

**RAWALPORA SRINAGAR KASHMIR** 

Life process

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<u>Nutrition</u>:- The word "nutrition" has been derived from the Greek word "<u>Nutrito</u>" which means to nourish. The sum total of all the processes starting from taking the food and its utilization by an organism in various metabolic activities is called nutrition. In the other words nutrition is the process of acquiring energy and materials for growth development, repairment, reproduction and maintenance.

### Modes of Nutrition

Organisms differ from each other in their modes of nutrition. The methods of obtaining food by the organisms are called modes of nutrition. Based on the modes of obtaining nutrients by an organism, nutrition is broadly classified into two types.

1) Autotrophic mode of nutrition.

2) Heterotrophic mode of nutrition.

1) <u>Autotrophic nutrition</u>: - The term has been derived from two Greek words "Auto" means "Self" and "trophe" means "Nutrition". Thus autotrophic means self nutrition. Autotrophic nutrition is a kind of nutrition in which the organisms prepare their own organic food from inorganic substances such as carbon-dioxide and water. This mode of nutrition is found in green plants, some bacteria (Green sulphur bacterium, chlorobium) and some protozoans (euglena). Autotrophic organisms or autotrophs are self-nourishing and are also called producers.

Depending upon the source of energy autotrophs are further categorized into two types.

a. Photo- autotrophs

### b. Chemo-autotrophs

(a)Photo-autotrophs:- All green plants and some bacteria which synthesis their food from inorganic materials in presence of sunlight and chlorophyll by the process of photosynthesis are called photoautotrophs

6CO<sub>2</sub>+6H<sub>2</sub>O Sunlight C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>+6O<sub>2</sub>.↑ Chlorophyll

**b**)<u>Chemo-autotrophs</u>:- Some autotrophs like hydrogen bacteria, Iron bacteria, nitrifying bacteria etc. synthesis their food by utilizing energy released by oxidation of certain inorganic substances. This process is called chemosynthesis and the organism which shows this type of nutrition are called Chemoautotrophs.

**2.** <u>Heterotrophic Nutrition</u>: - The word heterotrophic is derived from Greek Words "Hetero" means "different" and "Trophe" means "nutrition". Heterotrophic nutrition is a kind of nutrition in which an organism is directly or indirectly dependent on autotrophs for their food. Thus non-green plants, all animals including human beings, some bacteria, fungi etc. are heterotophs as they are not able to prepare their own food. Heterotrophs are also known as consumers as they are dependent on the producers directly or indirectly.

Heterotrophic mode of nutrition is of three types:-

### I) Holotrophic

**II)** Saprotrophic

### III) Parasitic.

**I) Holotrophic:** -The word holotrophic is derived from two Greek words "Holo" means "whole" and "trophe" means "nutrition". Holotropic nutrition is a kind of nutrition in which an organism generally takes complex food by the process of ingestion. The complex food under goes proper digestion before it is assimilated into the cells and utilized. Since it is characteristics of animals it is also called Holozoic nutrition ("Holo" means "whole" & "zoic" means "animal").

Depending upon the food habits the holozoic may be:-

a) *Herbivorous*:- which eat plants only e.g. Cow, rabbit etc.

b) *Carnivorous:*- Which eat flesh of other animals e.g. Lion, Tiger etc.

c) *Omnivorous:*- Which eat both plants and animals e.g. man, Sparrow etc.

**II)** <u>Saprotrophic nutrition</u>: - The word saprotrophic is derived from two Greek words "sapro" means "Rotten" and "trophe" means "nutrition". In this type of nutrition the organisms grow and live upon dead and decaying organic mater such as rotten leaves, dead animals, house hold wastes. They secreat

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digestive enzymes which break down insoluble decayed food into simple soluble form which is then absorbed through their body surface.. E.g., some bacteria, mushrooms and some non-green flowering plants show saprophytic mode of nutrition.

**III**) <u>**Parasitic nutrition**</u>:- It is that type of nutrition in which an organism live on or inside the body of other organisms and derive their readymade nutrients from them. The organism which derives its nutrients from other organisms is called parasite and the organism from which parasite derive their food is called host. Parasites are of two types: (i) Ectoparasites (ii) Endo parasites.

(i) **Ectoparasites:**- Ectoparasites are those parasites which live on the outer surface of host e.g. Body louse etc.

(ii) **Endo parasites:-** Endo-parasites are those parasites which live inside the body of host e.g., tapeworm & round worm are endo-parasite in the human body.

(Q) Distinguish Between Autotrop	hic & Heterotrophic nutrition.
A 4.4	TT 4

Autotrophic	Heterotrophic
1. In this type of nutrition an organism	1. In this type of nutrition an organism
prepares its own food.	can not prepare its own food but
	depends upon other organisms for its
	food.
2. In this nutrition the raw material are	2. In this nutrition the raw materials are
inorganic in nature (CO <sub>2</sub> &H <sub>2</sub> O)	organic in nature (carbohydrates).
3. In this type of nutrition radiant energy	3. In this type of nutrition no such
is converted into chemical energy.	process takes place.
4. Autotrophic organisms are producers.	4. Heterotrophic organisms are
	consumers.

### (Q) Define Photosynthesis? Write down the mechanism of photosynthesis?

**<u>Photosynthesis</u>**: - The process by which green plants prepare their food from raw material like carbon dioxide and water in presence of chlorophyll and light energy which is converted into chemical energy. The photosynthesis is the most important anabolic process for providing food supply to the biological world and purifying the atmospheric air by consuming  $Co_2$  and evolving oxygen.

Photosynthesis is fundamentally an oxidation-reduction process in which water is oxidized to  $O_2$  and  $CO_2$  is reduced to carbohydrates (glucose). The simple over all reaction of photosynthesis is as follows.

$6C0_2+6H_2O \xrightarrow{\text{light}} C_6H_{12}O_6+6$
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### Mechanism of photosynthesis

Photosynthesis occurs in two steps. The first step is called light reaction and the 2<sup>nd</sup> step is called dark reaction.

(1)Light Reaction: It occurs in the thylakoids of the chloroplasts. Light reaction involves following steps.

Light energy is absorbed by PS I & PS II (pigment system I and Pigment system II)

The absorbed light splits the water into molecular oxygen, electron and proton. This process is called as photolysis of water.

 $2H_2O \rightarrow 2H^+ + 2OH$  $2OH \rightarrow H2o + \frac{1}{2}O_2 + 2e$ 

In light reaction the excited electrons lost by the pigment system II pass through various intermediate carriers and finally reduce NADP<sup>+</sup> into NADP. During their travel through these intermediate carriers they release energy, which is used to produce ATP from ADP and inorganic phosphate (P). The pigment system II in turn receives the electrons released by photolysis of water. The formation of ATP and inorganic phosphate (P) is called photophosphorylation. The further two electrons and two protons reduce NADP into NADPH<sub>2</sub> Both ATP and NADPH<sub>2</sub> are called assimilatory powers which are used in dark reaction.



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*ii)* <u>*Dark reaction* : - The reactions of dark phase are pure thermo-chemical reactions and does not require light energy but it does not mean that it occurs during night.</u>

The dark reaction takes place in the stroma part of chloroplast.

In dark phase, the high energy  $NADPH_2$  and ATP molecules are utilized to reduce  $CO_2$  to carbohydrate. This fixation involves a biochemical pathway called calvin & benson Cycle. The overall reaction can be represented as.

 $6CO_2 + 12NADH_2 + 18ATP \longrightarrow C_6H_{12}O_6 + 12NADP + 18ATP + 6H_2O.$ 

### (Q) What are essential components required for photosynthesis?

### Ans) Essential components required for photosynthesis:-

Plants need four Essential components for photosynthesis these are .

1 CO2.

2 Water ( $H_2O$ )

3 Chlorophyll.

4 Light

1. <u>Carbon-dioxide</u>:- Green plants make use of  $CO_2$  in their food manufacturing process. The main source of  $CO_2$  for land plants is the atmosphere which contains 0.03-0.04 % of this gas. However, aquatic plants (Hydrophytes) make use of  $CO_2$  dissolved in water.  $CO_2$  enters the leaves by diffusion through stomata. The  $CO_2$  evolved as a result of respiration is also used during photosynthesis by the plants.

2. <u>Water</u>:- Water forms an important reagent for photosynthesis. Plants absorb water from the soil by their root hairs. This water is then transported up to the stem and leaves through Xylem vessels. Which contributes to the process of photosynthesis. However, only less than 1% of the water absorbed by plants is used for the photosynthesis and rest is lost by transpiration. Oxygen evolved during photosynthesis comes from  $H_2O$ .

3. <u>Sun light</u>:- The sun light is the natural and prime source of energy for the photosynthesis. Out of total solar energy reaching to earth, only about 2% is used in photosynthesis. In photosynthesis light energy is converted into chemical energy.

The rate of photosynthesis is affected by the quality, intensity and duration of light. Blue and red components of visible light are the best for photosynthesis. Photosynthesis does not occur in green light because leaves being green reflect it back.

4.<u>Chlorophyll</u>:- These are green coloured photosynthetic pigments found in thylakoids of the chloroplasts. There are five types of chlorophyll pigments. These are:

*i)* Chlorophyll a.

*ii) Chlorophyll b.* 

iii) Chlorophyll c.

iv) Chlorophyll d.

### v) Chlorophyll e.

Out of these Chlorophyll a and chlorophyll b are green in colour and are predominately found in higher plants. The function of chlorophyll molecules is to trap solar energy from sun light and converts it in to chemical energy during photosynthesis.

### (Q) Describe digestive system in human beings?

All the organs in the body of man that help in nutrition collectively constitute the digestive system. It can be divided into two parts.

### 1) Alimentary Canal.

### 2) Digestive glands.

1) <u>Alimentary canal</u>:- Alimentary canal in man is a long tube about 22 feet in length and is highly coiled, muscular structure starts from mouth and terminates as anus. It is differentiated into 8 parts:

### (I) Mouth (II) Buccal cavity (III) Pharynx

(IV) Oesophagus (V) Stomach (VI) Small intestine

(VII) Large intestine. (VIII) Anus

I. <u>Mouth:</u> The slit between two lips is called mouth. The lips prevent the loss of food from the buccal cavity during mastication of food.



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II. <u>Buccal Cavity or Oral Cavity:-</u> It is the large cavity bounded above by palate on the lower side by throat & the laterial walls formed by the jaws. The jaws bear teeth. The teeth are 32 in number in an adult human being.

III. <u>Tongue:-</u> Tongue is a muscular sense organ. It is attached at the posterior end with throat and free in the front. Tongue contains papillae and taste buds. The tongue is essential for mastication, taste, speech and secretion of mucous.

IV. <u>Pharynx</u>: - The pharynx is about 12cm-14cm long funnel shaped vertical canal. It serves as passage for food from the cavity to osophagus. (It is commonly called the throat).

V. <u>Oesophagus:</u> The oesphagus is also called food pipe. It is about 25cm long muscular narrow track which lies behind the trachea and heart. The oesophagus opens into the stomach. The junction of oesophagus & stomach is called cardiac orifice or gastrooesophaged junction. It is guarded by cardiac sphincter. The oesophagus passes food from pharynx to stomach.

<u>VI. Stomach</u>: - The stomach is 'J' shaped muscular sac present on the left side of the abdomen. The stomach has three regions namely **Fundus**, **Body** and **Pylorus**. The posterior end of stomach opens into small intestines by pyloric oriface & is guarded by pyloric sphincter

<u>VII. Small intestine</u>:- Small intestine is the longest and narrow tubular part of alimentary canal that lies coiled in abdomen. Small intestine has circular fords and villi. Small intestine is differentiated in to three parts:

- a) Duodenum
- b) Jejunum
- c) Illeum.
- a) **Duodenum:** It is a 20 25 cm long wider tube that forms a C-shaped arch with stomach. Duodenum has an ampoule where common bile duct and pancreatic duct open jointly.
- b) **Jejunum**: It is the middle part of small intestines; it is 0.80 1.15m long. Jejunum is rich in digestive glands.

c) **Illeum**:- It is 1.8 - 2.5m terminal narrow part of small intestine which is characterized by clubshaped villi and peyer's patches. Major digestion and absorption occurs in small intestine. It also produces a number of hormones.

### (VII) Large intestines

The illeum enters into wide tube called large intestine that measures about 1.5 metres it is differentiated. into 3 parts.

### a. Caecum b. Colon c. Rectum.

**a<u>. Caecum</u>**:- Small almost rounded blind sac measures about 6 cm. from caecum arises a blind worm like structure called vermiform appendix. Which measures about 3-8cm.

**b**. <u>Colon</u>:- Is largest part of large intestines and is divided into four regions they are: Ascending Colon, Transverse Colon. Descending colon & sigmoid colon.

c. <u>Rectum</u>:- It is "S" shaped tube measuring about 12cm that opens to outside as anus.

(IX) Anus:- Opening of alimentary canal at lower end is called anus. It is bounded by anal sphincter. Anus is meant for passing out faeces.

(2) **Digestive Glands:**-The glands which are associated with alimentary canal and secreats some enzymes that helps in the process of digestion are called digestive glands.

Human digestive glands include salivary glands, Gastric glands, liver, pancreas, intestinal glands.

(1)Salivary Glands: Salivary glands are present in mouth. There are three types of salivary glands in man.

(i) <u>**Parotid Glands**</u>:- ) Parotid Glands are the largest salivary glands, which are present below and in front of each pinna (ear) .

(ii) **Sub-maxillary:-** it is located on the inner side of Jaw, one on either side.

(iii)**Sublingual Glands**:- These are present below the tongue.

Salivary glands secreats fluid called saliva through salivary duct into the oral cavity. Saliva is slightly alkaline (PH=6.8) and its daily secretion is about 1 to 1.5 liters Saliva contains two enzymes.



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(a) Salivary amylase or Ptylin:- It converts starch into maltose.

(b) Maltase: - It converts maltose into glucose.

Mucus of saliva helps to lubricate the food for swallowing.

(2)Gastric Glands:- Gastric Glands are tubular multicellular glands present in the internal surface of stomach. There are about 35 million gastric glands in stomach. Gastric glands scerets gastric juice which is highly acidic and has PH 0.1-1.5. Gastric juice contains HCl and two inactive enzymes and an active enzyme called gastric lipase.

a) <u>HCl</u>:- It provides an acidic medium and activates in- active enzymes pepsinogen and prorenin into pepsin and rennin respectively.

b) **<u>Renin:-</u>** It coverts soluble casein into paracasein. This process is called curdling of milk.

c) **<u>Pepsin</u>**:- It converts proteins into peptones and proteoses.

d) Gastric lipase:- It splits fats into faty acids and gylcerol.

(3)<u>Liver</u>:- Liver is the largest gland of our body. It is bilobed reddish, brown gland which lies on the right side of the abdominal cavity. Liver is formed of hepatic cells. Numerous capillaries are present in between these cells called bile capillaries. The hepatic cells join together to form hepatic duct. The two hepatic ducts join together to form common bile duct. The liver secrets bile which is stored in the gall bladder until needed in the duodenunm. The bile is clear yellow alkline fluid and has bitter taste. About 500ml to 1 litre of bile is secreted by liver in a day. Bile contains bile pigments and bile salts.

Bile salts emulsify the fat and facilitate absorption of vitamins. The only enzyme present in bile is alkaline- phosphatase but it has no digestive function.

(4)<u>Pancreas</u>: - It is the second largest gland in our body. Pancreas is a heterocrine, pinkish, leaf like triangular gland present in `C` shaped loop of duoedenum. The pancreas secreats the panereatic juice which is poured into the doedonum through a hepatopancreatic duct. The exocrine region of Pancreeas secreates sodium bi-

carbonate and many digestive enzymes. The bicarbonate ions make the medium alkaline favourable for the action of Pancreatic enzymes.

The some important enzymes present in Panereatic Juice are:

i. <u>**Trypsin**</u>:- It converts proteins into proteoses, peptones and peptides.

ii. <u>Chymotrypsin</u> :- It acts on proteins and converts them into polypeptides and free amino acids.

iii. <u>Amylase</u>: - It converts starch into maltose and small amounts of glucose.

iv. <u>Steapsin or lipase</u>:- It converts fats into fatty acids and glycerol.

v. <u>Sucrase</u>:- It converts sucrose into glucose and fructose.

vi. Maltase :- It converts maltose into glucose.

vii. <u>Nucleases</u>; These acts on polynucleotide chains of RNA and DNA and convert them into nucleotides.
(5)<u>Intestinal Glands</u>: There are two types of numerous, microscopic glands present in the mucosa

of small intestines. They are

### a) <u>Crypts of lieberkuhun.</u>

### b) Brunner`s glands.

These glands secrets intestinal juice. Intestinal juice is alkaline in nature (PH=8.3). Man secrets about 2-3 lit. of intestinal juice. Intestinal juice contains following enzymes:

(i) **Erepsin:-** It converts peptones into amino acids.

(ii)Carbohydrases:- They convert carbohydrates into glucose.

(iii)Nucleases:- Which changes nucleic acids into nucleotides.

(iv)Lipase: - which converts lipids into fatty acids and glycerol.

### (Q) Discuss nutrition in Human Beings?

Human beings are heterotrophic, omnivores organisms. They obtain their food by holozoic mode of nutrition. The utilization of food involves following steps:

- (I) Ingestion (2) Digestion (3) Absorption (4) Assimilation
- (5) Egestion

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(1)<u>Ingestion:-</u>Ingestion means intake of food by an organism. In human beings, food is ingested through the mouth into the buccal cavity. In the buccal cavity, the food is masticated with the help of teeth, which breaks it into smaller pieces.

2) <u>Digestion</u>:- Digestion involves physical and chemical break down of complex, non diffusible food materials into simple soluble food materials. Digestion of food starts in oral cavity continues in stomach and is completed in small intestines.

In the buccal cavity food mixes with saliva secreated by salivary glands which contains enzymes namely ptylin or salivary amylase and maltase, these enzymes convert starch into sugar. The partially digested food called bolus enters into the stomach.

In the stomach, food is treated mechanically by peristaltic movements and chemically by gastric juice. Gastric juice contains HCl and enzymes like pepsin, rennin etc. the HCl provide acidic medium for the action of enzymes. The enzyme pepsin converts proteins into peptones and proteoses, while as enzyme renin converts milk into curd. The churned food called chyme passes from stomach into small intestines. In small intestines the chyme is treated with secreation of pancrease, liver and intestinal glands .These glands release enzymes like trypsin, carbohydrates, lipase etc.

Trypsin converts proteins into peptones and then peptones into aminoacids. While as carbohydrates convert starch into glucose. Lipases converts fats into fatty acids and glycerol. In the small intestines the food changes into diffusible form called chyle.

So during digestion, carbohydrates are converted into glucose, proteins into aminoacids and fats into fatty acids and glycerol.

(3)<u>Absorption</u>:- Diffusion of digested food through the walls of alimentary canal into the blood is called absorption. Simple substances like water, glucoses which do not require digestion is absorbed in stomach.

The digested food is absorbed mainly in small intestines. The inner surface of small intestine is provided with millions of finger like projection called villi. The villi increases the surface area of small intestines which helps in rapid absorption of digested food.

Each villus has lymph vessel in the centre called Lacteal, which is surrounded by a network of capillaries, which in turn is surrounded by a layer of epithelial cells. Digested lipids are absorbed into lacteal while as sugar and amino acids are absorbed by blood capillaries.

(4) <u>Assimilation:</u> Convertion of digested food in to living protoplasm is called assimilation

The blood carries digested food to all parts of the body where it becomes assimilated in to the cells.

In the cells, most of the glucose is oxidized to release energy required for various metabolic activities. The remaining glucose is converted in to glycogen which is stored in liver and muscle cells. The glycogen can be used as source of energy by the body when required.

The amino acids are converted into proteins while as fatty acids and glycerol is converted into fats.

(5) Egestion :- The elimination of faces from alimentary canal through anus is called egestion or defaecation.

### Q. Describe the process of digestion in human beings?

**ANS:** Digestion is a process in which the complex non-diffusible molecules such as proteins, fats, starch and nucleic acids are converted into simple diffusible molecules like amino-acids, fatty acids, glycerol and glucose with the help of enzymes.

The process of digestion can be studied under the fallowing headings:-

I)<u>Digestion of food in buccal cavity</u>:- First the food is taken into the buccal cavity, through mouth. In the buccal cavity, food is masticated with the help of teeth, which breaks it into smaller pieces in order to provide more surface area for the action of enzymes (Physical digestion). The tongue mixes the saliva, secreted by salivary glands with food. The saliva contains mucus which serves to moist the food and make it slippery for easy swallowing. The saliva contains two enzymes namely ptylin or

salivary amylase and maltase. The enzyme Ptylin converts the starch present in the food into maltase and the another enzyme namely maltase converts maltose into glucose. Therefore, only the digestion of carbohydrates takes place in the mouth. This partially digested food which is called bolus passes into stomach through oesophagus or food pipe. There is no digestion of food in the pharynx and esophagus.

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**II**)<u>**Digestion of food in stomach**</u>:- The gastric juice secreted by gastric glands present in the wall of stomach contains mucous, Hydrochloric acid (HCl) and enzymes like pepsin, rennin and gastric lipase.

a) The HCl neutralizes the saliva mixed food and makes the medium acidic for the action of gastric enzymes.

b) The mucous present in the gastric juice protects the inner lining of the stomach from the action of acid (HCl).

- a) The pepsin present in the gastric juice changes the proteins present in the food into peptones.
- a) The gastric juice also contains the small amount of lipase which changes fats into fatty acids and glycerol.
- b) Renin helps to change milk into curd.

The stomach churns the food into a slippery semi-solid mixture called chyme, which passes into small intestines, by the peristaltic movements of stomach.

**III**) <u>Digestion of food in small intestine</u>:- The duodenum is the first part of small intestines. In the duodenum food mixes with two important juices, the bile juice secreted by liver and pancreatic juice secreted by pancreas.

Bile which is alkaline in nature contains only one enzyme called alkaline phosphatase, which has no digestive function. Bile neutralizes the action of HCl and helps in digestion of fats by emulsifying them. Bile also helps in the digestion of fat soluble vitamins.

The pancreatic juice contains the following enzymes:-

ii. **Pancreatic amylase:-**Pancreatic amylase converts starch into sugar and sugar into glucose.

iii. **Pancreatic lipase**:- Pancreatic lipase changes fats (lipids) in to fatty acids and glycerol.

iv. Trypsin:- Trypsin converts proteins into peptones and peptones into amino acids.

The inner lining of small intestine is glandular in nature and it secretes intestinal juice. The intestinal juice contains following enzymes:-

i) Erepsin:- (Mixture of di-peptidase and amino peptidase enzymes) which changes peptones (lower peptides) into amino acids.

ii) Sucrase changes sucrose into glucose.

ii) Maltase changes maltose into glucose.

iv) Lactase changes lactose into glucose.

v) **Nucleolitic enzymes(Nucleases)** which change nucleic acids into nucleotides.

vi) **Lipase** which converts lipids into fatty acids.

In the small intestine the semi-liquid food changes into liquid food due as "chyle", which is diffusible and is absorbed by intestinal wall. Thus the digestion started in mouth is completed in the small intestine. (*O*) *Discuss respiration and its types*?

**<u>Respiration</u>**:-Respiration is a metabolic process in which breaking down of glucose takes place inside the living cells by the process of oxidation resulting in the release of  $CO_2 + H_2O$  and energy.

The compound which is oxidized during respiration is called respiratory substrate e.g., Glucose. Depending weather oxygen is used or not. The respiration is of two types.

(1) Aerobic. (2) Anaerobic.

1) <u>Aerobic Respiration:</u> In this type of respiration complete oxidation of substrate (Glucose) takes place in presence of atmospheric oxygen to  $H_2O \& CO_2$  with the release of energy. It occurs in most of the plants and animals.

enzymes			
$C_6H_{12}O_6 + 6CO_2>$	6CO <sub>2</sub> +	$6H_2O +$	38ATPs
Glucose Carbon	Carbon	Water	Energy
dioxide	dioxide		

<u>2) Anaerobic respiration</u>:- In this type of respiration, incomplete break down of Glucose takes place in absence of oxygen into  $CO_2$  and lactic acid or ethanol with the release of small amount of energy. It occurs in muscles and in certain micro-organisms such as bacteria and yeast.

### <u>Mechanism</u>

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The process of respiration (Aerobic & Anaerobic) is a long and complex process which is completed in two main steps.

- 1. Glycolysis.
- 2. Breaking down of pyruvate.
- 1. <u>*Glycolysis:*</u> It is common to both aerobic and anaerobic respiration . It takes place in cytoplasm without the use of atmospheric oxygen. During this process glucose a six carbon molecule undergoes a series of changes to form a three carbon molecule pyruvate or pyruvic acid.
- 2. <u>Breaking Down of Pyruvate</u> :- When oxygen not available (Anaerobic condition) the pyruvate undergoes incomplete oxidation and is converted into different molecules in different organisms. e.g.
- 3. In yeast glucose is converted into pyruvates and pyruvates are further converted into ethyl alcohol.  $C_6 H_{12} O_6 \xrightarrow{Glycolysis} CH_3COCOOH \xrightarrow{----->} C_2H_5OH$ Glucose Pyruvic acid Ethyl

ose	$\rightarrow$	Pyruvic acid	Ethyl
			alcohol

- 4. In the cells of higher plants under anaerobic condition glucose is converted into ethyl alcohol or organic acids like malic acid, oxalic acids etc.
- 5. In muscle cells, during active metabolism, glucose is oxidized anaerobically and is converted into pyruvates. The pyruvates are further converted into 3 compound molecule called Lactic acid. Glucose ------ pyruic acid -----lactic acid + Energy
- 6. In some bacteria glucose is partially converted into lactic acid or butyric acid.



Bacteria

Glucose -----> Lactic acid + Butyric acid



Figure 11.8 Break-down of glucose by various pathways

### Q. Write a short note on respiratory organs in different organisms.

Ans. The respiratory organs found in different animals are designed in such a way to suit their habitat. Following are the organs which act as respiratory organs in different animals.

*A. <u>General body surface.</u>* In lower organisms such as protists, sponges and cnidarians (protozoa, hydra etc.), exchange of gases takes place through the body surface by simple diffusion.

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habitat, skin acts as respiratory organs. This type of respiration in which exchange of gases occurs through the skin is called cutaneous respiration.

С. Trachea (Air tubes):- Terrestrial arthropods such as insects, millipedes and centipedes have evolved a complex system of whitish shining, inter communicating air tubes called trachea. The exchange of gases with the help of trachea is termed as tracheal respiration.

Gills:- Aquatic animals such as prawns, mussels, D. fishes and tadpoles breathe in water through their mouth and force it past the gills where the dissolved oxygen is taken up by blood.

*E*. Lungs:- Land animals namely reptiles, birds and mammals breathe air by respiratory organs called lungs.

(Q) Describe respiratory system in human being?

The respiratory system in human beings consists of two major components.

(1) Respiratory tract (2) Respiratory organ.

(1) **Respiratory tract**:-The path through which  $O_2$  reaches up to the lungs and CO<sub>2</sub> is removed from the lungs is called respiratory tract. In man it consists of following parts.

(II) Pharynx (III) Larynx (IV) Trachea (I) Nose (V) Primary Bronchi (I) Nose:- The respiratory tract begins with a pair of external nostrils situated at lower end of nose. Each nostril leads into a vertical tube like structure

called nasal chamber. The two nasal chambers are separated by a cartilaginous nasal septum. Each nasal chamber on the other side opens into the pharynx by a aperture called internal naris. In the beginning of the nasal chamber the inner surface is lined with ciliated epithelial lining with mucous membrane to filter the inspired air (warmed, moistened and becomes dust free).

- (II)Pharynx :- The nose opens into the pharynx by a pair of apertures called internal nares. The pharynx is differentiated into upper nasopharynx where open the internal nares and lower oropharynx. The oropharynx leads into two tubes i.e. larynx and oesophagus, through glottis and gullet respectively. The glottis is guarded by a flap called epiglottis (that does not allow anything other than to enter into the larvnx).
- (III)Larynx (voice box):- It is the upper slightly swollen part of trachea or wind pipe. It is more prominent in men as compared to women and is called "Adam's apple". In the larynx is present a pair of vocal cards which help in the production of sound, hence, it is also called voice box. During swallowing of food or liquid, the larynx moves upwards, so that it is opening glottis is close by epiglottis and food does not enter into larynx.
- (IV)Trachea :- The trachea or wind pipe is a long, narrow, whitish tube that extends through the neck, enters the thorax where it divides into a pair of branches called primary bronchi. The walls of trachea are supported by "C" shaped cartilaginous rings.

These rings prevent collapsing of trachea. The trachea at its lower end divide or splits into two branches called primary bronchi.

- (V)Primary bronchi:- These are pair of tubular structures formed as a result of bifurcation of the trachea. Theses are right and left primary bronchi that enters into corresponding lungs. These are also supported by cartilaginous rings
- (2) *Respiratory organs:* The respiratory organs in man are a pair of lungs.



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**Lungs** :- Lungs are a pair of highly elastic, thin walled, spongy, pinkish and hollow bag like structures situated in the thoracic cavity on the sides of the heart and are well protected by bony thoracic cage. Each lung is conical triangular structure. The upper pointed side is called apex and the lower broad side is called base. The left lung is slightly smaller and lighter than right lung. The right lung is divided into three lobs, while the left lung is divided into two lobs. Each lung is enclosed in doubled walled pleural sac. The inner membrane is called visceral layer and the outer as parietal layer of pleural sac. A narrow space exists between the two plural membranes. It is called pleural cavity and contain a fluid called pleural fluid. It acts as a lubricant to reduce friction between the lungs and thoracic wall during breathing.





**Bronchi**:- Each primary bronchus after entering the corresponding lung divides to form secondary bronchi that gives rise to tertiary bronchi. The tertiary bronchi divides into branches which give rise to alveolar ducts that open into blind sac called alveoli.

<u>Alveoli</u>: Alveoli or air sacs are functional units of lungs and forms the gas exchange surface. There are over 700 million alveoli present in the human lungs, representing a total surface area of 70-90 m<sup>2</sup>. Efficient gas exchange, which takes place in human lungs, is due to the increased surface area of lungs.

The wall of each alveoli is only 0.0001/mm thick  $(0.1\mu_m)$ . On its outside is a dense network of capillaries special cells are also present in the alveolus wall, which secrets a detergent like chemical called surfactant.

Surfactant has many functions like it reduces the amount of effort needed to breathe.

### Q) Discuss the process of breathing?

**<u>Breathing</u>**:-The movement of fresh air from outside into the lungs through respiratory tract and the movement of foul air in opposite direction is called breathing

### Mechanism of Breathing: - Breathing involves two steps.

- 1. Inhalation or Inspiration
- 2. Exhalation or Expiration

These two steps are together referred to as respiratory movements.

- 1. <u>Inspiration</u>:-Movements of fresh air in to the lungs is called inspiration .This process involves contraction of diaphragm and external intercostal muscles. This process of contraction results in the expansion of the thoracic cavity which in turn results in the expansion of lungs due to increase in the volume of lungs pressure of the air inside the lungs decreases as compared to the atmospheric pressure There fore fresh atmospheric air rushes into the lungs through respiratory tract .
- 2. <u>Exhalation or expiration</u> :- The movement of foul air from the lungs to out side is called expiration or exhalation. Expiration is a passive process and involves relaxation of the external intercostal & diaphragm muscles .The ribs return to their position and the diaphragm becomes dome shaped .Both these movements reduce the thoracic cavity volume and lungs return to their original size. The air rushes out of the lungs due to the increase in pressure in side the lungs above that of the atmosphere.

### Q. Difference between Aerobic and Anaerobic respiration

≈ 00	1
Aerobic Respiration	Anaerobic Respiration
1. It takes place in presence of	1. It takes place in absence of $O_{2}$ .
oxygen.	
2. It takes place in cytoplasm and	2. The whole process of respiration takes
mitochondria.	place in cytoplasm only.
3. Complete oxidation of substrate takes	3. Incomplete degradation of substrates

# FPS

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place.	takes place.
4. It yields water.	4. It does not produce water.
5. It involves grycolysis, Kreb's cycle and	5. It involves only glycolysis followed by
(More energy is released	incomplete break down of pyruic acid.
6. More energy is released.	6. Less energy is released
7. Examples are: most green plants and	7. Examples are: yeast seeds, fruits, some
animals.	bacteria etc.
Q):- Comparison between photosynthesis	and respiration:
<u>Photosynthesis</u>	<u>Respiration</u>
1. It is an anabolic process during	1. It is a catabolic process during which
food material is synthesized and e	tood material is broken down and energy
1s stored.	1s released.
2. It occurs in the presence of light.	2. It occurs both in the presence and
	absence of light.
3. It occurs in chloroplasts.	3. It occurs partly in cytoplasm and party in
A This seafined to the survey ments	mitocnondria.
4. It is confined to the green parts of	4. It occurs in the cells of all parts.
plant.	The new motorials required are C.U.O.
5. The raw materials required are CC	$J_2$ and $J_2$ and $J_2$ and $J_3$ . The faw materials required are $C_6 H_{12} O_6$
$H_2O.$	(glucose)
(The and any deate and C.U. O	6. The and products are $CO + HO$
6. The end products are $C_6H_{12}O_6$ .	0. The end products are $CO_2 + H_2O_2$
and $O_2$ .	
7. It is endergonic process as it	7. It is an exergonic process as it
stores chemical energy in the	releases chemical energy of the
bonds of organic compound	bonds in organic compounds.
formed .	
Q):-Comparison between breathing and Resp	iration:
Breathing	<u>Respiration</u>
1) It is a physical process. It invol	Ives     1) It is a biological process where glucose is
inspiration of fresh air and expiration	n of oxidized.
foul air.	
2) It does not release any energy.	2) It releases energy in the form of ATP
3) It is an extracellular process.	3) It is an intracellular process
4) Enzymes are not involved.	4) Enzymes are involved.
5) Breathing mechanism varies in differ	rent 5) Respiratory mechanism is
animals.	similar in all animals.
6) It is confined to certain organs only.	6) It occurs in all cells of the body.
Q):- Comparison of Respiration in plants and	l Animals.

# Similarities

Respiration in Plants Respiratio	on in Animals
1. In aerobic respiration free $O_2$ is needed. 1. In aerobic respiration	free $O_2$ is needed
2. $CO_2$ & water are produced in aerobic 2. $CO_2$ & $H_2O$ are	produced in aerobic
3. Energy released is stored ATP respiration.	-
molecules. 3. Energy released is sto	ored as ATP molecules.

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4.	Aerobic	respiration	takes	place	in	4.	Aerobic	respiration	takes	place	in
	mitochon	idria.					mitochon	dria.			
5. Respiratory substrate is glucose.			Respir	atory subst	ance in glucos	se.					

### Comparison between respiration and Combustion

1) No breathing takes place.	1) Breathing takes place except few lower
	animals.
2) No transporting system for the transportation	2) Blood vascular system is present in the
of O <sub>2</sub> & CO <sub>2</sub> is present. Gases diffuse from cell	animals for the transportation of $O_2 \& CO_2$ .
to cell.	3) A considerable amount of detectable heat in
3) In plants very small amount of detectable heat	produced.
is produced.	4) Aerobic animals have either air or $H_2Oas$
4)Green plants have additional oxygen source	source of $O_2$ .
from photosynthesis.	
	5) Rate of respiration is higher.
5) Rate of respiration is low.	
	6) Anaerobic respiration produces ethyl alcohol
6)Anaerobic respiration produces lactic acid.	
7) No $CO_2$ is produced in anaerobic respiration.	7) Anaerobic respiration produces $CO_2$
8) CO <sub>2</sub> produced is released in the atmosphere.	also.
	8) $CO_2$ produced in respirations is utilized
	in photosynthesis.

### Dissimilarities

Respiration	Combustion
	1. It is a non-metabolic process that occurs in non-
1. It is a metabolic process that takes place in	living objects.
living organisms.	
	2. No enzymes are required.
2. Enzymes are required.	
	3. Energy is released at once.
3. Energy is released step by step.	
	4. It occurs at ignition temperature
4. It occurs at body temperature.	
	5. Heat energy is evolved and it is accompanied by
5. Heat energy is evolved and it is not	evolution of light.
accompanied by the evolution of light.	

### Q) Write short note on:

a. Residual volume b. Tidal volume

c. Vital capacity.

d. Total lung capacity e. Dead space

Ans. <u>a. Residual volume:</u> The air left in the lungs even after a forceful breathing out is the residual volume. The residual volume of air in our lungs is about 1500 ml.

**<u>b.</u>** *Tidal Volume:* The volume of air inspired and expired during normal breathing is called tidal volume. The tidal volume in a healthy person is about 500 ml.

*c. Vital capacity:-* The maximum amount of air that can be moved in or out of the lungs is referred as vital capacity of lungs.





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*d. Total lung space:* The maximum air that can be contained in both the lungs of a normal person is the total lung capacity. It is about 6000 ml, i.e. vital capacity (4500 ml) + residual air (1500 ml). *e. Dead space:* The air remaining in the respiratory passage is called dead air space. It is about 150 ml.

### Transportation (Animals and Plants)

*<u>Transportation:-</u> The distribution of food and oxygen to all parts of the body as well as the removal of body wastes from the body is called as <i>transportation*.

Q.Write down structure of heart?

<u>Heart:</u> Heart is a hollow, muscular organ, roughly of the size of one's fist (12cm x 9cm x 6cm) and about 280-340gms in weight in males and about 230-280gms in females Heart is reddish-brown in colour and somewhat conical in form.

*Location:* Heart is located between two lungs in the thoracic cavity.

**Protection:** Heart is covered by layered sac known as pericardium. The inner layer is called visceral layer of *pericardium* and outer layer is called parietal layer of pericardium. In between the two layers of pericardium is present a narrow space called pericardial space full of self secreted fluid called pericardial fluid. Pericardial fluid protects the heart from any kind of mechanical injury and shock and also keeps the heart moist for proper functioning.

### External structure of heart:

Human heart is four chambered organ divided by septa into two halves, the right half and left half. Each half consists of two chambers. The upper chamber is small in size and is called auricle and lower chamber is large in size and is called ventricle.

The auricles are demarcated externally from the ventricles by an irregular grove called *cornary sulcus*. While as two ventricles are demarcated externally from each other by an oblique grove called *ventricular sulcus*.

### Internal structure of heart:

Internally the heart has following components:

- a) Two auricles (b)Two ventricles (c) Great blood vessels (d) Apertures and valves
- (a) <u>Auricles:</u> The auricles have thin walls and are separated from each other by an inter-auricular septum. The septum has an oval thin area called *fossa ovalis*.
- (b) <u>Ventricles:</u> These are thick walled chambers and are separated from each other by a thick, curved partition called inter-ventricular septum. The left ventricle has thicker walls as compared to right ventricle because it has to pump blood to all parts of the body.

<u>(c)Great blood vessels</u>: The blood vessels that enter or leave the heart are called great blood vessels. Blood from all the parts of the body except lungs goes to right auricle via three vessels, they are: (i) Superior vena cava (ii) Inferior vena cava (iii) Coronary sinus

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

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

(*iii*) Coronary sinus: brings deoxygenated blood from the heart walls.

Blood vessels leave from the heart are (i) pulmonary aorta (ii) systemic aorta.

- (i) Pulmonary aorta arise from right ventricle and carries deoxygenated blood to the lungs for purification.
- (ii) Systemic aorta arises from left ventricle and supplies

deoxygenated blood to all parts of body except lungs.

(d) Aperture and valves: There are four valves in the heart which control the flow of blood within the heart. They are;

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- *i.* Bicuspid valve or Mitral valve: It consists of two cusps, it guards the opening of the left auricle into left ventricle.
- *ii.* Tricuspid valve: It consists of three cusps, it guards the right auriclo-ventricular aperture.
- *iii.* Semilunar a pulmonary valves: It has three cusps and are present at the base of aortic and pulmonary arches.
- *iv.* Aortic semilunar valve: It is present at the point of origin of aorta from the left ventricle.



<u>Ans.:-</u> The study of blood vessels is called *ungroupy*. There are uncertypes of blood vessels through which the blood flows.

- (a) The artries (b) The veins (c) The capillaries
- (a) <u>The artries:</u> are the blood vessels that carry oxygenated blood away from the heart (except pulmonary artries) to various parts of body.

Artries are thick walled, highly elastic blood vessels having narrow lumen and no valves.

Each artrial wall is made up of three concentric layers i.e. the inner most tunica interna or intima, the middle layer is called tunica media and outermost layer tunica externa.

(b) <u>The veins</u>: Veins are the blood vessels that collects deoxygenated blood from all parts of the body (except pulmonary veins) to the heart.

Veins are thin walled, less elastic blood vessels having wide lumen and semilunar valves. Each vein is composed of three layers i.e. inner layer called tunica interna, middle layer called tunica media and outer layer called tunica externa.

(c) <u>Capillaries:</u> Capillaries were discovered by *Malpighi* in 1661. The capillaries are formed of single layer of endothelial cells. The capillaries are microscopic, narrow vessels present at the junction of artries (arterioles) and veins (venules), where exchange of food materials, gases, waste materials etc takes place. Capillaries are found abundantly in those tissues where metabolism is very fast.





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### Q.:-What is clotting of blood ? Write down mechanism and flow chart of blood clotting.

<u>Blood coagulation</u>: The conversion of liquid blood into semi-solid blood at the bleeding site is called coagulation it is also called as blood clotting and the semi-solid blood is called clot.

Coagulation is of great biological value for the survival of animals e.g. if someone receives a cut in the skin, the blood flows for a shorter while and then clots, which prevents further flow of blood. Thus clot acts as plug, thereby sealing the ruptured blood vessels.

### MECHANISM OF BLOOD CLOTTING

Platelets (thromboplasts) play an important role in blood clotting, when blood is shed, the platelets disintegrate and liberate thromboplastin. Some amount of thromboplastin is also derived from the damaged tissue. Thromboplast helps in the formation of an enzyme called prothrombinase. This enzyme inactivates heparin, an anti-coaglant substance of blood.

Thromboplastin also converts inactive prothrombin (plasma protein) into active thrombin with the help of Ca<sup>++</sup>. Then thrombin interacts with soluble *fibrinogen* results in the formation of insoluble fibrin which forms the mesh. The red Blood corpuscles get entangled in the mesh and form a blood clot.

Damaged tissue



The above scheme was given by *Morawitz* (1903). However, there are different opinions regarding the mechanism of coagulation.

Q.:-Discuss Blood pressure in human beings?

<u>Ans:-Blood pressure</u>: The *lateral* pressure or force that the blood exerts on the walls of a vessel is called *blood pressure*.

The blood pressure varies according to the contraction and relaxation of the heart. The pressure of the blood inside the artery during ventricular systole is called as *systolic pressure* while as the pressure of the blood inside the artery during joint diastole is called *diastolic pressure*. The instrument used to



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measure blood pressure is called *sphygmomanometer* and is expressed in terms of millimeters of mercury. The normal blood pressure values are:

Systolic pressure = 120mm Hg

Diastolic pressure = 80mm Hg

This is usually written as  $^{120}/_{80} mmHg$ 

(1)Hypertension: A persistent rise in blood pressure is called *hypertension* or high blood pressure. Hypertension is caused by constriction of arterioles, which results in increased resistance to blood flow. It can lead into rupture of an artery and internal bleeding:

### Causes of Hypertension.

(a) In older age arteries become less elastic so that heart has to pump blood with great force. Thus more force is exerted on the walls of arteries and caused high blood pressure.

(b) Intake of excessive saturated fats, smoking and adulterated food causes hypertension.

(2)*Hypotension:* Fall in the arterial blood pressure is called hypotension or low blood pressure. It may result expansion of arteries, loss of blood in *hemorrhage* or failure of the pumping action of heart.

### Q.:- Write a note on Lymphatic system in human beings

Ans) Lymph and its associated parts constitute lymphatic system. It consists of (a) lymph (b) lymph capillaries (c) lymph vessels (d) lymph nodes

*Lymph:* Lymph is a colourless fluid connective tissue. Lymph is formed from blood by the passage of substances through the wall of the capillaries in the intercellular tissue spaces.

*<u>Composition</u>*: Lymph is resembling with plasma and contains large number of lymphocytes, water and solid components like sugar, urea, nitrogen substances, phosphorus, calcium, enzymes and antibodies etc.

(b) Lymph capillaries: These are blind at one end and are interwoven with blood capillaries but are not connected with them. They have very thin walls.

(c) Lymph vessels: Lymph capillaries join to form lymph vessels. Lymph vessels resemble veins in structure but have thinner walls and more valves. The smaller lymph vessels join together to form large vessels, which in then join to form two main larger lymphatic vessels or trunks (1) Thoracic duct (2) *Right lymphatic* duct.

(d) Lymph nodes:- The bead like swelling which occurs at intervals in the course of lymphatic vessels are called lymphatic nodes. Lymph nodes are masses of *reticular connective tissue* and contains lymphocytes plasma cells and fixed macrophages. Lymph is filtered through lymph nodes. Lymph nodes are abundant in the regions of neck, arm-pits and groins.

### Functions of lymph:

- a) It helps in the exchange of various materials between blood and body tissues.
- b) It carries lymphocytes and antibodies from lymph nodes to the blood.
- c) It transports fatty acids and glycerol from intestines to blood.
- d) It destroys micro-organisms.
- e) It carries plasma proteins synthesized in liver and hormones from endocrine glands.
- f) Spleen is a lymphatic organ, acts as blood bank and graveyard of RBC's

### Q.:-Differentiate between artries and veins

$\sim$ JJ	
Artries	Veins
1) Artries carry blood away from the heart	1) Veins bring deoxygenated blood from the
for distribution to the body.	body back to the heart.
2) They carry oxygenated blood except	2) They carry deoxygenated blood except
pulmonary artery.	pulmonary veins.
3) The flow of blood is fast and jerky due to	3) The flow of blood is slow and steady.
the beat.	
4) In Artries blood has high pressure.	4) In veins blood has low pressure.
5) Artries are deep seated.	5) Veins are superficial.
6) They have thick elastic walls and narrow	6) Veins are thin-walled less elastic blood
lumen.	vessels with wide-lumen.
7) They are not collapsible.	7) They are collapsible.



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8) They do not posses any valve.	8) Valves are present at regular intervals.
9) They do not contain any blood after the	9) They contain blood even after the death of
death of an animal.	an animal.
Q.:-Differentiate between blood and lymph	
Blood	Lymph
1) Blood is red in colour.	1) Lymph is colourless.
2) Erythrocytes are present.	2) Erythrocytes are absent.
3) Hemoglobin is present.	3) Hemoglobin is absent.
4) It contains many plasma proteins.	4) Plasma proteins are absent or in very low
	concentration.
5) Calcium and phosphorus concentration is	5) Low concentration of calcium and
very high.	phosphorus.
6) It flows in blood vessels.	6) It flows in lymph vessels and also bathes
	various body tissues.
7) It helps in transportation of various	7) It acts as a middle man for the exchange of
materials.	materials between blood and body tissues.
8) Its flow is fairly rapid.	8) Its flow is very slow.
9) It flows from the heart and flowing	9) It starts from the tissue spaces and flowing
through the artries, capillaries and veins and	through the lymphatic capillaries and vessels
returns to the heart.	enters the subclavian vein.

### **Transportation in plants**

#### **O)** What is transportation?

Ans) The water and minerals absorbed by the roots are transported through the xylem tissue, while food

prepared by the leaves is phloem. through This water and food occurs by processes of ascent of sap translocation, respectively collectively called as transportation.

### Q.:- Describe transport of and minerals. OR What is of Sap?

Ans) Plants require water making food and mineral salts for

purposes such as making proteins etc. Plants absorb and mineral salts from the soil by their root system. roots the water and dissolved minerals called sap is transported to the various parts of the plant like leaves through xylem.

The upward movement of water with dissolved minerals (sap) from roots to stem branches leaves is called ascent of sap. The elongated, tracheids and xylem vessels placed end to end any cross walls forms the pipe line for conducting and minerals from the roots to the leaves.

### Path of ascent of sap

Water along with dissolved substances is 1. absorbed by the root hairs from the soil.



Epidermis

b. Pathway of water through

the plant

Root hair

Water entering root hair

vapour from

stoma

Spongy mesophyll

Water stream in

stem xylem

Vein

water

for various water From the

stem,

and their lignified without water



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- 2. Water enters the root hairs first by *imbibation* and then by the process of *osmosis*.
- 3. Water with dissolved minerals called sap, absorbed by the root hairs is passed through the cortex, passage cells and *pericycle* of the roots to enter the *tracheary* elements of xylem.

The movement of sap takes place by virtue of one or more forces such as:

#### (1) Root pressure (2) Transpiration pull.(3) Cohesion and adhesion of water and

(1) Root pressure: - Develops in the root due to the turgidity of cells.

(2) Transpiration pull: - As a result of transpiration the mesophyll cells lose water vapours through the stomata and thus lowers the water potential of the surrounding mesophyll cells which in turn draw the water from the deeper cells of the leaf. Thus during transpiration a stress is developed, which drawn continuously from the roots (in contact with soil water) along the xylem of the stem. This stress or tension in the water column is called transpiration pull. As a result of transpiration pull whole of the water is lifted like a rope or cord.

(2) Cohesion and Adhesion of water:- The walls of xylem vessels made of lingo-cellulose has strong affinity for water molecules. Water in vessels forms continuous unbroken column due to the forces of cohesion (among water molecules) and adhesion (between water molecules and xylem vessels).

Thus according to above theory, water ascends in the plants because of transpiration pull and the coloumn of water remains continuous because of cohesive force of water molecules.

#### *O*) What is translocation? Or how is food transported in plants?

Ans) Green cells in the plants prepare organic food by the process of photosynthesis. The organic food (carbohydrates) is transported from the green cells mainly of leaves to all the non-green cells of the plant for utilization. The transport of organic solutes form one place to another in higher plants through phloem is called as translocation of organic solutes.

#### Mechanism of translocation

Munch in 1930 explained theory of mass flow to demonstrate the translocation of food. Munch's hypothesis postulates that the mass flow of organic solutes (source)

takes place from the site of higher concentration to the site of lower concentration (sink).

The Principal of mass flow hypothesis can illustrated in figure. Two chambers 'A' and 'B' permeable membranes are connected with a tube chambers are immersed in two interconnected containing water. Sugar solution in chamber 'A' is concentrated whereas chamber 'B' contains dilute solution. Water from the reservoir enters in A due to endosmosis and its turgor pressure This causes mass flow of sugar solution from 'A' to





movement will continue. Till the solutions in both chambers attain similar concentration.

Cambium Mesophyll cells Xylem Phloem CO with semi Supply 0 'T'. These reservoir chamber increases. chamber chamber through tube under the influence of turgor Consumption pressure end gradient. Boot cells Fig. 3.4 Mechanism of translocation of food



containing

be

sugar

**'B'** 

**'**T'

The

the

In young seedlings, the cotyledons reserve food are major source of food and the roots act as sink. Therefore, the translocation of organic solutes occurs from, the cotyledons to the roots.



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In grown up plants, carbohydrates are synthesized in the mesophyll cells of the leaves (source) consequently it causes increases in the osmotic pressure of these cells. The increase in osmotic pressure causes these cells to absorb water from the surrounding cells. The turger pressure (the pressure due to increased turgidity) of the mesophyll cells causes some of the solutes to pass in to the sieve tubes of the phloem where from it is transported to sink (The non synthesizing regions) stem and roots.

### **Q**) What is excretion?

Ans) The elimination of metabolic wastes, excess of salts and excess of H<sub>2</sub>O from the body is called excretion

**Excretion** 

Various metabolic waste products are formed due to the complex chemical reactions taking place within the body. These waste products if accumulated in the body will tend to alter normal internal environment of the body and cell functioning will deteriorate, causing eventual death of the cells which may possibly result in the death of the individual. Therefore, the metabolic wastes must be removed from the body.

### Q:- What are excretory organs ? Discuss different excretory organs in different groups of animals.

Ans.:-The organs that help in the elimination of metabolic wastes from the body are called excretory organs.

Excretory organs are different in different groups animals.

- (1) In unicellular organisms like *amoeba*, *paramecium*, *euglena* excretory products are eliminated through general body surface by the process of diffusion.
- (2) *Sponges* and *coelenterates* also excrete excretory products i.e. ammonia through the general body surface in the surrounding water by the process of diffusion.
- (3) Is *platyhelminthes* or *flat-worms* have special cells called flame cells of protonephridia for excretion.
- (4) In *Annelids* like earthworm and leech, the excretory organs are highly coiled tube like structure called *nephridia*.
- (5) In *crustaceans* such as prawn excretory organs are green glands or *antennary* glands.
- (6) In insects, *millipeds*, *centipeds* and *scorpions* the excretory organs are fine unbranched tubules called *malpighian tubules*.
- (7) In vertebrates, a pair of kidneys along with some other parts constitute excretory system of vertrabates.

Some other organs like skin, lungs, liver and large intestines act as accessory excretory organs in most of the vertrabates.

### Q.:- Define Excretory system? Discuss excretory system in man.

Ans.:-All the body organs which help the animal in excretion collectively constitute the excretory system. The excretory system of man consists of man:

- 1. A pair of kidneys.
- 2. A pair of ureters.
- 3. A urinary bladder and
- 4. Urethra.

### (1) Kidney

The kidneys are reddish brown, bean shaped slightly flattened organs about 10cm long, 5cm wide and 4cm thick. Each weighing about 150 grams in an adult male and 135 grams in an adult female.

The kidneys are placed against the back wall of abdominal cavity just below the diaphragm, one on the either side of vertebral column. They are protected by the last two pairs of ribs. The kidneys are asymmetrical in position i.e. present in different levels. The right kidney is about 1 - 1.5cms lower than left kidney. The outer surface of the kidney is convex and inner surface is concave and has deep notch called *hilus*. The *ureters*, renal artery, renal vein and nerves enter into the kidney.



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In a section of kidney the peripheral portion appears dark reddish brown called *cortex* and central portion called *medulla*. The medulla is subdivided into 15 or 16 conical masses called renal pyramids. Each pyramid has thousands of tubules called *uriniferous tubules* or *nephrons* and blood vessels.

### (2) Ureters

From the *hilum* or *hilus* of each kidney emerges a cylinder tube called the ureter. Each ureter is about 10 – 12 inches in length and about 3mm in diameter. The upper end of each ureter enters the kidney of its side and expands forming a funnel shaped structure, the renal pelvis. The lower end of the ureter opens into the sac like structure called *urinary bladder*.

### Urinary bladder

Urinary bladder is a median pear shaped sac situated in the lower of pelvic region. The lower part or neck of the bladder leads into the uretrhra is guarded by a sphincter muscle, which remains closed until the time of micturition (urination) the size of urinary bladder depends upon the urine in it. It can hold 0.5 - 1litre of urine.

### (3) Urethra

The urethra is small tube leading from the floor of the urinary bladder and leads to the exterior. In a female it is quite short about 3 – 5cm long and carries only urine. It opens by urinary aperture in the valve infront of vaginal aperture. In a male urethra is much longer about 20cms and carries urine as well as spermatic fluid. It opens out at the tip of the penis by *urinogenital* aperture.

### *O*)Write in detail the internal and external structure of Kidneys?

Ans: The kidneys are reddish brown, bean shaped slightly flattened organs about 10cm long, 5cm wide and 4cm thick. Each weighing about 150 grams in an adult male and 135 grams in an adult female.

The kidneys are placed against the back wall of abdominal cavity just below the diaphragm, one on the either side of vertebral column. They are protected by the last two pairs of ribs. The kidney are asymmetrical in position i.e. present in different levels. The right kidney is about 1 - 1.5 cms lower than left kidney. The outer surface of the kidney is convex and inner surface is concave and has deep notch called *hilus*. The *ureters*, *renal artery*, *renal vein* and nerves enter into the kidney.

In a section of kidney the peripheral portion appears dark reddish brown called *cortex* and central portion appears called *medulla*. The medulla is subdivided into 15 or 16 conical masses, called renal pyramids. Each pyramid has thousands of tubules called *uriniferous tubules* or *nephroi* and blood vessels.

Nephron or uriniferous tubule is the structural and functional unit of kidney. Each kidney of man is formed of about 1 million nephroi, each nephron is a coiled tubule having a length of 3cms. Each nephron of the kidney is differentiated into two parts.

- (1) Malpighian body or renal corpuscle.
- (2) Renal tubule.

(A) Malpighian body or renal corpuscle: It lies in the cortex of the kidney and is further differentiated into (i) Bowman's capsule (ii) Glomerulus

- Bowman's capsule: The proximal end of the nephron located towards the outer surface of the *(i)* kidney is produced into doubled walled cup called Bowman's *capsule*. The space lying between the two walls of Bowman's capsule is called capsular space. The cavity of the cup contains a network of capillaries called *glomerulus*.
- Glomerulus: It is formed by the capillaries of incoming blood vessels (afferent arteriole) and (ii)that of out going blood vessel (efferent arteriole). The glomerulus and Bowman's capsule are together called *malpighian corpuscle*.

### (B) Renal tubule

The Bowman's capsule leads into tubular portion called *renal tubule*. The proximal portion of renal tubule arising from the Bowman's capsule is thrown into many coils called proximal convoluted tubule which is about 12 - 24 cms in length.

The proximal convoluted tubule leads into a U shaped portion located into renal meddula called henle's loop. Loop of henle has three regions namely:

(a) proximal descending limb (b) a middle thin segment (c) a distal ascending limb.



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The ascending limb leads into another coiled portion called distal convoluted tubule. It opens into a common tubule called *collecting duct*.

The open ends of so many nephrons open into the wider tube called collecting tubules that extends from cortex to medulla. The collecting tubules converge to form groups called pyramids. The narrow apex called renal papilla or ducts of *Bellini*. These ducts drain the urine collected from the nephron into the *pelvis* which leads to ureter.

### (Q) Write a short note on: (a) Diffusion (b) Stomata (c) Alveoli

(a) Diffusion:- Diffusion may be defined as the movement of molecules or atoms of a substance from the region of higher concentration to the region of lower concentration.

The exchange of gases like  $CO_2$  and different organs of the plant and atmosphere region of higher concentration to lower concentration is an example of diffusion.

(b) Stomata:- Stomata are microscopic pores by two specialized kidney shaped guard cells. are present in the epidermis of the leaves and stems.

Stomata are chiefly concerned with exchange during respiration and photosynthesis.

<u>c) Alveoli</u>: Alveoli or air sacs are functional lungs and forms the gaseous exchange There are over 700 million alveoli present in lungs, representing a total surface area of 70-



efficient gas exchange, which takes place in human lungs is due to the increased surface of lungs. The wall of each alveoli is only 0.0001/mm thick  $(0.1\mu_{m})$ . on its outside is a dense network of capillaries special cells are also present in the alveolus wall, which secrets a detergent like chemical called surfactant.

Surfactant has many functions like.

a. Reduces the amount of effort needed to breath.

b. Speeds up the O<sub>2</sub> & Co<sub>2</sub> transport and also helps to kill any bacteria which reach to the alveoli.

### Q.1 Define chlorophyll?

Ans. These are green coloured photosynthetic pigments of the chloroplasts. These are five types chlorophyll pigments called chlorophyll a,b,c d and e. Higher plants contains predominantly two types of chlorophylls i.e. chlorophyll a and chlorophyll b

The function of chlorophyll molecules is to trap solar energy from sun light and convert into chemical energy during photosynthesis

### Q.3 Write a short note on Human teeth?

Ans. The white shining, hard structures present in the upper and lower jaw of the buccal cavity.

**Types :-** Human teeth are heterodant i.e. of various shapes, size and structure adapted for different functions. They are of four types:-

- 1. *Incisors*:- They are chisel shaped and are used for cutting the food.
- 2. *Canines:* They are pointed and are used for cutting and tearing.
- 3. *Pre-molars*:- Pre- molars are broad and are used for grinding the food.

4. <u>Molars:-</u> Molars are also broad and are used for grinding or chewing the food.

### <u>Structure of teeth.</u>

*Structure:* Tooth have an inner cavity called pulp cavity filled with blood vessels on the outer side is surrounded by two hard layers i,e layer of dentine and outer hard layer of enamel. Enamel is the hardest substance in body.

Ds

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pm

 $2\left[\frac{2}{2},\frac{1}{1},\frac{0}{0},\frac{2}{2}\right] = 20$ 

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Externally tooth consists of three regions crown, neck and root. The crown is exposed part of the tooth, the neck is usually covered by flesh skin called the gum. The root is embedded in the socket of jaw bones.

### <u>Dental Formula:-</u>

- 1. Milk teeth (or) Temporary set
- 2. Teeth at the age of 20- years  $2 \begin{bmatrix} i & c & pm & m \\ 2 & 1 & 2 & 2 \\ 2 & 1 & 2 & 2 \end{bmatrix} = 28$
- 3. Teeth in adult  $2\begin{bmatrix} i & c & pm & m\\ \frac{2}{2} & \frac{1}{1} & \frac{2}{2} & \frac{3}{3} \end{bmatrix} = 32$

Where 'i' stands for incisors

'c' stands for canines.

- 'PM, stands for pre-molars
- 'M' stands for molars.

### Q) Write a short note on haemoglobin?

Ans) (1)Haemoglobin is red coloured respiratory pigment present in the blood.

(2) Haemoglobin occurs in all vertebrates, several crustaceans, annelids, flat worms etc.

(3) It occurs in blood corpuscles of vertebrates.

(4) Haemoglobin is composed of two components namely a protein component called globin and nonprotein component called haem.

(5) Haemoglobin transports  $O_2$  from lungs to cells by combining with oxygen and forms oxyhaemoglobin.

 $Hb + O_2 \iff HbO_2$  (oxyhaemoglobin)

(6) Haemoglobin also transports  $CO_2$  from cells to lungs.

(7) The red colour of blood in vertebrates is due to the presence of haemoglobin.

### (Q) Write a short note on nutrition in Amoeba?

The mode of nutrition in Amoeba is holozic and it is omnivorous. It feeds on microscopic animals bacteria, other protozoon's etc, and the process of obtaining food is called phagocytosis.

The nutrition in Amoeba takes place in the following steps:-

1. <u>Ingestion</u>: The process of taking the food in side the body is called ingestion. There are four different modes of ingestion in Amoeba but engulfing active prey is very common. During ingestion Amoeba sends out the pseudopodia around the prey. A cup like structure is formed and it is called food cup enclosing prey along with water. Ultimately the opening of food cup closes and a non-contractile food vacuole is formed.

2. <u>Digestion:-</u> Digestion in case of Amoeba is intracellular i.e. inside the cell in food vacuole (phagosome). First of all the medium is acidic in the food vacuole and the organism is killed. Then the medium becomes alkaline. In alkaline medium the digestion of starch, proteins and fats is completed with the help of enzymes, amylase, protease and lipase respectively.

3. <u>Absorption and assimilation:-</u> Each food vacuole remains in endoplasm for about 25 hours. During this period, the digestion is completed. The food vacuole circulates in the endoplasm and gradually shrinks in size and the products of digestion defuse into cytoplasm. This is called absorption by simple process of diffusion. There the digested food gets assimilated to form new protoplasm.

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4. *Egestion:* Egestion of undigested products takes place at any point on the surface of body i,e there is no fixed anus. The much reduced food vacuoles shift to temporary posterior end of the animal and is left behind as the Amoeba moves ahead. The plasma membrane heals up to prevent loss of cytoplasm.

![](_page_22_Figure_6.jpeg)

Fig. 1.13 Nutrition in Amoeba

### Q) Write a short note on opening and closing of stomata?

Stomata are minute pores present either on one or both the surfaces of the leaf to facilitate exchange of gases between the leaf and the atmosphere. Each stomata consists of a stomatal aperture and two surroundings guard cell. The guard cells are kidney shaped and contain chloroplasts. The inner wall of each guard is thick and the outer wall is thin.

During the day, the cell-sap concentration becomes high due to accumulation of sugar as a result of photosynthesis. This leads to end osmosis and water is withdrawn inside the guard cells from neighbouring cells. This makes the guard cells turgid so that their thin outer walls get stretched out widening the stomatal pore. This pressure in guard cells is called turgor pressure.

At night, there is no photosynthesis, carbon dioxide get accumulated in guard cells this  $CO_2$  combines with water to form carbonic acid. It promotes the conversion of sugar into starch which is insoluble in water. As a result exosmosis takes place and guard cells become less turged. Thus stomatal pore gets narrow down and closes.

### Q) Write a short note on artificial kidney (haemodialysis)?

Ans) Artificial kidney is used to filter the blood of a patient whose kidneys are damaged. The patient is said to be put on dialysis and the process of purifying blood by an artificial kidney is called haemodialysis.

### <u>Process of haemodialysis:</u>

- > Blood of the patient is taken out from main artery and cooled to  $0^{0}$ C and an anticoagulant (heparin) is mixed with it.
- The blood is then pumped into the apparatus (artificial kidney), wherein, the blood flows in cellophane tubes, which are kept in a salt solution that is isotonic with the blood plasma.
- As the blood flows through these tubes, molecules of compounds like urea, uric acid, creatinine, etc. diffuse out in the dialysis fluid.
- Blood coming out from the apparatus is pure blood; it is warmed to the body temperature and mixed with anti heparin to restore its normal coagulatibility.
- $\succ$  This purified blood is then pumped into the body through a vein.
- Q.2 Difference between Holozoic and saprophytic organisms. Ans. Holozoic Saprophytic

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- 1, These organisms feed on the solid complex food.
- 2. The site of digestion is always inter cellular.
- 1, These organisms feed

on dead and decaying organic matter.

- 2, The site of digestion is always extra cellular.
- 3, Two examples of holozoic organisms 3, Two examples of saprophytes are bacteria are human beings (man) and rabbit. and fungi.

### *Q.:-Write a short note on urine and its compositions?*

Ans.:- An adult man normally passes about 1-8 litres of urine in 24 hours. Urine is a transparent yellowish fluid.

Its yellow colour is due to a pigment urobilinogen derived from the breakdown of haem component of haemoglobin of worm out RBC's.

Its pH ranges from 6-8. it has unpleasant odour. If allowed to stand, the urea present in it is degraded by bacteria to ammonia, which imparts a strong smell to it.

In normal composition, urine consists of 95 percent water, and the rest 5 percent is the compounds-urea 1.5g, uric acid 0.7g, creatinine 2.3g and negligible amount of hippuric acid of these, urea is the principal compound in human urine. The non-nitrogenous organic compounds include vitamin C, oxalic acid and phenolic substance.

The inorganic substances include ammonia (0.6g/L) and mineral salts, such as phosphates, sulphates and chlorides of Na, K, Ca and Mg. Sodium chloride (9.0 g/L) is the principal mineral salt in the urine.

Abnormal components of urine include albumin, bile salts, bile pigments, glucose and ketone bodies, which occur in the urine in various pathological conditions.

### of CO<sub>2</sub> and

### (Q) Describe blood and its composition?

Blood:- Blood is red-coloured, viscous & complex connective tissue fluid. It is salty in taste. It is slightly alkaline in nature with a PH range of 7.3-7.5. It is also known as "river of life" An average human being has about 5.5 liters of blood in his body. About 55% of blood is fluid called plasma and the remaining 45% is made of solid particles called corpuscles. Blood always moves from the heart through the arteries & back to the heart through veins.

Composition of blood:- Blood is made up of two main components plasma (liquid part) & blood corpuscles (solid part)

1) Plasma:- Plasma is a straw-coloured aqueous solution. It contains water (about 90-92%) inorganic salts (about 1-2%) & organic compounds (about 7-10%). The inorganic salts present in plasma are chlorides, carbonates, bicarbonates, sulphates, potassium, calcium, magnesium, iron etc. there are many types of organic compounds in plasma which are:

- a. <u>Plasma Proteins:-</u> The main plasma proteins present are albumin, globulin & fibrinogen.
- b. Nutrients:- The main nutrients present in plasma are glucose, amino acids, fatty acids and vitamins,
- c. <u>*Regulatory Substances:-*</u> The main regulatory substances present are hormones, enzymes etc.

2) Blood corpuscles:- These include RBC's, WBC's and blood platelets

a) Red blood Corpuscles (RBC's) or Erythrocytes:- Red blood corpuscles are biconcave & anucleated disc-like structures, flat in the centre and thick & rounded at the periphery. They are about 7-8 µ m in diameter and 2µ m thick RBC's are produced in the bone marrow of bones such as ribs, vertebrae column & skull bones. Their number ranges from 5-5.5 millions in an average human male & 4.5 -5 million in an average human female. RBC's have a coloured spongy body which contains haemoglobin. The haemoglobin is the respiratory pigment which is formed of an iron containing part known as haem and a protein part known as globin

b) White blood corpuscles: (WBC's) or leucocytes: White blood corpuscles are rounded to irregular shaped cells and are capable of amoeboid movement. WBC's are produced in lymphnodes, spleen, thymus and red bone marrow. Their number varies from 5000 to 10000 per cubic millimeter or micro litre. WBC's are nucleated and are colourless.

![](_page_23_Picture_28.jpeg)

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![](_page_24_Picture_1.jpeg)

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WBC's are of two types; Granulocytes (contain granules in their cytoplasm) and Agranulocytes (Lack granules in their cytoplasm)

<u>(c) Blood platelets</u>: The platelets are the smallest formed elements of the blood. They are rounded or oval, disc like bodies. They are non-nucleated. Their number varies from 20,0000–30,0000 per mm<sup>3</sup> of blood and its size is about  $3 - 4 \mu m$  in diameter. They are produced from red bone marrow. Their life span is about 3 - 5 days and is mainly destroyed in spleen. They are colourless and play a major role in blood clotting. They release a chemical called thromboplastin which initiates the process of blood clotting.

### (Q) Write in detail the functions of blood?

Ans) Blood is important component of transport system in human beings and performs following functions:

(*i*) *Transport of nutrients:*- The digested food substances are absorbed by blood at the site of absorption (intestine) and transported to different organs of the body.

(*ii*) *Transport of respiratory gases:*-Blood transports oxygen (respiratory gas) from the lungs (respiratory organ) to the tissues and carbon dioxide (respiratory gas) from the tissues to the respiratory surface.

(*iii*) *Transport of respiratory waste products:*-The metabolic waste substances produced in the body are transported by blood to the organs meant for their removal from the body.

(*iv*) *Transport of body secretions:* Blood transports chemical secretions like hormones, from the site of their secretion to the target organ.

(v) *Regulation of body temperature:*-Blood helps to control the body temperature by evenly distributing the blood to different parts of the body.

(*vi*) *Defense against infection:*-Blood contains white blood corpuscles that are phagocytic in nature. WBC's also produce antibodies which combat the bacteria, after neutralizing their toxins and thus, play a protective role.

(*vii*) *Maintenance of PH:-* The plasma proteins are amphoteric in nature i.e. they act as buffer and thus prevent any shift in Ph of blood.

(*viii*) *Water balance:*-Blood maintains water balance to a constant level by bringing about constant exchange of water between the circulating blood and the tissue fluid.

### (CIRCULATION OF BLOOD)

### (Q) Describe double circulation in human beings?

Ans: Heart contracts and expands alternatively to send or receive the blood .It is called circulation. The contraction of heart is called systole while as the expansion of heart is called Diastole.

The circulation of blood in human heart is called double circulation and was first discovered by William Harvey in 1628.. Double circulation means that the blood passes through the heart twice for each circuit of body.

Double circulation consists of:

1. Pulmonary circulation

2. Systemic circulation.

![](_page_24_Picture_24.jpeg)

![](_page_25_Picture_1.jpeg)

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RIGHT	pulmonary		LUNGS	pulmonary	LEFT
VENTRICLE	arch	$\rightarrow$		veins	AURICLE

**<u>1.Pulmonary circulation</u>**: Circulation of deoxygenated blood from the right ventricle to the left auricle through lungs is called pulmonary circulation. Pulmonary arch arise from the right ventricle, divides into the right and left pulmonary arties. These pulmonary arties supply deoxygenated blood to respective lungs for purification. Oxygenated blood from the lungs is returned to the left auricle through four pulmonary veins

**<u>2. Systemic circulation</u>**: Circulation of blood from the left ventricle to the right auricle through various body parts or systems is called systemic circulation. Aortic arch arises from the left ventricle gives off many branches and supplies oxygenated blood to all the body parts or organs of the body except lungs. From these artries, oxygen is diffused into the tissues. Deoxygenated blood from visceral organs is collected by various veins that unite to form two very large veins called Superior and inferior vana cava. These veins pour deoxygenated blood into the right auricle.

In man the oxygenated blood and deoxygenated blood remains fully separated from each other. Such a separation allows a highly efficient supply of oxygen to the body as they have high energy demands.

#### (Q) Write a short note on ATP?

<u>ATP (Adenosine tri phosphate):-</u> It is an energy rich molecule which is formed from ADP and inorganic phosphate by utilizing energy released during respiration.

 $ADP + Pi \xrightarrow{energy} ATP$ 

*Structure of ATP:* ATP consists of sugar, base and three phosphate groups which can be represented as:

![](_page_25_Figure_13.jpeg)

<u>Significance of ATP</u>: During various metabolic processes like contraction of muscles, protein synthesis, conduction of nerve impulse and various other activities, the ATP is converted into ADP and inorganic phosphates with the release of energy.

 $ATP + H_2O \xrightarrow{hydrolysis} ADP + Pi + energy (30.6 k.j/mole of ATP)$ 

This reaction is called hydrolysis reaction and is enzyme (ATPase) controlled reaction.

ATP is used by metabolic cells for performing all activities of the cell and is called universal energy carrier (the energy currency of cell).

### **Textual questions**

Q.1) Why is diffusion insufficient to meet the oxygen requirement of large organisms?

multicellular

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![](_page_26_Picture_4.jpeg)

Ans) Diffusion is insufficient to meet the oxygen requirements of large multicellular organisms like humans because;

(1) In case of multicellular organisms, only the cells present in the surface layer are in direct contact with the surrounding environment

(2) Also the volume of multicellular organism's body is so big that oxygen can not diffuse into all the cells of the body of an organism quickly, because diffusion being a very slow process will take a lot of time to make oxygen available to all body cells.

Thus, the multicellular organisms require specialized organs for breathing and exchange of gases, to meet the oxygen requirements.

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

Ans) Following are some prominent characteristics by which we can decide whether something is alive:

- 1. In living things growth and development takes place with the passage of time.
- 2. Living things respond to stimuli in their environment.
- 3. Living things interact i.e. exchange matter and energy with their environment.
- 4. Living things reproduce to continue their existence.
- 5. Living things obtain food from their environment.
- 6. Living things perform metabolic activities.
- 7. Living things have definite life span.

### Q.3) What are the outside raw materials required by an organism?

Ans) The raw materials required by an organism depends upon the mode of nutrition. As in autotrophs, which make their own food, require water, carbon dioxide from the environment while in heterotrophs, the raw material required are the products formed by autotrophs i.e. carbohydrates and oxygen.

### Q.4) What process would you consider essential for maintaining life?

Ans) The important life processes essential for maintaining life are:

- 1. *Nutrition:* It is a process by which living organisms obtain and utilize the nutrients.
- 2. *Respiration:* It involves oxidation of respiratory substances and release of energy.
- 3. *Transport:* It involves the transport of substances from one part to other parts of body.
- 4. *Excretion:* It involves removal of excess or toxic wastes from the body.
- 5. <u>*Reproduction:*</u> To produce young ones of their own kind for the continuity and multiplication of their race
- 6. <u>Control and co-ordination:</u> It includes nervous system and endocrine system. Both these systems control and co-ordinate all the activities of multicellular organisms.

### Page No. 188 (Textual questions)

### Q.1) What are the differences between autotrophic and heterotrophic nutrition?

Ans) Refer additional questions.

Q.2) Where do plants get their raw materials required for photosynthesis?

Ans) The raw materials required for photosynthesis are carbon dioxide from the atmosphere and water from the soil.

### Q.3) What is the role of acid in stomach?

Ans) (1) It provides an acidic medium for the action of enzymes, which can not act in the basic medium.

(2) It converts inactive enzymes like pepsinogen and pro-renin into their active forms i.e. pepsin and renin respectively.

(3) It neutralizes the saliva mixed with the food so that one may not feel hunger immediately after eating food.

(4) Stomach acid also plays an important role to destroy disease causing pathogens that invade the human body along with food.

### (Q.4) What are the functions of digestive enzymes?

Ans) Digestive enzymes, secreted by digestive glands located in different parts of alimentary canal, help in the digestion of food i.e. carbohydrates, proteins and fats etc.

(a) The enzymes and their function that are involved in carbohydrate digestion are:

1. <u>Amylase:</u> It converts starch into maltose.

![](_page_27_Picture_1.jpeg)

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- 2. <u>Maltase:</u> It converts maltose into glucose.
- 3. Lactase: It converts lactose into glucose and galactose.
- 4. Sucrose: It converts sucrose into glucose and fructose.
- (b) The enzymes and their function that are involved in protein digestion are:
  - 1. <u>Pepsin:</u> It converts protein into proteoses, peptones and polypeptides.
  - 2. <u>Trypsin:</u> It converts proteins and peptones into polypeptides and dipeptides.
  - 3. *Chymotrypsin:* It's action is similar to that of trypsin.
  - 4. Carboxypeptidase: It acts on proteoses, peptones and polypeptides and converts them into dipeptides and amino acids.
  - 5. Amino peptidase: It acts on proteins, peptones and polypeptides converting them into dipeptides amino acids.
  - 6. *Dipeptidase:* It acts on dipeptides and converts them into amino acids.
- (c) The enzymes and their function that are involved in fat digestion are:
  - (1) Gastric lipase (2) Phospholipase (3) Phosphodiesterase

The general function of above three enzymes is that they convert fats into fatty acids and glycerol.

### (Q) How are the small intestines designed to absorb food?

Glycolysis

Ans) The mucus membrane of intestines is raised into numerous finger like projections called villi. There are about 50 lac villi present in human intestines. The number of villi is about 20 - 40 per sq.mm. These villi increase the surface area of the small intestines for absorption of digested food.

### (Q) What advantages over an aquatic organism does a terrestrial organism have with regard to obtaining oxygen for respiration?

Ans) Terrestrial organisms have advantages over aquatic organisms with regard to obtaining oxygen for respiration because:-

(1)Aquatic animals such as fish, prawns, mussels and tadpoles etc, breath water, i.e. they draw oxygen dissolved in water for respiration. On the other hand, the terrestrial organisms take oxygen directly from air.

(2) The amount of oxygen in water is fairly low as compared to the amount of oxygen in the air. Due to low concentration of O<sub>2</sub> in water, the rate of breathing in aquatic organisms is much faster than terrestrial organisms.

### Q) What are different ways in which glucose is oxidized to provide energy in various organisms?

Ans) Different organisms obtain energy by oxidizing glucose through different pathways:

a) Under aerobic conditions: Breaking down of glucose takes place in presence of oxygen, and occurs in cytoplasm and mitochondria. In most of the multicellular organisms including human beings, most plants, the glucose is converted into pyruvates in cytoplasm called glycolysis. Pyruvates enter into the mitochondria where it is converted into carbon dioxide and water with the release of energy.

 $\begin{array}{c} & \text{Glycolysis} & \text{Kreb's cycle} \\ & \text{Glucose} & \text{-------> pyruvate} & \text{------> Co}_2 + H_2O + 38ATP \text{ (energy)} \\ \end{array}$ 

(b) Under anaerobic condition i.e. Breathing down of glucose in absence of oxygen takes place in cytoplasm and in different ways in different animals. e.g. In yeast glucose is converted into pyruvates and pyruvates are further converted into ethyl alcohol.

In the cells of higher plants under anaerobic condition glucose is converted into ethyl alcohol or organic acids like malic acid, oxalic acids etc.

In muscle cells, during active metabolism, glucose is oxidized anaerobically and is converted into pyruvates. The pyruvates are further converted into compound molecule called Lactic acid.

Glucose ------ pyruic acid -----lactic acid + Energy

Heps

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In some bacteria glucose is partially converted into lactic acid or butyric acid.

Bacteria

Glucose -----> Lactic acid + Energy

Bacteria Glucose -----> Lactic acid + Butyric acid Clostridium butyricum

#### (Q.12) How is oxygen and carbon dioxide transported in human beings?

Ans) The transport of  $O_2$  from the lungs to the cells and the transport of  $CO_2$  from the cells to the lungs is called transport of gases.

1. <u>Oxygen transport</u>: The transport of  $O_2$  from the lungs to the cells is called  $O_2$  transport.

The concentration of oxygen in lung alveoli is higher than that in the deoxygenated blood in capillaries. This difference causes oxygen to diffuse from the alveoli into the lung capillaries. In the blood capillaries the  $O_2$  is transported by haemoglobin present in the RBC's of blood. Here Hb combines with  $O_2$  to form oxyhaemoglobin (HbO<sub>2</sub>). Each Hb molecule combines with four molecules of oxygen. The oxygen rich blood leaving the lungs enters the heart and is then pumped to various organs of the body by simple diffusion. As blood coming from the lungs via heart has high concentration of  $O_2$  than the body cells. So oxygen diffuses from the blood capillaries into the cells of the body. The cells present in tissues of various organs consume  $O_2$  continuously for various metabolic activities and releases  $CO_2$ .

2. <u>*CO*<sub>2</sub> *transport*</u>: The transport of  $CO_2$  from the tissues to the lungs through the blood is called  $Co_2$  transport.

In tissues oxygen is used up in various metabolic activities and  $CO_2$  is produced continuously. Hence, in tissues the concentration of oxygen is decreased where as  $CO_2$ concentration increases. Therefore,  $CO_2$  is diffused from body cells to capillaries. In the capillaries, the  $CO_2$  is transported both by plasma and RBC of the blood. About 67% of  $CO_2$  is carried by plasma and the remaining 33% is carried by RBC's.

 $CO_2$  is carried in three forms namely: (a) Carbonic acid (5%) (b) Carbo amino compounds (10%) and (c) Bi-carbonates (85%)

### Q.13) How are lungs designed in human beings to maximize the area for exchange of gases?

Ans) Lungs are the pair of highly elastic, hollow, bag like structure respiratory organs in human beings. Within the lungs, the major bronchi divides into the secondary bronchi which sub divides into the smaller tertiary bronchi and finally into still smaller bronchioles. Each bronchiole divides into alveolar ducts which enter the alveolar sacs also called alveoli. The alveoli are the tiny air sacs where gas exchange takes place.

In one set of human lungs there are about 300 million alveoli. These alveoli increase the surface area of the lungs for exchange of gases. It has been estimated that if we flatly spread out all the alveoli in both the lungs, they would cover an area of about 70-75m<sup>2</sup>, which is almost equal to single tennis court. The outer surface of each alveolus is densely covered by a network of blood capillaries.

## (Q.14) What are the components of the transport system in human beings? What are the functions of these components?

Ans: Refer additional questions. (Blood and its functions and lymph blood and its functions)

### Q) Why is it necessary to separate oxygenated and deoxygenated in mammals and birds?

Ans:-It is necessary to separate oxygenated and deoxygenated blood in mammals and birds because:-

- 1. Such separation allows highly efficient supply of oxygen to body
- 2. In birds and mammals such separation is useful as they comparatively need more energy with respect to other animals like amphibians for maintaining body temperature.

### Q) What are the components of transport system in highly organised plants?

Ans:- The components of transport system in higher plants(Gymnosperms & Angiosperms) are :-1) Xylem 2) Phloem.

![](_page_29_Picture_1.jpeg)

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Life process

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<u>1) Xylem:-</u> Xylem (Greek word Xylos=wood). It is a complex tissue which forms the bulk of the roots and stem of vascular plants. It is primarily concerned with the conduction of water and minerals and also provides mechanical support. It consists of four different types of cells. These are tracheids, vessels, xylem fibers and xylem parenchyma.

<u>2)Phloem:-</u> It is also called bast or leptome. Phloem is complex tissue and forms vascular system of plants. Phloem is mainly concerned with the conduction of the organic food. Phloem is also composed of four types of cells. These are Sieve elements, companion cells, and phloem parenchyma and phloem fibres.

### Q) How are water and minerals transported in plants?

Ans: Refer additional questions (Ascent of sap in plant)

### Q) How is food transported in plants?

Ans:- Refer additional questions (translocation)

### Q) Describe the structures and functions of nephron?

Ans:- Refer additional questions {(a) Structure of Nephron (b) Urine formation}

### Q) What are the methods used by plants to get rid of excretory products?

Ans:-The methods used by plants to get rid of various wastes in the plants takes place in the following ways:

- 1. The major waste substances, produced are  $CO_{2}$ , oxygen and water. Carbon dioxide and water are used by plants for photosynthesis while as oxygen escapes from plants into the environment by diffusion.
- 2. Excess salts are removed through hydathodes by the process of guttation.
- 3. Most of the toxic waste products are stored within dead permanent tissues such as heart wood, leaves or bark.
- 4. Some excess organic acids combine with excess cations and precipitate out as insoluble crystals such as calcium oxalates which can be safely stored in plant cells.
- 5. Some waste products are eliminated through petals, fruits and seeds.
- 6. Aquatic plants lose their waste products by diffusion directly into the water.
- 7. Some excretory products such as latex, gums, essential oils etc are stored in special type of tissues and glands e.g. resin ductsstore resin, oil glands store essential oil etc.
- 8. Many waste products are recycled in the synthesis of new metabolic products.

### (Q) How is the amount of urine produced regulated?

Ans) The amount of urine (water and solute content of body fluids) is regulated by the kidney. This function of regulation of osmotic pressure of blood by the kidney is called osmoregulation.

In human beings, the kidney is extremely flexible in its working generally in summer when most of the water lost from the body by perspiration; the urine passed out is hypertonic. However, in winter as there is no perspiration, the urine passed out is hypotonic. This flexibility in the working of human kidney and renal tubules is brought about by the movements of water and Na+ in and out of nephron under the influence of certain hormones namely. (1) Antidiuretic hormone (ADH) and (2) Aldosterone.

(1)Antidiureatic hormone released from the posterior lobe of pituitary gland ,increases the permeability of the renel tubule to water when the blood plasma is concentrated, more ADH is secreted and more water is absorbed in the urinary tubules. Hence, urine passed out from the body is concentrated. When the blood plasma is diluted, less ADH is secreted and less water is reabsorbed in the urinary tubule, and hence, dilute urine is passed out of the body.

(2) Aldosterone, a hormone released from adrenal cortex regulates the amount of sodium (Na) and potassium (K) that is to be retained in the blood and that which is to be excrete

Q) The kidneys in human beings are a part of system for?

Ans: Excretion

Q) The xylem in plants is responsible for?

Ans: Transport of water and minerals

Q) The autotrophic mode of nutrition requires

Ans: All of the above.

![](_page_30_Picture_1.jpeg)

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### Q) The break down of pyruvate give $CO_2$ , $H_2O$ and energy takes place in

Ans: Mitochondria

### (Q) How are fats digested in our bodies? Where this process does takes place?

The digestion of fats starts in stomach with the help of an enzyme called gastric lipase which converts fats into fatty acids and glycerol. But the main and final digestion occurs in small intestines where fats are first emulsified by the action of bile salts present in bile. During emulsification bile salts breaks large gloubules (which are not digested easily) into smaller gloubules for the action of enzymes.

After emulsification the enzyme lipase present in pancreatic juice acts on emulsified fats and converts them into fatty acids and glycerol. The internal lining of small intestines releases intestinal juice containing intestinal lipase also acts on emulsified fats and converts them into fatty acids and glycerol.

Thus, digestion of fats starts in stomach but the main and final digestion of fats occurs in small intestines.

### (Q) What is the role of saliva in digestion?

Ans) The salivary glands release colourless, slightly alkaline fluid called saliva.

### <u>Role of saliva:</u>

(1) Saliva is important digestive enzyme which contains two enzymes namely: (a) Ptylin or salivary amylase (b) Maltase

Ptylin splits starch into maltose and maltase acts on maltose and converts it into glucose.

(2) Saliva contains bi-carbonates, mucin, phosphates, which acts as buffers.

(3) Saliva moistens, lubricates the food and helps in mastication and deglutition.

(4) Saliva acts as solvent to dissolve some food particles that stimulates taste buds and allow us to know the taste of the food.

(5) saliva also keeps the mouth moist and helps in speech.

(6) Saliva is essential for giving a feeling of thirst.

(7) Besides, digestive enzymes, saliva contains another bacteriolitic enzyme namely lysozyme, which destroys bacteria entering in mouth thus saliva acts as antiseptic.

### Q) How are alveoli designed to maximize the exchange of gases?

Ans) In the lungs, the air passage (wind pipe) divides into smaller tubes called bronchi which in turn form bronchioles. The bronchioles then terminate in balloon like structures called alveoli. There are over 700 million alveoli present in the human lungs, the alveoli present in the lungs provide maximum surface area of about 70-90 m<sup>2</sup> for the exchange of gases. The alveoli have very thin walls and contain an extensive network of blood vessels to facilitate exchange of gases.

### Q) What would be the consequences of deficiency of hemoglobin in our bodies?

Ans) Haemoglobin is a red coloured respiratory pigment present in the red blood corpuscles of blood of human beings. Haemoglobin has very high affinity for oxygen and its deficiency causes anemia in our bodies which results in oxygen diffiency in our body, tiredness and loss of weight.

### Q) What are the difference between Transport of materials in xylem and Phloem?

Xylem	Phloem
Xylem is responsible for transportation of	Phloem is responsible for transportation of
water and minerals.	organic food and hormones.
Xylem helps in upward movement of	Phloem is responsible for downward movement
lateral water and mineral salts.	organic food.
Xylem is composed of Tracheids, vessels,	Phloem is composed of sieve tubes, companion
Xylem fibers and xylem parenchyma.	cells, Phloem parenchyma and phloem fibres.

![](_page_31_Picture_1.jpeg)

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# Q) Compare the functioning alveoli in the lungs and nephrons in the kidneys with respect to their structure and functioning?

Ans.:-	
Alveoli	Nephrons
1. ALVEOLI are the structural and functional	NEPHRONS are the structural and functional
units of lungs.	units of kidneys.
2. ALVEOLI help in removal of Co <sub>2</sub> from	NEPHRONS help in removal of excess
blood.	water, Salts and Urea in the form of Urine
	from blood
3. ALVEOLI have thin walls with rich blood	NEPHRONS too have thin walls and rich
supply	blood supply
4. ALVEOLI are excretory in function as	NEPHRONS too are excretory in function as
they remove $Co_2$ (a waste of the body) out	they remove urine (a waste) from the body
	out