (ii), (d) - (i), (e) - (iv)
(C) (a) - (ii), (b) - (iii), (c) - (v), (d) - (i), (e) - (iv)
(D) (a) - (v), (b) - (iv), (c) - (i), (d) - (ii), (e) - (iii)

55. Match column - I with column - II and select the correct option from the codes given below.

Column - I
(a) Energy value of food is measured in calories.
(b) Starch and sugar are proteins.
(c) Cellulose can be digested in our digestive system.
(d) In absence of peristalsis, food from oesophagus cannot enter stomach.

Column – II
(i) True
(ii) False
(A) (a) - (i), (b) - (ii), (c) - (ii), (d) - (i)
(B) (a) - (ii), (b) - (i), (c) - (ii), (d) - (i)
(C) (a) - (i), (b) - (i), (c) - (ii), (d) - (ii)
(D) (a) - (ii), (b) - (i), (c) - (i), (d) - (ii)

56. What is common among pancreatic amylase, rennin and pepsin –
(A) All these are protein
(B) All these are protein digesting enzymes
(C) All these are not produced in stomach
(D) All these act at lower pH

57. Which one of the following enzyme acts efficiently at pH 2.0
(A) Pepsin (B) Trypsin
(C) rennin (D) Both (A) & (C)

58. Which of the following statement is correct about Euglena.
(A) It is exclusively autotrophic.
(B) It is exclusively heterotrophic.
(C) It does not possess chlorophyll.
(D) It is autotropic in presence of light and heterotrophic in absence of light.

59. Humans are unable to digest the cellulose of the food because:
(A) Their stomach is not divided into compartments.
(B) The lumen of the small intestine is narrow.
(C) They are unable to chew cellulose.
(D) Certain bacteria that are present in ruminants are not present in humans.

60. Which of the following has ability to fix carbon into organic products.
(A) Autotrophs (B) Heterotrophs
(C) Parasites (D) All of these

FILL IN THE BLANKS

1. Lowest rate of photosynthesis takes place in_____ light.

2. Organisms those feed on fruits _____

3. _____is the ultimate source of energy

4. Gas released during photosynthesis is _____

5. Intestinal juice is called as_____

6. After complete digestion proteins break down into _____

7. Largest gland of body is _____

8. Saliva is secreted in mouth by _____
9. Food is pushed down into the stomach by _____

TRUE / FALSE

1. Plants obtain nitrogen from soil.
2. Human being is an omnivorous organism.
3. Plant intake carbon dioxide during respiration.
4. Solar energy is captured by leaves.
5. Mushroom is a saprophytic organisms.
6. Absorption and assimilation are similar processes.
7. Tongue gives the sense of smell.
8. Pointed teeth in buccal cavity are called canines.
9. Formula of half upper jaw of permanent teeth is 2123.
10. Tongue help in mixing of food with saliva.
11. Rhythmic contraction and relaxation of food pipe is called peristalsis.

EXERCISE - II

VERY SHORT ANSWER TYPE QUESTIONS

1. Write the name of photosynthetic organ in plants.
2. CO_2 in photosynthesis provided by.
3. Why plant appear green in colour?
4. What is the role of juice?
5. What is the main function of teeth?
6. What is Oesophagus?
7. What is digestion?
8. What is the function of saliva?

SHORT ANSWER TYPE QUESTIONS

1. Explain holozoic mode of nutrition.
2. What is the mode of nutrition in fungi ?
3. What are raw material for photosynthesis.
4. Define term autotrophics and heterotrophic.

LONG ANSWER TYPE QUESTIONS

1. Explain the importance of photosynthesis.
2. Why plants appear green in colour ?
3. What are the raw materials required for photosynthesis ?
4. Define the terms – autotrophic & heterotrophic.
5. Explain various modes of nutrition.
6. Label the following parts in figure and name them.

(A) The largest gland in our body.
(B) The organ where protein digestion starts.
(C) The organ that releases digestive juice into the small intestine.
(D) The organ where bile juice gets stored.

EXERCISE - III

PREVIOUS YEAR QUESTIONS

1. A group of students of class 7th were performing an experiment. Among them a student poured alcohol on a plant continuously for a long time. The plant could not prepare food on its own anymore. Which of the following statements explains the reason behind it ?

(A) Alcohol absorbed all the food prepared by the plant.

(B) Alcohol does not let the plant absorb carbon dioxide from the air.

(C) Alcohol dissolved all the minerals present in the plant.

(D) Alcohol dissolved the chlorophyll present in the plant.

2. From which of the four chambers of ruminant stomach, semi-digested food is moved back to mouth ?

(A) Rumen (B) Abomasum

(C) Omasum (D) All of these

3. Which one of the following is a correct match ?

Type of teeth	Function
(A) Incisors	Biting and cutting
(B) Canines	Crushing and grinding
(C) Molars & premolars	Piercing and tearing
(D) Molars	Smaller than premolars

4. The function of scissors is synonymous with the function of

(A) Incisors (B) Premolars

(C) Canines (D) Molars

5. Match Column-I with Column-II and select the correct option from the codes given below.

Column I

(a) Salivary gland

(b) Intestinal gland

(c) Pancreas

(d) Liver

Column – II

(i) Breaks down fats

(ii) Breaks down proteins into peptides

(iii) Breaks down peptides into amino acids

(iv) Breaks down starch into sugar

(A) (a)-(iv), (b)-(iii), (c)-(ii), (d)-(i)

(B) (a)-(i), (b)-(ii), (c)-(iii), (d)-(iv)

(C) (a)-(ii), (b)-(iii), (c)-(i), (d)-(iv)

(D) (a)-(iv), (b)-(ii), (c)-(iii), (d)-(i)

6. Read the given statements and select the correct option.

Statement 1: Plants serve as the ultimate food source for all the organisms whether herbivores or carnivores.

Statement 2: Plants use solar energy to prepare their own food.

(A) Both statements 1 and 2 are true and statement 2 is the correct explanation of statement 1.

(B) Both statements 1 and 2 are true but statement 2 is not the correct explanation of statement 1.

(C) Statement 1 is true but statement 2 is false.

(D) Both statements 1 and 2 are false.

7. Tanmay took a potted plant and covered one of its leaves entirely with black paper and marked it as X and left the plant in sunlight for 6 hours. After 6 hours, he plucked three leaves X, Y and Z. He immersed leaves X and Z immediately in water but smeared leaf Y with petroleum jelly prior to immersion. Bubbles were seen on the surfaces of leaves X, Y and not on leaf Z. Which of the following is most likely the reason for it ?

(A) Bubbles on leaf Z are of oxygen, produced in photosynthesis.

(B) Bubbles on leaf X are of carbon dioxide, produced in respiration.

(C) Stomata on leaf Y are blocked with petroleum layer, thus oxygen cannot come out from leaf.

(D) All of these

Direction (Q. 8 & 9) :

Refer the given passage and answer the following questions. Some organisms like fungi, etc. take in nutrients in solution form from dead and decaying matter. and are called saprotrophs. Fungi also grow on pickles, leather clothes and other articles that are left in hot and humid weather for long time. Certain fungi live in the roots of trees and share shelter and nutrients. This is called symbiotic relationship.

8. Which of the following statements is/are incorrect ?

(i) Fungi are called saprotrophs because they grow on pickles, leather and clothes.

(ii) Saprotrophs lack chlorophyll. so cannot make food by photosynthesis.

(iii) Like some fungi, lichens also show symbiotic relationship.

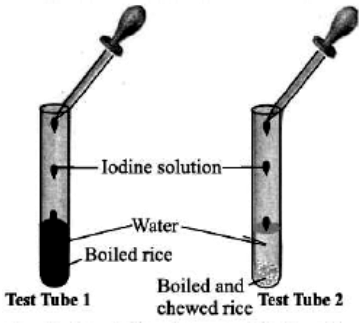
(iv) The bacterium called Rhicobium shows symbiotic relationship as it provides shelter. water and minerals to legumes and, in return. the legumes provide food which they prepare by photosynthesis.

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

9. Which of the following organisms shows symbiotic relationship ?

(A) All fungi (B) Lichens
(C) Rhizobum (D) Both B & C

10. Ridhima took two test tubes labelled as 1 and 2 as shown in the figure. In test tube 1. She put one table spoon of boiled rice and in test tube 2, she put one table spoon of boiled rice after chewing it for 3-5 minutes. Then she added 3-4 mL of water in both the test tubes.



Which of the following would be the expected observation b Ridhima?

(A) Colour changes to blue-black in test tube 1 as rice is rich in starch.

(B) Colour changes to blue-black in test tube 2 as saliva breaks down the starch into sugars.

(C) Colour changes to blue-black in both the test tubes.

(D) Colour does not change in either of the test tubes

11. Which of the following statements is/are true (T) or false (F) regarding nutrition in organisms?

(i) Photosynthesis also occurs in leaves having colour other than green.

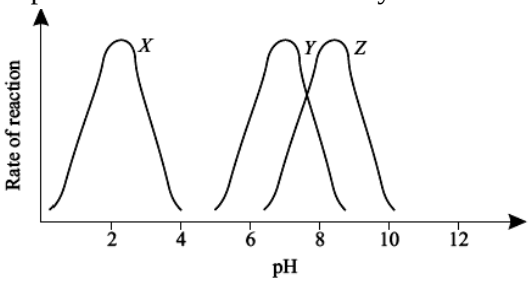
(ii) The process of photosynthesis first produces a simple carbohydrate called glucose which then gets converted into a complex carbohydrate called starch.

(iii) Cuscuta is a yellow-coloured plant but it can synthesize its own food by photosynthesis.

(iv) In a symbiotic association. Rhizobium bacteria derive their nutrition from fungus.

	(i)	**(ii)**	**(iii)**	**(iv)**
(A)	F	T	T	T
(B)	T	T	T	F
(C)	F	F	F	T
(D)	T	T	F	F

12. Refer to the given graph which shows the effect of pH on the activities of three enzymes. X. Y and Z.



The three enzyme samples, X, Y and Z are taken from which parts of the human alimentary canal?

	X	**Y**	**Z**
(A)	Duodenum	Mouth	Stomach
(B)	Mouth	Stomach	Duodenum
(C)	Stomach	Duodenum	Mouth
(D)	Stomach	Mouth	Duodenum

13. The given graph shows the percentage of undigested carbohydrates. proteins and fats through successive parts of the human alimentary canal.

Why does the percentage of undigested carbohydrates remain constant in part X ?

(A) All the starch has been digested and only other carbohydrates remain.

(B) Protease at part X prevents the salivary amylase from acting on starch.

(C) The acidic conditions of part A -prevent salivary amylase from acting on starch.

(D) All the carbohydrates have been digested before reaching part X.

14. Which of the following statements support(s) the fact that the upper surface of a leaf is usually greener than the lower surface ?

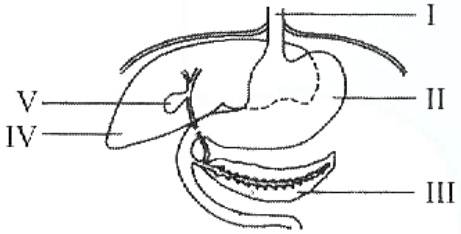
(A) More chlorophyll is present on the upper surface to absorb more light.

(B) There are more stomata present on the upper surface than the lower surface.

(C) More sugar is formed on the lower surface.

(D) The green leaves look greener under the hot Sun.

15. Refer to the given diagram which shows various parts of human digestive system labeled as I, II, III, IV and V.



Identify the organs and select the incorrect statement regarding them.

(A) Organ V is involved in storage of bile not its production.

(B) Organ II secretes digestive juice which contains mucus, hydrochloric acid and digestive enzymes.

(C) Organ IV is the largest gland of the body.

(D) Organ I is involved in the absorption of water from food.

16. Read the given statements and select the correct option.

Statement-1: Chemical digestion of food involves breaking down of food by chewing and churning.

Statement-2: Mechanical digestion of food involves coversion of complex substances such as carbohydrates into their simpler forms such as glucose by enzymatic action.

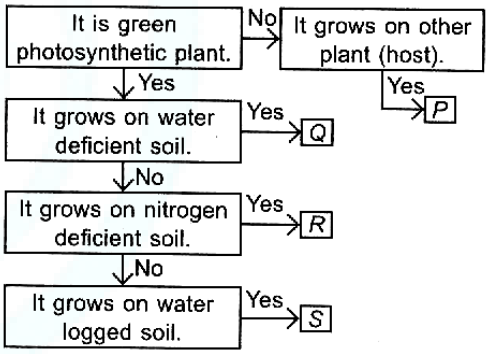
(A) Both statements 1 and 2 are true and statement 2 is the correct explanation of statement 1.

(B) Both statements 1 and 2 are true but statement 2 is not the correct explanation of statement 1.

(C) Statement 1 is true but statement 2 is false.

(D) Both statements 1 and 2 are false.

17. Refer to the given flow chart and select the correct option regarding P, Q, R and S.



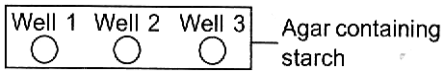
(A) Plant P derives nutrition from the host plant with the help of haustoria and possesses hygroscopic roots which absorb moisture directly from atmosphere.

(B) Plant Q possesses broad thin leaves with superficial stomata.

(C) Plant R possesses special leaf modifications to catch and digest insects.

(D) Plant S possesses stilt roots which help in aeration.

18. Digestive juices were collected from three different regions of the alimentary canal. Drops of these juices were added to wells made in an agar of starch as shown below.



After an hour, the wells were rinsed with distilled water and flooded with iodine solution. The results are shown below.

Well	1	2	3
Colour of iodine solution	Blue-black	Yellow - brown	Yellow - brown

Which of the following correctly identifies the regions of the alimentary canal from which the three digestive juices were obtained ?

	Well 1	**Well 2**	**Well 3**
A.	Mouth cavity	Small intestine	Stomach
B.	Mouth cavity	Stomach	Small intestine
C.	Small intestine	Mouth cavity	Stomach
D.	Stomach	Mouth cavity	Small intestine

19. Read the given paragraph where few words have been italicised. Buccal cavity of humans contains two pairs of salivary glands which secrete digestive juices that help in digestion of proteins present in food. From here food enters stomach where digestion of mainly fats takes place. As this semi-digested food enters small intestine complete digestion of food occurs. Small intestine receives bile juice from pancreas which digests fats. Most absorption of water occurs in large intestine. Select the correct option regarding this.

(A) Two should be replaced by four whereas proteins should not be replaced as it is correctly mentioned.

(B) Fats should be replaced by carbohydrates and pancreas should be replaced by liver.

(C) Digests should be replaced by emulsifies.

(D) Large should be replaced by small.

20. Which of the following pair of teeth differ in structure but are similar in function?

(A) canines and incisors

(B) molars and premolars

(C) incisors and molars

(D) premolars and canines

21. Read carefully the terms given below.

Which of the following set is the correct combination of organs that do not carry out digestive functions?

(A) oesophagus, large intestine, rectum

(B) buccal cavity, oesophagus, rectum

(C) buccal cavity, oesophagus, large intestine

(D) small intestine, large intestine, rectum

22. Read the following statements with reference to the villi of small intestine.

(i) they have very thin walls.

(ii) they have a network of thin and small blood vessels close to the surface.

(iii) they have small pores through which food can easily pass.

(iv) they are finger-like projections.

Identify those statements which enable the villi to absorb digested food.

(A) (i), (ii) and (iv) (B) (ii), (iii) and (iv)

(C) (iii) and (iv) (D) (i) and (iv)

23. Cellulose rich food substances are good source of roughage in human beings because:

(A) human beings do not have cellulose digesting enzymes.

(B) cellulose gets absorbed in the human blood and converts into fibres.

(C) the cellulose digesting bacteria convert cellulose into fibres.

(D) cellulose breaks down into smaller components which are egested as roughage.

ANSWER KEY

EXERCISE– I

SINGLE CORRECT TYPE QUESTIONS

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	C	D	C	D	A	C	A	C	B	D	C	D	D	C	A
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	B	D	B	B	A	B	A	B	D	A	A	D	C	D	B
Que.	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Ans.	B	B	B	C	B	B	B	A	B	C	B	C	C	D	A
Que.	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	B	B	B	B	B	D	B	C	C	A	A	D	D	C	A

FILL IN THE BLANKS

1. Green **2.** Frugivorous **3.** Sun **4.** Oxygen

5. Succus entericus **6.** Amino acids **7.** Liver **8.** Salivary glands

9. Peristalsis

TRUE / FALSE

1. True **2.** True **3.** True **4.** True **5.** True

6. False **7.** False **8.** True **9.** True **10.** True

11. True

EXERCISE– II

PREVIOUS YEAR QUESTIONS

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	D	A	A	C	A	A	D	A	D	A	D	D	C	B	D
Que.	16	17	18	19	20	21	22	23							
Ans.	D	C	D	C	B	A	A	A							