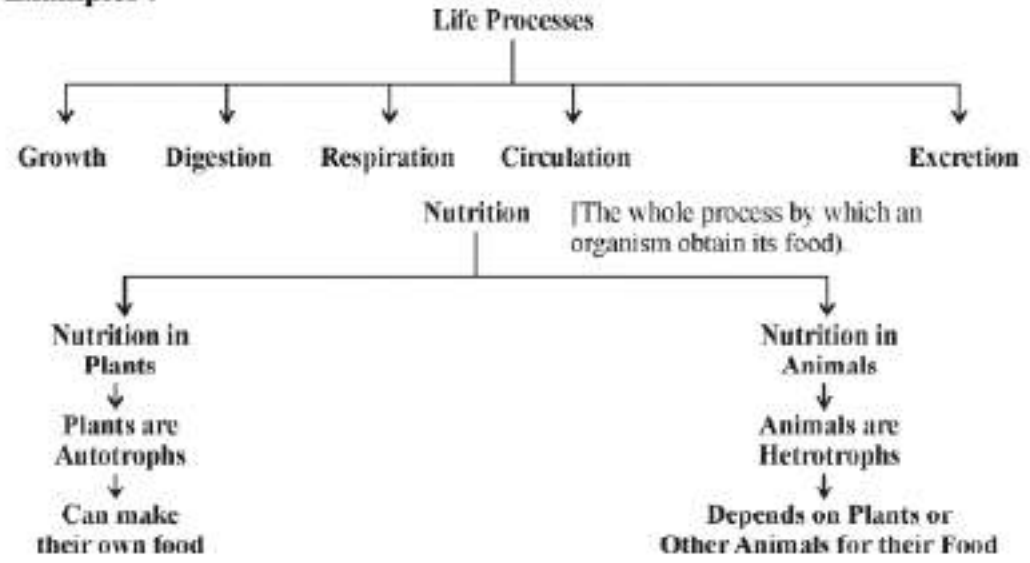
CHAPTER – 6

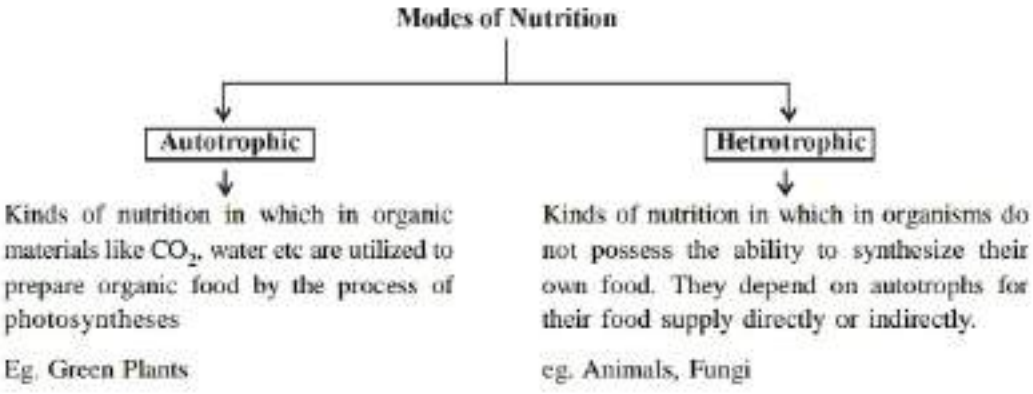
LIFE PROCESSES

All living things perform certain life processes like growth, excretion, respiration, circulation etc.

All the processes like respiration, digestion, which together keep the living organisms alive and perform the job of body maintenance are called life processes.

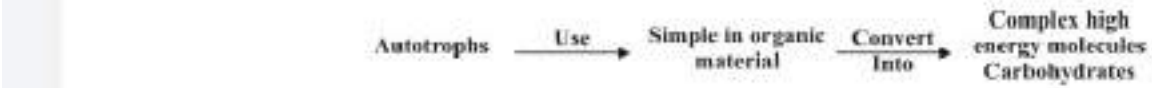
Examples :





Autotrophic Nutrition :

The organisms which carry out autotrophic nutrition are called autotrophs (green plants)



Autotrophic nutrition is fulfilled by the process by which autotrophs take in CO_2 and H_2O and convert these into carlohydrates in the presence of chlorophyll, sunlight is called PHOTOSYNTHESIS

Equation :

$$6CO_2 + 12H_2O \xrightarrow[\text{Chlorophyle}]{\text{Sunlight}} C_6H_{12}O_6 + 6O_2 + 6H_2O$$

Raw Materials for Photosynthesis :

Sunlight

Chlorophyl → Sunlight absorbed by chlorophyll

CO_2 → enters through Stomata, and Oxygen (O_2) is released as by product through stomata on leaf.

Water → water + dissolved minerals like Nitrogen phosphorous etc are taken up by the roots from the soil.

Site of Photosynthesis :

Chloroplast in the leaf. Chloroplast contain chlorophyll. (green pigment)

Main Events of Photosynthesis :

Absorption of light energy by chlorophyll

Conversion of light energy into chemical energy + splitting (breaking) of water into hydrogen and oxygen.

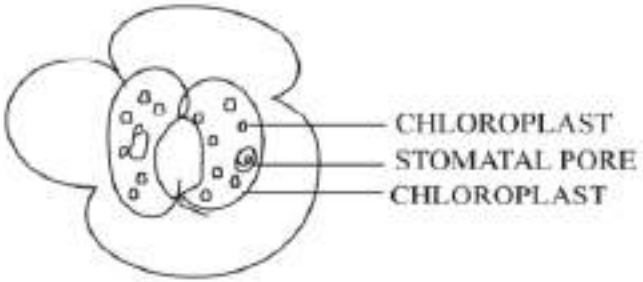
Reduction of CO_2 to carbohydrates.

STOMATA : Tiny pores present on the surface of the leaves

FUNCTIONS :

(i) Exchange of gases O_2/CO_2

(ii) Loses large amount of water [water vapour] during transpiration.



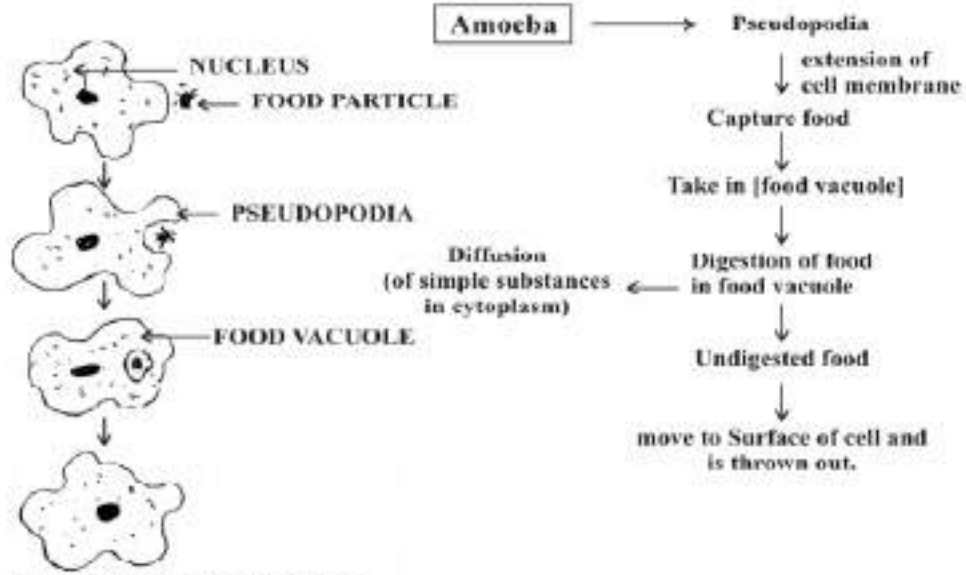
Hetrotrophic nutrition

HOLOZOIC	SAPROPHTIC	PARASITIC
Animals take in solid food and breakdown inside the body	Organisms feed on dead, decaying matter	Parasites live inside or outside other organism (host) and derive nutrition from it.
eg. Amoeba, animals	eg. fungi	eg. cuscuta (plant parasite ticks etc.

How do organisms obtain their food

Unicellular / single celled organism : food is taken up through entire surface.

Example : (i) Amoeba. (ii) Paramaecium



NUTRITION IN AMOEBA

(ii) Paramecium → Cilia (present all over the body) → take in food ↓ At a specific spot

Steps in Hologic nutrition

- **Ingestion** अंतर्ग्रहण
- **Digestion** पाचन
- **Absorption** अवशोषण
- **Assimilation** स्वांगीकरण
- **Egestion** बहिक्षेपण

NUTRITION IN HUMAN BEINGS

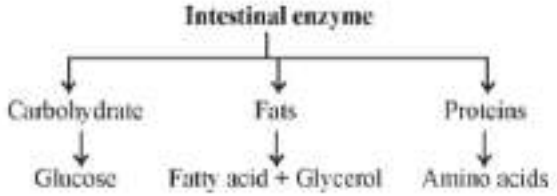
The human digestive system comprises of alimentary canal and associated disgestive glands.

Mouth → Intake of whole food
↓
Teeth → Chewing/grinding of food.
↓
Tongue → Rolling of food
+
Tasting of food
+
Swallowing / pushing down of the food
↓
Salivary Glands → Secrete Saliva + Mucus.
↓
Starch —(Salivary amylase [Saliva])→ Sugar
↓
Oesophagus → Taking food from mouth to stomach by Peristaltic movements
[contraction and expansion of muscles of the oesophagus]
↓
Stomach → Gastric glands secrete Gastric juice

Gastric juice

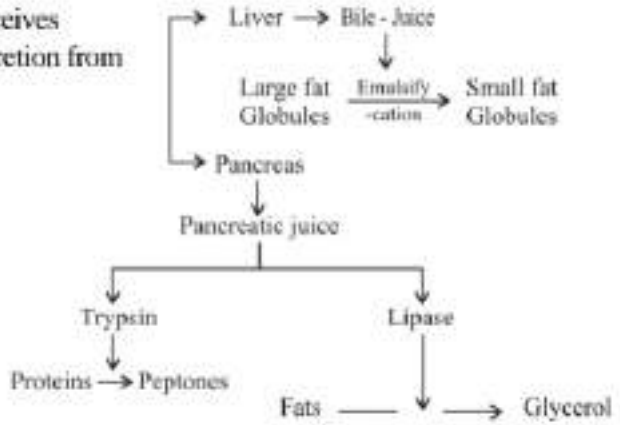
- PEPSIN [enzyme that breaks down proteins]
- HCl [makes medium acidic]
- MUCUS [Protects inner lining of the stomach]

Small Intestinal →



Small Intestine → Villi ⟶ helps in absorption of food into the blood. [finger like projections]

small intestine → Receives secretion from



Emulsification : The process of breakdown of large fat globules into smaller fat globules by bile juice.

Large intestine → Absorb excess of water.

→ The rest of the material is removed from the body via the anus. (Egestion)

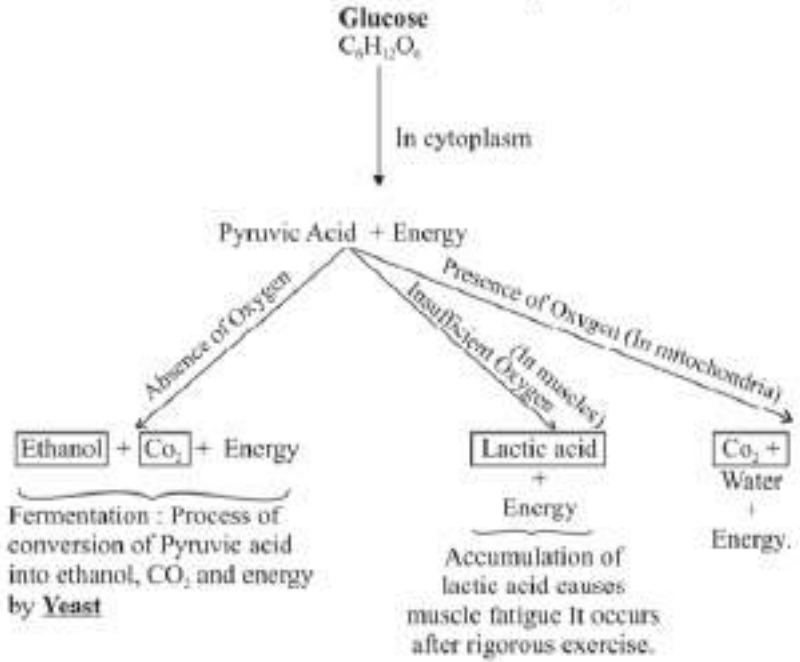
Respiration

Respiration involves

(i) Gaseous exchange : Intake of oxygen from the atmosphere and release of CO_2 → Breathing

(ii) Breakdown of simple food in order to release energy inside the cell → Cellular Respiration

Breakdown of Glucose by various pathways



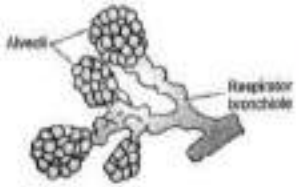
Respiration

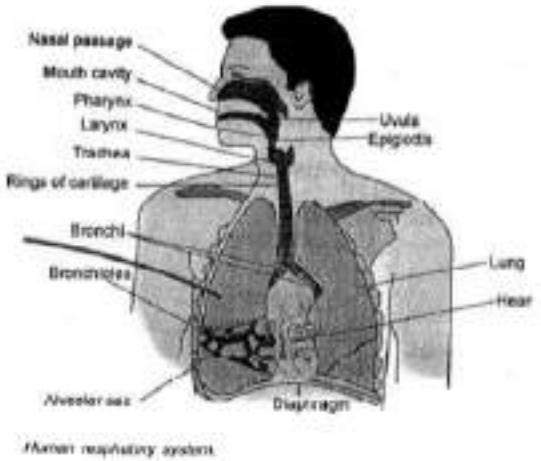
Aerobic	Anaerobic
* Takes place in the presence of oxygen	* Takes place in the absence of oxygen
* Occurs in mitochondria	* Occurs in cytoplasm
* End products are CO_2 and H_2O	* End products are alcohol or lactic acid.
* More amount of energy is released	* Less amount of energy is released.

Human Respiratory System

Passage of air through the respiratory system.

Nostril
↓
Nasal Passage
↓
Nasal Cavity
↓
Pharynx
↓
Larynx
↓
Trachea
↓
Bronchi
↓
Lungs
↓
Bronchioles
↓
Alveolar → Blood capillaries





Human respiratory system

Mechanism of Breathing

Inhalation

* During inhalation the thoracic cavity (chest cavity) expands
* Ribs lift up
* Diaphragm become flat in shape
* Volume of lungs increases and air enters the lungs

Exhalation

* Thoracic cavity contracts
* Ribs move downwards

Diaphragm becomes dome shaped

* Volume of lungs decreases and air exits from the lungs.

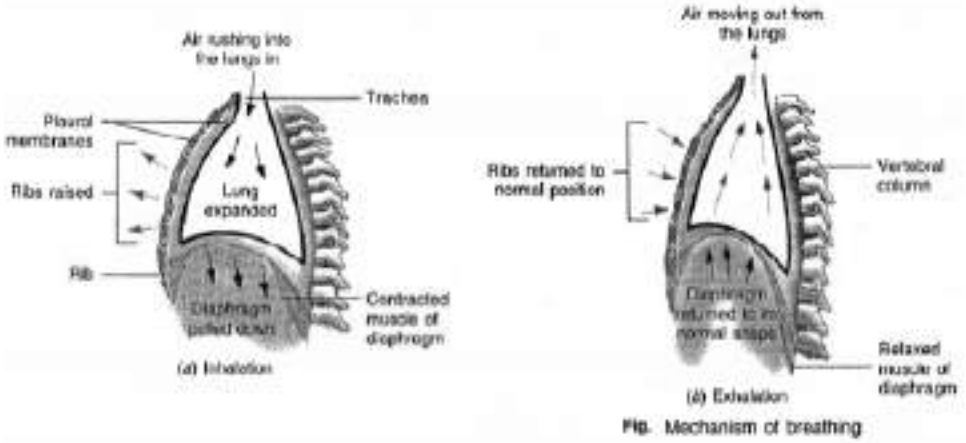


Fig. Mechanism of breathing

Exchange of Gases between alveolus, blood and tissues.

1. Air (rich in O_2) (in alveolus) → Blood [through blood vessels] → O_2 Binds with Haemoglobin in RBC → O_2 is released in tissues

2. CO_2 (from tissue) → CO_2 released into blood → CO_2 Dissolved in blood → Blood vessels (in alveoli) → CO_2 Released in alveolar SaC → CO_2 Sent out through nostrils

Terrestial Organism – use atmospheric oxygen for respiration

Aquatic Organisms – used dissolved oxygen for respiration

Respiration in Plants :

Respiration in plants is simpler than the respiration in animals. Gaseous exchange occur through

1. Stomata in leaves
2. Lenticels in stems
3. General surface of the roots.

Life Process (II)

Transporation and Excretion

- Human beings like other multicellular organism need regular supply of food, oxygen etc., This function is performed by circulatory system or Transport system.
- The circulatory system in human beings consists of :

The circulatory system in human beings consists of :

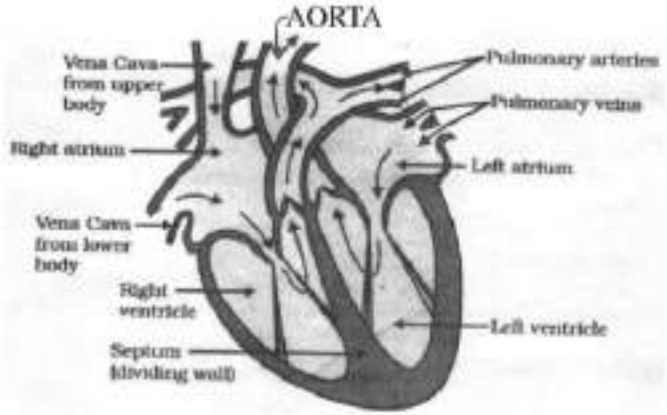
A Pumping Organ **Heart**

Blood vessels **- Arteries & Veins**

A circulatory medium **Blood & Lymph**

Blood Circulation in Human Heart

Deoxygenate Blood (from body) → Vena Cava → Right Atrium (Relaxed) → Right Atrium (contracts) → Right Ventricle (relaxed) → Right ventricle contracts → Lungs → Oxygenated blood → Left Atrium (relaxed) → Left Atrium (contracts) → Left Ventricle (relaxed) → Left Ventricle (contracts) → Body Parts via AoRTA



Blood
(A fluid Connective Tissue)

- **Solid Component** — Blood Corpuscles
  - **R.B.C.s** → - carries respect gas (O_2, CO_2) - contain Hb impart red colour to me blood
  - **Blood Platelets** → helps in Blood Clotting
  - **W.B.C.** → Provide Body defence by engulfing the germ cells & producing antibodies
- **Liquid Component** — PLASMA → A yellow colour fluid contain 90% water & 10% Organic substances like
  - Plasma Proteins viz. albumin, globulin
  - inorganic-mineral ions

- Lymph - a yellowish fluids escapes from the blood capillaries into the intercellular spaces contain less proteins than blood. Lymph flows from the tissues to the heart assisting in transportation and destroying germs.

Blood Vessels

Arteries	**Veins**
1. Carry Oxygenated blood from heart to body part except pulmonary Artery	1. Carry deoxygenated blood from body parts to heart except pulmonary vein.
2. Also called distributing Vessel	2. Also called collecting Vessel.
3. Thick and elastic	3. Thin and Less elastic.

Transportation in Plants

- There are two main conducting Pathways in a Plant

Xylem	**Phloem**
1. Carries water & minerals from the roots to other part of the plant	1. Carries product of photosynthesis from leaves to the other part of the plant.
2. No energy is used.	2. Energy is used from ATP

- Transpiration is the process of loss of water as vapour from aerial parts of the plant.

  Function :

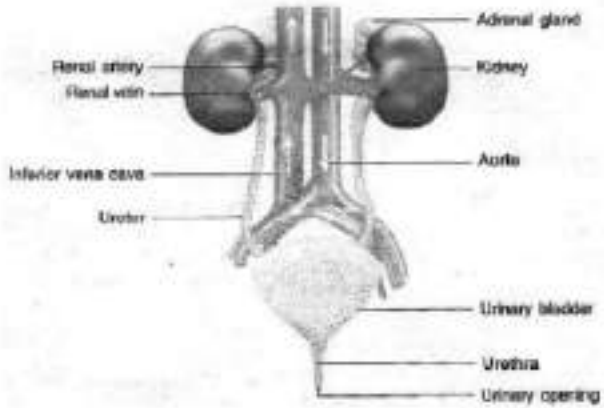
  1. Absorption and upward movement of water and minerals by creating PULL.
  2. helps in temperature regulation in Plant.

- Transport of food from leaves (food factory) to different part of the plant is called Translocation.

EXCRETION

- The process of the removal of the harmful metabolic wastes from the body.
- Excretory system of human beings includes :

  1) A pair of kidneys
  ii) A Urinary Bladder
  iii) A pair of Ureter
  iv) A Urethera



- Urine produced in the kidneys passes through the ureters into the urinary bladder where it is stored until it is released through the urethera.
- The purpose of making urine is to filter out waste product from the blood ie, urea which is produced in the liver.
- Each kidney has large numbers of filtration units called nephrons.
- The Urine formation involves three steps

  1. **Glomerular Filtration :** Nitrogenous wastes, glucose water, amino acid filter from the blood into Bowman Capsule of the nephron.
  2. **Tubular reabsorption :** Now, useful substances from the filtrate are reabsorbed back by capillaries surrounding the nephron.
  3. **Secretion** Extra, water, salts are secreted into the tubule which open up into the collecting duct & then into the ureter.

- Haemodialysis : The process of purifying blood by an artificial kidney, it is meant for Kidney failure patient.

Excretion in Plants

- Oxygen, CO_2 & H_2O $\left.\begin{matrix}\longrightarrow \\ \longrightarrow\end{matrix}\right]$ Through stomata (Transpiration)

- Other wastes may be stored in leaves, bark etc. which fall off from the plant.
- Plants excrete some waste into the soil around them.
- Gums, Resin In old Xylem
- Some metabolic wastes in the form of crystals of Calcium oxalates in the leaves of colocasia and stem of Zamikand.

Life Processes

EXERCISE

(Question Bank)

Very Short Answers (1 Mark)

1. State one difference between autotrophic and heterotrophic mode of nutrition.
2. What will happen to a plant if the xylem is removed.
3. What is the role of saliva in the digestion of food?
4. Name the tissue that transports water and minerals in plants.
5. What is the role of acid in our stomach?
6. What is emulsification
7. Name the organelle in which photosynthesis occur.
8. Name the largest artery in the human body.
9. Define transpiration
10. What are structural and functional unit of kidneys called.

Short Answers (2 Marks or 3 Marks)

1. How is small intestine designed to absorb digested food?
2. What are stomata? Draw a labelled diagram of stomata.

3. Write the equation for the process of breakdown of glucose in a cell
   i) in the presence of oxygen
   ii) in the absence of oxygen.
4. Write the difference between inhalation and exhalation.
5. List the three events which occur during photo synthesis.
6. How does transpiration helps in upward transport of substances.
7. Describe the process of double circulation in human beings.
8. Write the functions of the components of blood.

Long Answers (5 Marks)

1. Explain the process of digestion of food in mouth stomach and small intestine in human body. Draw a well labelled diagram.
2. Draw a diagram showing Human Respiratory system. Label the following parts
   i) Larynx ii) Trachea
   iii) Bronchus iv) Lungs

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

Multicellular organisms need more oxygen than unicellular organisms because in multicellular organisms the rate of respiration is very high because-

a. Multicellular organisms are made up of billions of cells, all of which require oxygen.

b. The rate of respiration is much higher in multicellular organisms than unicellular organisms. This is particularly true for warm blooded mammals and birds because they need more energy to maintain their body temperature.

In unicellular organisms (like *Amoeba*) the single cell is directly in contact with the environment. So, oxygen directly diffuses into the cell through the cell membrane.

But in multicellular organisms like human beings, all cells of the body are not in direct contact with the air to take up oxygen directly by diffusion. More over even if we ***imagine*** that oxygen would diffuse out from air inhaled into the lungs and reach every cell of the body it would take a very long time to reach every cell of the body because ***diffusion is a very slow*** process. For example, it is estimated that it would take 3 years for a molecule of oxygen to get to our toes from our lungs.

To overcome this difficulty, we have a transport system i.e., circulatory system to transport high amount of oxygen to every part of the body in a short time. In the lungs there are small air pockets called alveoli to increase surface area for exchange of gases between **blood and air**. When the air is inhaled, oxygen from the air diffuses into the blood. In the blood oxygen is very quickly taken up by haemoglobin in the red blood cells ***making*** the process of diffusion faster. The absorbed oxygen is rapidly transported to all the cells of the body by the blood and in return CO_2 produced in every cell due to respiration is taken up by the blood and transported to the lungs for removal.

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

To decide whether something is alive we can use the following criteria-

a. Living things show different life processes such as nutrition, respiration, photosynthesis, excretion etc, which are not shown by non living or dead things.

b. The ***ability to sense the surroundings and show proper response*** is one of the basic properties of living organisms. Plants, animals and even microorganisms can sense the changes in environment and show responses. Consciousness therefore, becomes the defining property of living organisms.

c. Living organisms show ***cellular organization*** of the body. Each living cell is highly organized and performs different functions that keep it alive. In multicellular the level of organization goes even higher from cellular to tissue level followed by organ level which is further followed by organ system and organism level.

d. Living organisms are able to ***reproduce*** and produce off springs that show similarity with the parents. This is not seen in non living things.

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

Living organisms are made up of cells in which different metabolic reactions take place continuously. For these metabolic reactions, the cells of living organisms take up different materials from the environment.

Basically it is the plants that gather materials from the environment to make the complex organic compounds, which help in building up the cells. Plants take simple raw materials like CO_2 from air, water and minerals from the soil to make their own carbon based compounds like proteins, carbohydrates and fats etc. Sunlight is used as energy source.

Animals and other organisms including human beings that cannot gather these materials directly from the environment take complex compounds produced by plants in the form of food.

All organisms take up water from the environment because it is very important for the cellular processes.

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

The processes essential for maintaining life are-

a. Nutrition- It is the process by which living organisms take up nutrients from the environment and use them for the formation of their cells and tissues and also for energy.

b. Respiration- It is the process of oxidation of carbohydrates in the cells to *release* energy that is used by the cells for different purposes.

c. Photosynthesis- It is the main process that converts sun light energy to usable chemical energy. The energy rich compounds that are produced during photosynthesis are used by all the organisms in the food chain for getting energy and for their growth.

d. Excretion- Living cells performing different metabolic reactions also produce many waste materials. The process of removal of these wastes from the cell/ body is called excretion. It is necessary to keep the cell/ body in proper and healthy condition.

e. Transportation- A well organized transport system is essential especially for multicellular organisms to carry and supply necessary materials to all the cells or the body and to remove the wastes from the body.

f. Reproduction- It is the process of production of the offspring by the parents so as to maintain the continuity of that species on earth.

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

S.No	Autotrophic Nutrition	Heterotrophic Nutrition
1.	It takes place in those organisms like plants that can make their food by the process of photosynthesis.	It takes place in those organisms like animals that cannot make their food by the process of photosynthesis.
2.	Raw materials are accumulated from the environment for making food.	Ready food is taken and used as a source of nutrition.
3.	Solar energy is converted to chemical energy by photosynthetic pigments like chlorophyll and stored in foods such as carbohydrates like glucose and starch.	Solar energy is not taken up directly. Instead chemical energy is obtained along with the food and used up by the organism.
4.	Simple inorganic raw materials such as CO_2, water and minerals are used to make complex compounds such as carbohydrates, fats, proteins etc.	Complex carbon compounds are taken up in the form of food and used as a source of nutrition. These are proteins, fats, carbohydrates etc.

6. Where do plants get each of the raw materials for photosynthesis?

Plants take up simple raw materials from the environment to make complex compounds of carbon by the process of photosynthesis. **CO_2** is taken up from the air through leaf stomata. CO_2 diffuses into the leaf through stomata and is taken up directly by the leaf cells. **Water** is absorbed from the roots by osmosis and transported to the leaves by the xylem. **Sunlight** is received by group of chlorophyll molecules in the chloroplasts. Photosynthesis takes place in the chloroplasts, which are the cell organelles present in the leaf cells of the plants. Following reaction takes place in the chloroplasts-

$$6CO_2 + 12H_2O \xrightarrow[\text{Sunlight}]{\text{Chlorophyll}} C_6H_{12}O_6 + 6O_2 + 6H_2O$$

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

Hydrochloric acid is produced in the stomach by the gastric glands that are present in the walls of the stomach. Acid plays an important role in-

a. Activating Pepsinogen to form the enzyme Pepsin, which digests proteins to smaller chains of amino acids.

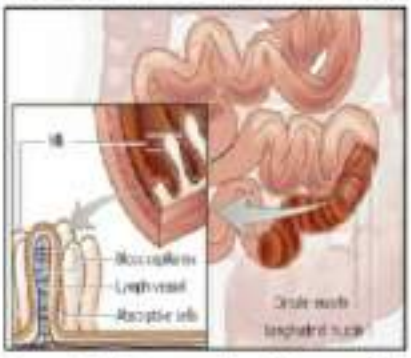
b. HCl also kills many bacteria and other microorganisms that enter along with the food.

c. HCl denatures the proteins so that they can be easily digested.

8. What is the function of digestive enzymes?

Digestive enzymes help in the chemically digestion of food. They break the bonds of bigger molecules such as proteins, fats, carbohydrates etc to release smaller molecules that can be easily absorbed by the small intestine. For example, Pepsin that is present in the gastric juice acts upon proteins to break them into smaller chains of amino acids, which are further, reduced to amino acids by other enzymes. The amino acids are absorbed into the small intestine and transported to the body cells for making proteins.

9. How is the small intestine designed to absorb digested food? OR What are villi and what is their function?



The inner wall of small intestine has many finger like structures called **Villi**. These *villi increase the surface area of the small intestine for proper absorption of the digested food*. The villi are richly supplied by blood and lymph to absorb the food. The absorbed food is supplied to different tissues of the body for building up new cells and tissues, for energy and for repair of old tissues.

10. What advantage over an aquatic organism does a terrestrial organism have with regard to obtaining oxygen for respiration?

Oxygen is needed by the cells for aerobic respiration. A terrestrial organism living on land breathes in air, which contains a higher amount of oxygen (about 21 %). So it gets a higher amount of oxygen in each breath. On the other hand, an aquatic organism (like fish) has to breathe in water and take the oxygen that is dissolved in water. But as the solubility of oxygen in water is very low the organism does not get sufficient oxygen in each breath. So it has to breathe faster in order to get sufficient oxygen.

11. What are the different ways in which glucose is oxidized to provide energy in various organisms? OR Explain different types of respiration. OR What is aerobic and anaerobic respiration?

Glucose is oxidized in two ways to provide energy-

a. **Anaerobic respiration-** *Partial oxidation* of glucose in the absence of oxygen, resulting in release of some energy. Glucose is oxidized to pyruvate, which is then changed to ethyl alcohol or lactic acid. There is no role of mitochondria. Only two ATP molecules are gained by the oxidation of one glucose molecule.

$$\text{Glucose} \xrightarrow[\text{2 ATP Gain}]{\text{Glycolysis}} \text{Pyruvate} \longrightarrow \text{Lactic acid (in muscles)}$$

$$\text{Pyruvate} \longrightarrow \text{Ethyl alcohol} + CO_2 \text{ (In yeast)}$$

b. **Aerobic respiration-** *Complete oxidation* of glucose using oxygen to release high amount energy. Glucose is oxidized in the cytoplasm to pyruvate, which is then shifted to *mitochondria* for further breakdown. The pyruvate is oxidized to CO_2 and water. 38 ATP molecules are formed by the oxidation of one molecule of glucose.

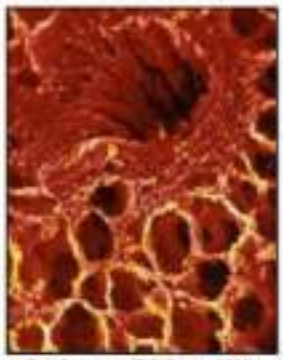
$$\text{Glucose} \xrightarrow{\text{Glycolysis}} \text{Pyruvate} \longrightarrow CO_2 + \text{Water (In Mitochondria)}$$

12. How are Oxygen and Carbon dioxide transported in human beings?

Oxygen and Carbon dioxide are transported from in human beings by the blood. In the lungs, there is exchange of gases between the blood and air. Oxygen from air diffuses into the blood flowing in the thin walled blood capillaries. This oxygen is quickly taken up by haemoglobin in the RBCs. Thus, oxygen is mostly carried by the haemoglobin in the RBCs. Very little oxygen is carried in the dissolved form in the blood plasma. This is because solubility of oxygen in plasma (water) is very low.

When the blood reaches inside the tissues, oxygen is released into the tissue fluid and carbon dioxide enters from tissue fluid into the blood plasma through the capillary walls. As carbon dioxide is more soluble in water than oxygen it is transported in the dissolved form in the blood plasma.

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



The lungs are organs where gas exchange takes place between the ***blood and air***. The blood gets re-oxygenated and carbon dioxide is released into the air. Inside the lungs there are millions of air sacs called **alveoli**, which increase the surface area for exchange of gases. The ***thin*** walls of alveoli are richly supplied with blood capillaries to carry blood for gas exchange. CO_2 diffuses out from the blood into the air and the blood takes up fresh oxygen from the air.

The figure shows the tiny air sacs also known as alveoli, within a section of human lung tissue. Human beings have a thin layer of about 700 million alveoli within their lungs! This layer is very necessary in the process of gas exchange between air and blood. The subdivision of lung into millions of tiny air sacs provides a greater surface area for gas exchange to take place.

14. What are the components of transport system in human beings? What are the functions of these components?

Components of transport (circulatory system) in human beings are-

a. Blood- It is the fluid connective tissue that is responsible for transport of materials in human beings. It contains the fluid part called ***Plasma***, which carries most of the materials in dissolved form. Plasma, which is basically water, carries materials such as minerals, amino acids, glucose, urea (as a waste), hormones, dissolved proteins etc. In the blood plasma are also present the following cells-

i. RBC- Red blood cells contain the pigment haemoglobin, which helps in carrying oxygen from the lungs to different tissue cells for respiration. This is because solubility of oxygen in the plasma is very low.

ii. WBC- White blood cells, are responsible for killing the microorganisms entering into the blood. Thus, WBCs play an important role in the immune system of the body.

The blood plasma also contains **Blood Platelets**, which help in clotting of the blood during injury to prevent blood loss.

b. Blood Vessels- These are Arteries, Veins and Blood capillaries.

i. Arteries carry blood away from the heart. The three layered wall of arteries is thick to bear the pressure of blood that is pumped by the heart.

ii. Veins carry blood towards the heart. The three layered wall of veins is thinner than arteries because it has to bear very low blood pressure. There are ***valves*** in the veins, which prevent back flow of the blood.

iii. Blood Capillaries are the thinnest of the blood vessels. There is a wide network of blood capillaries in every organ of the body. The capillaries pass between the cells of the tissues. Oxygen, glucose, amino acids and other nutrients pass through the capillary walls and enter into the tissue fluid from where they are taken up by the surrounding cells.

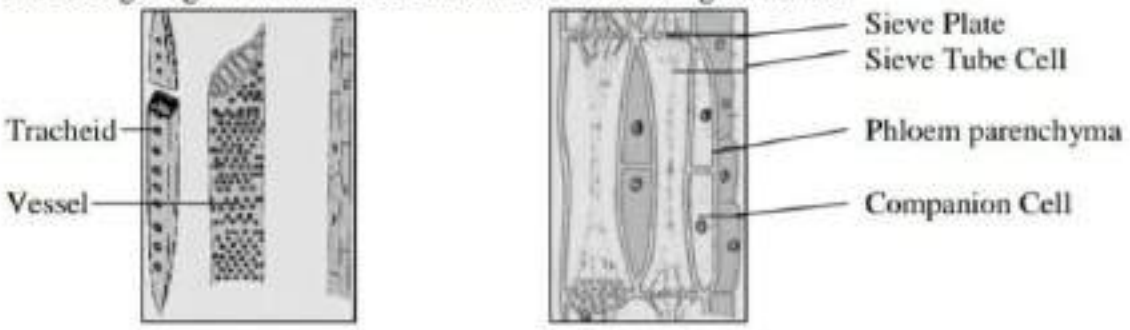
c. Lymph- The extra *tissue fluid* in the tissues enters the lymph capillaries. The lymph capillaries join up to form lymph vessels. The composition of lymph is almost similar to blood plasma but it contains less proteins. The lymph vessels join with veins and supply lymph into the blood. Functions of Lymph are-

a. Lymph that is basically the blood plasma that has come out of the blood capillaries into the intercellular spaces *serves as a source of nutrients for the cells of the tissues*. The cells take up many nutrients from the tissue fluid and release their wastes into the same.

b. Lymph helps in *removing extra tissue fluid along with proteins* from the body organs and returning them to the blood.
c. Lymph contains specialized WBCs that play an important role in *killing the microorganisms* invading the body.
d. Lymph plays an important role in the *absorption of fats and fat soluble vitamins A, D, E and K in the small intestine*.

15. Why is it necessary to separate oxygenated and deoxygenated blood in mammals and birds?
Mammals and Birds are warm blooded animals and *so to keep the body warm heat has to be continuously produced* in the body. As a result ***the rate of respiration is also higher in mammals and birds as compared to other animals***. As the rate of respiration is high the demand for oxygen is also higher in mammals and birds as compared to other animals.
To supply sufficient oxygen to the body tissues and cells oxygenated blood ***should*** move separately to the body tissues and cells. It should not mix with the deoxygenated blood carrying carbon dioxide. Otherwise, it will not be able to carry sufficient oxygen to the body tissues.
On cold blooded animals such fishes, amphibians and reptiles the rate of respiration is low. As a result their oxygen demand is also lower. In these animals there is partial mixing of oxygenated and deoxygenated blood. So the blood carries lesser oxygen to the body tissues.

16. What are the components of transport system in highly organized plants?
Highly organized plants have Vascular Tissues (also called complex tissues) for transport of materials. These tissues are like continuous tubes that conduct materials in dissolved form in water medium rapidly through the plant body. These tissues are-
a. Xylem- It ***carries water and dissolved minerals*** from the plant roots to the leaves and other parts of the body. It has Vessels and Tracheids as the conducting elements to carry water and minerals.
b. Phloem- Helps in ***translocation of food*** from leaves to other parts of the plant body and storage organs. It has Sieve Tubes as the conducting elements.



Xylem Phloem

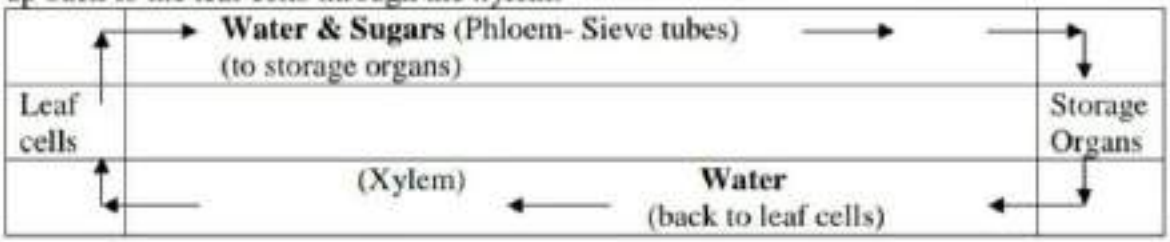
17. How are water and minerals transported in plants?
Water and dissolved minerals are transported by **Xylem** in the higher plants. Xylem has Tracheids and Vessels, which act as tubes for the upward supply of water and dissolved minerals.
There are mainly two forces that are responsible for the movement of water in the xylem against gravity, which pulls water downwards-
a. Root pressure- At the roots, cells in contact with the soil actively (that is using energy from ATP) take up dissolved ions from the soil. As a result, the cytoplasm of root cells becomes hypertonic as compared to the water in the soil. Water therefore moves into the roots from the soil by endosmosis. This creates a column of water in the xylem that is pushed upwards. This upward push on the water is called Root pressure. It can push up water up to some height in the plants.

b. Transpiration pull- Plant leaves lose water by the process of transpiration through stomata. To make up the water loss the ***leaf cells draw out*** water from the leaf xylem. As a result a ***suction pull*** is created on the water in the xylem tubes and the water rises up to great heights.

The transpiration pull is strong enough to draw up sufficient water to great heights. Transpiration pull generally operates during the day when the plants lose more water by transpiration due to sun€s heat. Root pressure mainly operates during night.Both of these forces together help in supplying water to great heights of big trees.

18. How is food transported in plants?

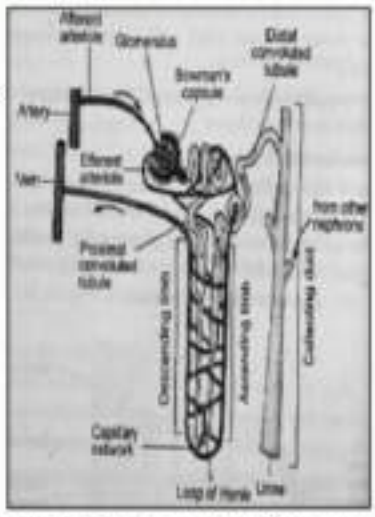
In plants, ***food is transported (Translocated) in dissolved form by the Phloem***. The phloem carries ***dissolved sugars like glucose or sucrose and amino acids*** from the leaves to the other parts of the plant body and also to the storage organs. Water-soluble carbohydrates like Sucrose are transported actively to the sieve tubes of phloem using energy from ATP. Due to this water moves into the sieve tubes by endosmosis creating high pressure inside. As a result water moves in the sieve tubes from supply end (leaves) to the storage organs. In the storage organs the dissolved sugars are removed from the sieve tubes. As a result the sieve tubes also lose water by exosmosis. This water is carried up back to the leaf cells through the xylem.



19. Describe the structure and functioning of the nephrons.

Nephron is the working unit of kidney. A kidney consists of many such nephrons, which work together to filter the blood. The working of a nephron can be divided into 2 parts-

a. Ultra filtration in the Bowman€s Capsule A nephron consists of a Bowman€s capsule into which blood is supplied by the renal arteriole. Inside the Bowman€s capsule the arteriole divides into a fine network of capillaries. Filtration of blood takes place through the capillaries at a **high pressure** to remove blood plasma along with dissolved materials including urea, salts, glucose, amino acids and water. The filtered water along with dissolved materials then passes through the tubules.



b. Tubular Reabsorption- When the filtered plasma passes through the tubules, selective reabsorption of important materials like salts, glucose and water takes place. The reabsorbed materials are returned back to the blood.

The urine containing water, urea, unabsorbed salts etc is collected in the collecting duct, which receives urine from other nephrons and finally the urine is carried out of the kidney by the ureter.

20. What are the methods used by plants to get rid of excretory products?

Excretion in plants is by following methods-

a. Oxygen produced as a waste during photosynthesis, diffuses out of the leaf stomata.
b. During the day carbon dioxide produced in respiration is used up in photosynthesis.
c. Water in excess is removed by transpiration through the leaves.
d. Resins and gums are stored in old xylem.
e. Latex (white fluid) is stored in stems and leaves of some plants.

f. Zimikand tubers contain calcium oxalate crystals.
g. Plants also excrete some waste materials from roots into the soil.

21. How the amount of urine produced is regulated?
The amount of urine produced depends on the amount of water in the body. This is called osmoregulation. It helps in controlling the amount of water in the body.
When the body contains large amount of water, the tubules of nephrons in the kidney reabsorb very less water from the filtered urine. As a result very dilute urine is produced and passed out. But when the body contains less water, the tubules of nephrons in the kidney reabsorb more water from the filtered urine. As a result concentrated urine is produced and passed out. Thus the kidneys not only help in filtration of nitrogenous wastes like urea but also in osmoregulation.

22. The kidneys in human beings are a part of the system for-
a. Nutrition.
b. Respiration.
c. Excretion. ✓
d. Transportation.

23. The Xylem in plants are responsible for-
a. Transport of water. ✓
b. Transport of food.
c. Transport of amino acids.
d. Transport of oxygen.

24. The autotrophic mode of nutrition requires-
a. Carbon dioxide and water.
b. Chlorophyll.
c. Sunlight.
d. All of the above. ✓

25. The breakdown of pyruvate to give carbon dioxide, water and energy takes place in-
a. Cytoplasm.
b. Mitochondria. ✓
c. Chloroplast.
d. Nucleus.

26. How are fats digested in our body? Where does this take place?
Fats are digested mainly in the small intestine by the action of intestinal and pancreatic lipases. The fats cannot be easily digested because they are in the form of large globules (drops). The bile juice from liver contains salts, which emulsify large fat globules to fine droplets so that the lipases can act properly and bring about faster breakdown of fats into fatty acids and glycerol. The lipase enzymes present in pancreatic and intestinal juices act on fats digesting them to *fatty acids and glycerol*. The digested fats are then absorbed into the lymph capillaries present in the villi. Along with fats, fat soluble vitamins A, D, E and K are also absorbed into the lymph capillaries.

27. What is the role of saliva in the digestion of food?
Saliva is the digestive juice produced by the salivary glands and secreted in the mouth.
Saliva plays the following role in the digestion of food-
a. It lubricates the food so that it can easily pass down through the oesophagus or food pipe in the form of a bolus.
b. Lysozyme present in the saliva acts as an antibacterial agent and prevents infections.

c. Salivary Amylase (ptyalin) is the main enzyme present in the saliva. It acts on starch and digests it to maltose.

$$\text{Starch} \xrightarrow{\text{Salivary Amylase}} \text{Maltose } (C_{12}H_{22}O_{11})$$

28. What are the necessary conditions for autotrophic nutrition? What are its by products?

Conditions necessary for autotrophic nutrition by the process of photosynthesis are-

a. Chloroplasts containing chlorophyll- Chloroplasts are the cell organelles that contain the *necessary enzymes and machinery* for production of food by the process of photosynthesis. Chlorophyll is the green pigment in the chloroplasts. It catches the solar energy and changes it to chemical energy, which is used in the production of food.

b. Light is also necessary for photosynthesis because it is the natural source of energy used by the green plants for photosynthesis.

c. Carbon dioxide is a necessary raw material for photosynthesis and is taken up from the air that diffuses into the leaves from the leaf stomata.

d. Water is also used as a raw material by the plants and is absorbed through the roots by osmosis.

e. Proper temperature range of 25-30° C is also necessary for photosynthesis. At very high temperature photosynthesis decreases and respiration increases.

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

S.No	Aerobic Respiration	Anaerobic Respiration
1.	Carbohydrate (glucose) is oxidized completely using molecular oxygen.	Carbohydrate (glucose) is incompletely oxidized. Molecular oxygen is not used.
2.	CO_2 and water are the end products.	Lactic acid or ethanol and CO_2 are the end products.
3.	About 38 ATP molecules are produced by the oxidation of one glucose molecule.	Very little chemical energy is released and there is gain of just 2ATP molecules per glucose molecule.
4.	Mitochondria play an important role in the process because after glycolysis pyruvate is transferred to mitochondria for further breakdown.	There is no role of mitochondria as the pyruvate is further processed in the cytoplasm to give different end products like ethyl alcohol or lactic acid.
5.	Most of the higher organisms respire by aerobic mode.	Anaerobic respiration basically takes place in primitive organisms like bacteria and under special conditions in the human muscle cells under continued muscular activity when sufficient oxygen is not supplied to the muscles.

Some bacteria and yeasts use the anaerobic mode of respiration. In yeasts it is called fermentation, during which glucose is broken down to Ethyl alcohol and Carbon dioxide.

$$\text{Glucose} \longrightarrow \text{Pyruvate} \longrightarrow \text{Ethyl alcohol} + \text{Carbon dioxide}$$

30. How are the alveoli designed to maximize the exchange of gases?

The lungs are organs where gas exchange takes place between the ***blood and air***. The blood gets re-oxygenated and carbon dioxide is released into the air. Inside the lungs there are millions of air sacs called **alveoli**, which increase the surface area for exchange of gases. The ***thin*** walls of alveoli are richly supplied with blood capillaries to carry blood for gas exchange. CO_2 diffuses out from the blood into the air and the blood takes up fresh oxygen from the air.

Alveoli

The figure shows the tiny air sacs also known as alveoli, within a section of human lung tissue. Human beings have a thin layer of about 700 million alveoli within their lungs! This layer is very necessary in the process of gas exchange between air and blood. The subdivision of lung into millions of tiny air sacs provides a greater surface area for gas exchange to take place.

31. What would be the consequences of deficiency of haemoglobin in our body?

Haemoglobin is the iron containing pigment in the red blood cells. Its main function is to carry the respiratory gases that is oxygen and carbon dioxide. Deficiency of iron or some vitamins in the food causes deficiency of haemoglobin in the body (blood). This condition is called haemoglobin deficiency anemia, which is characterized by the following symptoms-

a. Low red blood cell count in the blood.
b. Pale skin and tired appearance.
c. Loss of stamina to do hard work.
d. Dizziness on standing for a long time and
e. Low oxygen supply to the body tissues and low metabolic rate and respiration.
f. Rapid heartbeat.

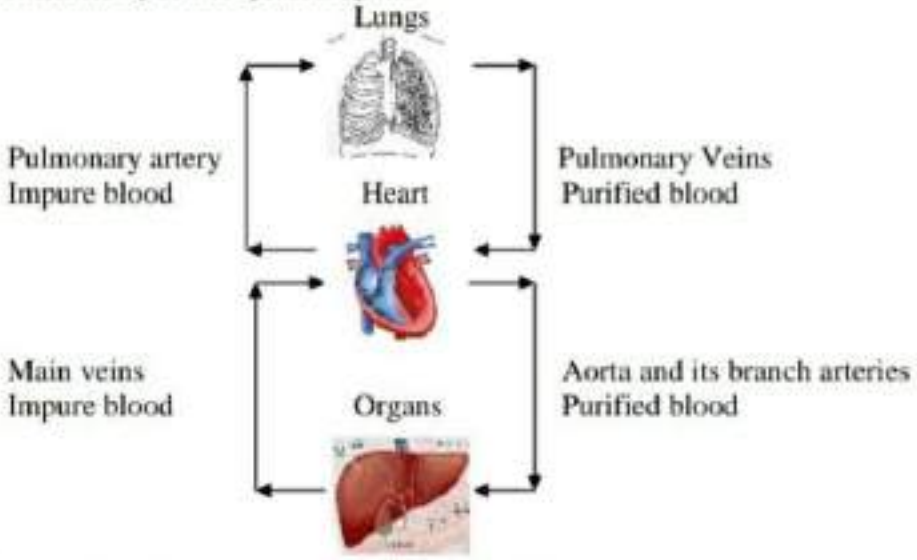
Deficiency of haemoglobin can be cured by eating food that is rich in iron and vitamin B.

32. Describe double circulation of blood in the human beings. Why is it necessary?

In human beings (and other mammals), the circulatory system is designed in such a way that blood passes twice through the heart, which acts as a pumping organ. As shown in the figure there are two circulations of blood in the human body-

a. Between Heart and Body organs- The left side of heart receives pure oxygenated blood from the lungs and pumps it to the body organs. In the body organs blood gives oxygen to the tissues and takes up carbon dioxide. This impure blood carrying carbon dioxide returns back by the veins to the right side of the heart.

b. Between Heart and Lungs- The right side of the heart pumps the impure blood carrying carbon dioxide to the lungs for gas exchange. In the lungs blood releases CO_2 into the air and takes up fresh oxygen. This pure oxygenated blood returns back to the left side of the heart and the cycle is repeated again.



This type of double circulation is present in the heart of human beings, other mammals and birds. ***This helps in separating the flow of oxygenated and deoxygenated blood in the body to supply sufficient oxygen to the body organs and tissues because in mammals and birds the respiration rate is high as they are warm blooded.***

In other animals there is partial mixing of impure and pure blood and so the supply of oxygen to the tissues is low, which is sufficient for them because they are cold blooded and do not require high oxygen for respiration.

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

S.No	Xylem	Phloem
1.	Xylem transports water and minerals from roots to the leaves and other plant parts.	Phloem transports prepared food (sugars and amino acids) from the leaves to the other parts of the plant body and to the storage organs.
2.	Conducting elements are tracheids and vessels, which are dead elements.	Conducting elements of phloem are sieve tubes, which are living cells.
3.	There is only upward conduction of water and dissolved minerals.	There is two way transport (translocation) of dissolved food through the phloem.
4.	The forces responsible for upward movement are root pressure and transpiration pull.	There is active transport of Sugars and Amino acids from the leaf cells into the phloem using energy from ATP. This increases the osmotic pressure of the sieve tube cells and water enters into the sieve tubes by osmosis creating a pressure, which makes the materials to flow in the phloem.

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

Alveoli and Nephrons are designed for the removal of wastes from the blood. Both have capillaries for filtration of the blood and removal of wastes. Alveoli in the lungs are basically balloon shaped structures to increase the surface area for gas exchange. They have an extensive network of blood capillaries to allow removal of CO_2 from the blood and uptake fresh oxygen from the air.

Nephrons are the working units of kidneys. They have a Bowman€s capsule***which again*** has an extensive capillary network and blood supply for removal of nitrogenous wastes i.e., Urea along with filtered water, salts, glucose etc. Of course the important materials are reabsorbed before the urine is released from the nephron.

In the alveolar capillaries the blood flows at a lower pressure as compared to the capillaries present in the nephrons. The high blood pressure in the capillaries of nephrons helps in proper removal of water and dissolved wastes from the blood plasma.

Extra Questions

1. Define nutrition. OR What is nutrition?

Nutrition *is the mode of taking food by an organism and its utilization by the body.* The mode of nutrition in which organisms make food themselves from simple substances is called autotrophic (auto = self; trophos = nourishment) nutrition. Therefore, plants are called autotrophs. Animals and most other organisms take in ready made food prepared by the plants. They are called heterotrophs (heteros = other).

2. What is Cellular Respiration? OR Define respiration.

Cellular Respiration is the breakdown or oxidation of food (glucose) in the body cells to release chemical energy. The chemical energy that is released from the food is stored in ATP, which is used to supply energy for various cellular processes. The carbohydrate used for respiration is generally glucose. It is of two types-

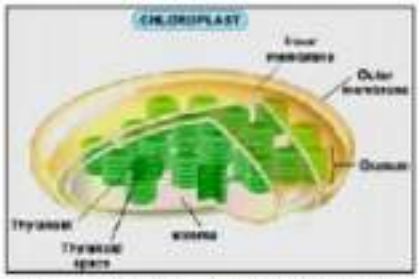
a. Anaerobic Respiration- Glucose is incompletely oxidized to different compounds. So, the energy output is also very less. As a result very less ATP is formed.

b. Aerobic Respiration- Glucose is completely oxidized to CO_2 and water using oxygen. So, the energy output is also very high. As a result more ATP is formed.

3. Explain the process of photosynthesis in brief.

The process of photosynthesis takes place in three basic steps-

a. ***Absorption of light energy*** by the groups of chlorophyll molecules called quantasomes in the chloroplasts and changing it to chemical energy. The chemical energy is stored in ATP.



b. ***Splitting of water molecule into hydrogen and oxygen***. Oxygen is released to the atmosphere as oxygen gas. Hydrogen is stored and carried by the hydrogen carrier.

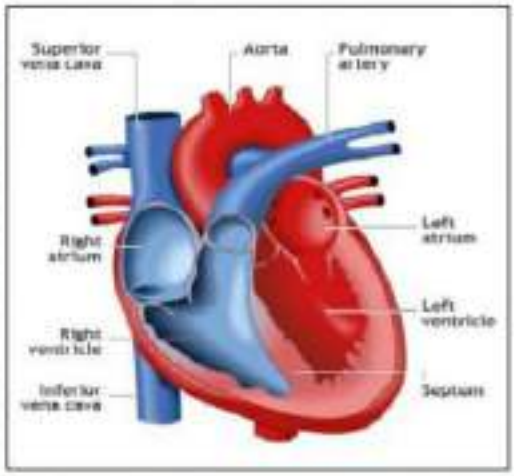
c. Using the chemical energy from ATP, CO_2 is reduced by hydrogen to produce carbohydrate.

These steps of photosynthesis are performed in the ***Chloroplasts*** in the plant cells because they have the necessary pigments and enzymes for photosynthesis. The overall reaction of photosynthesis is-

$$6CO_2 + 12H_2O \xrightarrow{\text{Sunlight}} C_6H_{12}O_6 + 6H_2O + 6O_2$$

4. Explain the flow of blood through the human heart.

Human heart is basically designed to separate the flow of pure oxygenated and impure blood. Thus there are two sides of the heart. There are four chambers. Two upper chambers are called auricles and the two lower chambers are called ventricles. There is a septum to divide the right and left sides of the heart. Flow of blood through the heart is as follows-



a. Blood flow in right side of heart- The Main Veins (superior and inferior vena cava) collect impure blood containing CO_2 from all the veins and drain it into the Right Atrium. The blood then passes into the Right Ventricle through the valve. When the heart contracts, blood from the right ventricle is pushed into the Pulmonary Arteries, which supply it to the lungs for gas exchange.

b. Blood flow in left side of the heart- Purified blood (oxygenated blood) is supplied from the lungs to the Left Atrium by the Pulmonary Veins. The blood then passes into the Left Ventricle through the valve. When the heart contracts, blood from the left ventricle is pushed into the Aorta (i.e., the main artery), which supplies blood to different arteries of the body.

5. Why do Ventricles have thick walls than Atria (auricles)?

Atria are the two upper chambers of the heart.

a. They receive blood through veins in which blood *does not* flow at high pressure.

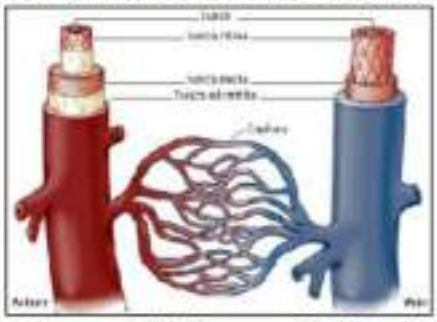
b. They force blood into the ventricles, which are situated right below them.

So, the Atria do not bear much blood pressure either while receiving or pushing out blood. So they have thin walls.

On the other hand both the loser chambers i.e., Ventricles have to force blood into the arteries, which carry it to long distances. So, Ventricles have thicker walls as compared to atria. Left Ventricle has the thickest walls with strong cardiac muscles because it has to force out blood into the main artery (Aorta), which supplies blood throughout the body at high pressure.

6. Explain how exchange of materials takes place between Blood and Tissues.

Arteries supply fresh oxygenated blood to different body organs. Inside the body organ the artery divides into smaller branches called arterioles. The arterioles further divide into extremely thin walled blood capillaries.



The blood capillaries form an extensive network inside the body organ. They make their way through the tissue cells. Blood plasma along with the dissolved materials comes out of the thin walls of the blood capillaries and collects into the tissue. It is then called tissue fluid, which ***acts as an intermediate medium between blood and tissue cells.*** The tissue fluid contains different materials such as oxygen, amino acids, glucose, mineral ions, proteins etc. which are needed by the body cells. The body cells take up the required materials from the tissue fluid and release their wastes such as CO_2. CO_2 enters through the blood capillary wall and dissolves into the blood plasma or enters into the red blood cells.

7. What is the size of heart in human adults?

The human heart in the adults is roughly the size of human fist.

8. What is blood? Mention the functions of the blood.

Blood is a fluid connective tissue of the circulatory system.

Composition of the blood-

a. Plasma- Plasma consists of water and dissolved materials like salts, proteins, glucose, amino acids, urea (as a waste), hormones, gases etc.

b. Red Blood Cells- Also called Erythrocytes. These cells contain a red compound called haemoglobin, which helps in the transport of oxygen and carbon dioxide in the blood.

c. White Blood Cells- These are smaller in number but play an important role in the immune system by killing invading microorganisms like bacteria, viruses etc.

d. Blood Platelets- These help in clotting of the blood to prevent blood loss when a blood vessel is broken.

Functions of Blood-

a. Transport of Materials- The first and main function of blood is the transport of materials in the body. The blood plasma, which carries many materials in dissolved form, is the main transport medium in the body. It carries materials like glucose, proteins, amino acids, salts, water, hormones etc to different cells in the body.

b. Osmoregulation- Blood helps in controlling the amount of water (fluid balance) in the body. It carries extra water to the kidneys where it is filtered out in the urine. When there is water scarcity in the body water is retained in the blood.

c. Role in Immune system- The White Blood Cells protect the body from many invading microorganisms by killing them. In addition the blood plasma also carries special proteins, called antibodies which also kill the invading microorganisms.

d. Role in Absorption of Digested Food in the intestine- Blood is richly supplied to the small intestine where it absorbs the nutrients from the digested food and supplies them to the different body organs.

e. Role in Excretion of Wastes- Blood carries different wastes. CO_2, which is produced as a waste during respiration is transported to the lungs for removal into the air. Urea that is produced in the liver is transported by the blood to the kidneys. Here urea along with other wastes is filtered out and released as urine.

f. Role in Maintaining Proper Body Temperature- Blood helps in proper distribution of heat in the body. Plasma has high heat carrying capacity. It helps in normalizing the body temperature in extreme hot and cold conditions.

9. Name the respiratory pigment. Where is it found in the body?

Haemoglobin is basically an iron containing protein that is present in the Red Blood Cells. It acts as a respiratory pigment by carrying Oxygen and Carbon dioxide to and from the cells respectively.

a. Haemoglobin carrying Oxygen- In the lungs, the oxygen gas that diffuses from *air into the blood* is taken up by the haemoglobin very rapidly. Every haemoglobin molecule can typically carry four oxygen molecules.

b. Haemoglobin carrying Carbon dioxide- When the blood reaches into the tissues, by a reverse reaction oxygen is released from the haemoglobin and diffuses out into the tissue fluid. The tissue cells take up this oxygen and in return release CO_2 into the tissue fluid. Some of the CO_2 coming into the is taken up by the haemoglobin in the red blood cells and carried to the lungs for removal

10. Why is CO_2 carried in dissolved state in the blood?

Solubility of Carbon dioxide gas in the blood plasma is higher than oxygen. So, the carbon dioxide that diffuses into the blood plasma from the tissue fluid gets dissolved into the blood plasma and is carried in the dissolved state.

11. Differentiate between arteries and veins.

S.No	Arteries	Veins
1.	Arteries are the blood vessels that carry blood away from the heart.	Veins are the blood vessels that carry blood towards the heart.
2.	Blood moves in the Arteries by the pumping action of the heart.	Blood moves in the veins by the movement of the body organs and muscles.
3.	In arteries blood flows at a high pressure.	In veins blood flows at a very low pressure.
4.	Pulse is felt on the arteries.	Pulse is not felt on the veins.
5.	The arteries are thick walled to bear the high blood pressure.	The veins are thin walled as compared to arteries because in them blood flows at much low pressure.
6.	The lumen of arteries is wider than veins.	The lumen of veins is narrower than the arteries.
7.	There are no valves in the arteries to prevent back flow of the blood.	There are valves in veins that allow flow of blood only in one direction that is towards the heart. If the blood flows back the valves close and stop the back flow.
8.	Generally most of the arteries carry pure oxygenated blood with only one exception of the pulmonary artery, which carries impure blood.	Generally most of the veins carry impure blood with only exception of the pulmonary vein, which carries oxygenated pure blood towards the heart.

12. What is lymph? What are its functions?

Lymph is basically the Tissue fluid (also called Interstitial fluid), which is present in spaces between the cells of the tissues. The extra tissue fluid enters into the lymph capillaries, which join up to form large lymph vessels. These lymph vessels finally meet with the veins and supply lymph into the blood.

Functions of Lymph are-

a. The lymph serves to return the tissue fluid into the blood.

b. It carries the plasma proteins that are produced in the liver to the blood plasma.

c. It helps in the absorption of fats in the intestine. The lymph capillaries that are present in the villi of the intestine are called lacteals. These lacteals take up the absorbed fats and fat soluble vitamins and supply it to the blood.
d. Lymph contains specialized WBCs called lymphocytes, which kill the microorganisms thus protecting the body from diseases.

13. Mention the steps of heterotrophic nutrition in human beings?
The process of nutrition in human beings takes place in the following steps-
a. Ingestion- The process of intake of food in the mouth is called ingestion.
b. Digestion- The process of breakdown of material into simpler substances is called digestion. It is of two types-
i. Mechanical Digestion- It takes place in the mouth by chewing. When the food is chewed it becomes a paste in which different digestive juices can mix and bring about break down of the complex food materials.
ii. Chemical Digestion- The food gets mixed with ***Digestive juices*** in different organs of the digestive system. These Digestive juices contain *Digestive enzymes*, which act on macro molecules (larger molecules) of complex food materials such as proteins, carbohydrates and fats. *The digestive enzymes break the chemical bonds* in the macro molecules and release simpler molecules that can be easily absorbed into the small intestine. The table below shows the process of chemical digestion-

S.No.	Organ	Digestive juice	Digestive enzyme	Acts on	Product formed
1.	Mouth	Salivary juice	Salivary amylase	Starch	Maltose
2.	Stomach	Gastric juice	Pepsin	Proteins	Smaller chains of Amino acids
			Gastric lipase	Fats	Fatty acids and glycerol
3.	Small intestine	Pancreatic juice	Trypsin	Proteins	Smaller chains of Amino acids
			Pancreatic amylase	Starch	Maltose
			Pancreatic lipase	Fats	Fatty acids & Glycerol
		Intestinal juice	Intestinal lipase	Fats	Fatty acids & Glycerol
			Amino peptidases & Di peptidases	Smaller chains of Amino acids	Free Amino acids
			Maltase	Maltose	Glucose

c. Absorption- The digested food material containing simpler food nutrients is absorbed in the small intestine. The inner wall of small intestine has finger like villi that increase the surface area for proper and complete absorption of the digested food. These villi are supplied with blood and lymph capillaries, in which the digested food is absorbed.
i. Water soluble materials like salts, glucose, amino acids, vitamin B and C etc are taken up by the blood in the blood capillaries.
ii. Fats and fat soluble vitamins A, D, E, and K are absorbed into the lymph capillaries by the lymph. The lymph carries these materials and supplies them to the blood.

d. Assimilation- The blood carries the absorbed food materials to the tissue cells. The tissue cells take up the nutrients and use them for different purposes. This utilization of the food nutrients by the cells is called assimilation. For example, amino acids that are absorbed in the small intestine are used by the tissues and cells to produce proteins; similarly glucose is used to supply energy to the cells by respiration.

e. Egestion- It is the process of removal of undigested and unabsorbed food from the body. The undigested and unabsorbed materials are passed into the large intestine, where there is absorption of water. Finally the undigested materials are released out of the body.

14. What are the functions of HCl, salivary amylase, mucus and pepsin?

a. HCl- Hydrochloric acid is secreted in the stomach by the gastric glands present in the walls of the stomach. The functions of HCl are-

i. Activating Pepsinogen to form the enzyme Pepsin, which digests proteins to smaller chains of amino acids.

ii. HCl also kills many bacteria and other microorganisms that enter along with the food.

iii. HCl denatures the proteins so that they can be easily digested.

b. Salivary amylase (also called Ptyalin) is the enzyme present in the Saliva. It acts on Starch and digests it to Simple sugar- Maltose. If bread or any other food containing starch is chewed for sometime then it tastes sweet because starch is chemically digested to the simple sugar Maltose

c. Mucus is the sticky material present in the gastric juice. It forms a layer on the inner wall of the stomach and protects it from the action of HCl and the protein digesting enzyme Pepsin.

d. Pepsin is the digestive enzyme that digests proteins in the stomach. It acts on proteins and digests them into smaller chains of Amino acids. It also coagulates milk protein so that it can be digested.

15. What are the functions of Bile Juice?

Bile Juice is produced in the liver and released into the food entering into the small intestine from stomach. It ***does not*** contain any enzyme but has other roles to play.

a. Bile juice contains bicarbonate ions, which react with the HCl in the food and neutralize it. Thus, the medium of food changes from acidic to alkaline (basic). This is necessary because enzymes present in the pancreatic and intestinal juices can act only in basic medium.

b. Bile juice helps in the emulsification of fats i.e., breaking of larger fat globules into fine droplets so that pancreatic and intestinal lipase enzymes can act quickly on the fats and digest them to produce fatty acids and glycerol.

16. What regulates the exit of food from stomach?

The exit of food from stomach is regulated of controlled by a muscular valve called ***Pyloric Sphincter***, which allows very slow passage of food from stomach into the small intestine. It opens and closes periodically to allow movement of food in small amounts into the intestine. This is necessary to allow proper mixing of bile juice, pancreatic juice and intestinal juice with the food while it is passing from the stomach into the small intestine.

17. Name the first part of small intestine.

First part of small intestine that is connected to the stomach and receives food through the Pyloric sphincter is called ***Duodenum***. Duodenum also receives bile juice and pancreatic juice through the common bile duct.

18. Name the largest part of alimentary canal.

Largest part of alimentary canal is the ***Small Intestine*** in which complete digestion of carbohydrates, fats and proteins takes place followed by its absorption.

19. Why is the Small Intestine of herbivorous animals longer than that of carnivorous animals?

Digestion of fibrous food present in the plant materials is difficult and takes more time than digestion of flesh. Hence, small intestine of herbivorous animals like cows is longer than that of carnivorous animals like lions and tigers.

20. Name the two secretions received by the small intestine.

The two secretions received by the small intestine are-

a. Bile juice from the liver,

b. Pancreatic juice from the pancreas.

The Bile juice does not contain any enzyme but it helps in the emulsification of fats into fine droplets and also in the neutralization of HCl present in the food coming from the stomach. Pancreatic juice contains many enzymes, which act on the proteins, carbohydrates and fats.