

CBSE Class 10 Science
CHAPTER – 6
Life Processes

Properties of Living Beings Compared to Non - living -

1. Movement
2. Grow
3. Need Food
4. Excrete
5. Respiration
6. Reproduce

Life Processes - Life processes are processes undergoing in living organisms to sustain life. For example: Reproduction, Excretion, Respiration and Growth.

Nutrition -

The Process of taking of food inside the body and converting it into smaller molecules which can be absorbed by the body is called Nutrition.

Need of nutrition: Nutrition is needed to provide energy for doing any activity and provide essential nutrients for life processes.

Mode of Nutrition -

Mode of nutrition means method of obtaining food by an organism. There are mainly two modes of nutrition:

1. Autotrophic mode
2. Heterotrophic mode

a. Autotrophic Mode: As the name suggest 'auto' means 'self' and 'trophe' means 'nutrition'.

In this mode of nutrition an organism does not depend on other living beings for food. Organism makes (or synthesizes) its own food by photosynthesis.

Those organisms which can make their own food by photosynthesis are called Autotrophs. For example: all green plants, autotrophic bacteria.

b. Heterotrophic Mode: As the name suggest 'heteros' means 'others' and trophe' means 'nutrition'.

Heterotrophic nutrition is that mode of nutrition in which an organism cannot make (or Not synthesizes) its own food and depends on other organisms for its food.

Heterotrophic mode of nutrition is of three types:

- (i). Saprotrophic (saprophytic) nutrition
- (ii). Parasitic nutrition
- (iii). Holozoic nutrition

(i) Saprotrophic nutrition: Saprotrophic nutrition is that nutrition in which an organism obtains its food from decaying organic matter of dead plants, dead animals and rotten bread etc. The organisms having saprotrophic mode of nutrition are called saprophytes.

Saprophytes are the organisms which obtain food from dead plants (like rotten leaves) dead and decaying animal bodies and other decaying organic matter. For example: Fungi (like bread moulds, mushrooms) and many bacteria.

(ii) Parasitic nutrition: The parasitic nutrition is that nutrition in which an organism derives its food from the body of other living organisms without killing it.

A parasite is an organism which feed on another living organism called its host. For example, some animals like Plasmodium and roundworms, etc

(iii) Holozoic nutrition: The holozoic nutrition is that nutrition in which an organism takes the complex organic food materials into its body by the process of ingestion; the ingested food is digested and then absorbed into the body cells of the organism. For example: human beings and most of the animal.

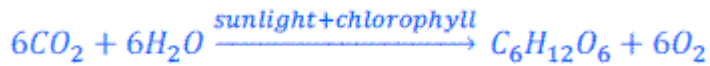
Nutrition in Plants -

Green plants prepare their own food. They make food from carbon dioxide and water in the presence of sunlight and chlorophyll. This process is called photosynthesis.

Conditions necessary for photosynthesis:

The conditions necessary for photosynthesis to take place are:

1. Sunlight
2. Chlorophyll
3. Carbon dioxide
4. Water



(Glucose)

The process of photosynthesis can be represented as:

- The process of photosynthesis takes place in the green leaves of a plant.
- The food is prepared by the green leaves of a plant in the form of a simple sugar called glucose.
- The extra glucose is changed into another food called starch (carbohydrate). This starch is stored in the fruits and leaves of the plant.
- Plants provide food for animals.
- The green plants convert sunlight energy into chemical energy by making carbohydrates.

How the plants obtain carbon dioxide?

- There are a large number of tiny pores called stomata present on the surface of the leaves of plants.
- The carbon dioxide gas enters into the leaves of the plant through the stomata present on the surface of leaves.
- Each stomatal pore is surrounded by a pair of guard cells. The opening and closing of stomatal pores is controlled by the guard cells.
- When water flows into the guard cells, they swell, become curved and cause the pore to open.
- On the other hand, when guard cells lose water, they shrink, become straight and close the stomatal pores.

Site of photosynthesis:

- The site of photosynthesis in a cell of the leaf is chloroplasts which contain Chlorophyll.
- Chloroplasts are mainly present in the photosynthetic cells (mesophyll cells) of green plants. These cells contain more chlorophyll than other plant cells.

Nutrition in Animals/ Heterotrophs -

Animals are heterotrophs and hence they depend on other organisms (plants and other animals) for their food. Fruits, vegetable, milk, fish are some small substances which can be used by body to obtained nutrients.

Nutrition in Simple Animals:

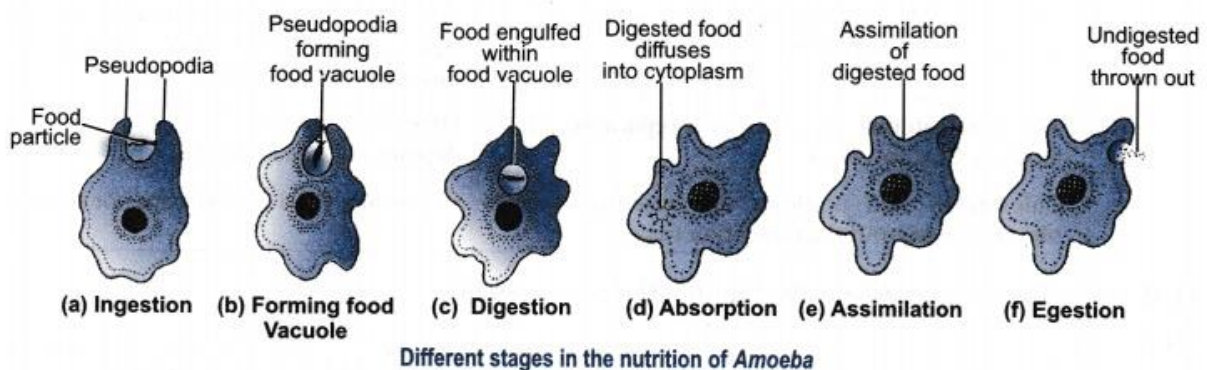
Amoeba and paramecium are two very simple unicellular animals. In unicellular animals, all the processes of nutrition are performed by the single cell.

a. Nutrition in Amoeba:

- Amoeba eats tiny plants and animals as food which floats in water in which it lives.
- The mode of nutrition in Amoeba is holozoic.
- The process of obtaining food by Amoeba is called phagocytosis.

Steps involved in the nutrition of Amoeba:

- Amoeba captures food near its body through temporary finger-like projections called pseudopodia to form food vacuole.
- Enzymes enter food vacuole from cytoplasm. The enzymes convert the taken food to smaller substances which can be absorbed by body.
- The digested food diffuses out to reach to the entire body.
- Body uses the food for growth.
- Cell membrane of amoeba ruptures at any point to throw out waste material.



Enzymes: Enzymes are juice like substances secreted by organs in living organisms which act as bio-catalyst in biochemical reactions inside the body.

There are five steps in the process of nutrition in animals.

1. Ingestion: The process of taking food into the body is called ingestion.
2. Digestion: The process in which the food containing large insoluble molecules is broken down into small water soluble molecules which can be absorbed by body to get required nutrients is called digestion.
3. Absorption: The process of distribution of digested food to body parts is called absorption.
4. Assimilation: The process in which the absorbed food is taken in by the body cells and used for energy, growth and repair is called assimilation.
5. Egestion: The process in which the undigested food is removed from the body is called egestion..

Nutrition in Human Beings (Digestive System in Human Body):

Basic organs of the human digestive system are:

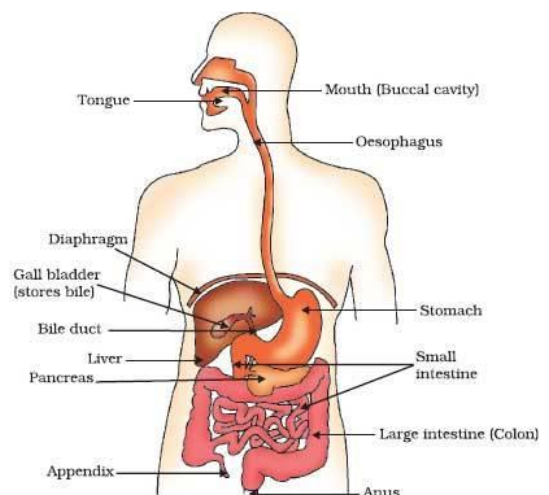
1. Mouth (Buccal cavity),
2. Oesophagus (Food pipe),
3. Diaphragm (Sheet),
4. Stomach (J shaped),
5. Small intestine,
6. Large intestine,
7. Rectum,
8. Anus

- Alimentary canal/ Gut is the entire path of food from mouth to anus.
- Small intestine is longer than large intestine but still it is called small as it is thinner.
- **Peristaltic movement:** When the slightly digested food enters the food pipe, the walls of food pipe start contraction and expansion movements to move the food along gut. This movement of walls of food pipe is called peristaltic movement.
- **Sphincters:** These are circular muscular structures which control the movement of substance through them. Normally, they remain closed. When movement is required, they open. There are many sphincters in gut.

Glands of human digestive system are:

1. Salivary glands,
2. Liver,
3. Pancreas.

- **Salivary glands** in our mouth produce saliva (watery liquid) which contains enzyme called salivary amylase which digests the starch (carbohydrate) present in the food into sugar (Chemical digestion).
- **Pancreas** lies behind the lower portion of stomach. It secretes pancreatic juice which contains many digestive enzymes (pancreatic amylase, trypsin, and lipase).
- **Liver** secretes greenish yellow liquid called bile. Bile is temporarily stored in gall bladder before it is send to small intestine through bile duct.



Working of Digestive System -

Ingestion: In human beings, food is ingested through the mouth. The food is put into the mouth with the help of hands.

Digestion:

1. Mouth:

- The digestion of food begins in the mouth itself.
- The teeth cut the food into small pieces, chew and grind it. (Physical digestion)

- The salivary glands in our mouth produce saliva (watery liquid) which contains an enzyme salivary amylase which digests the starch (carbohydrate) present in the food into sugar. (Chemical digestion)
- Our tongue helps in mixing this saliva with food.
- The digestion of food remains incomplete in mouth.

2. Oesophagus:

- The slightly digested food in the mouth is swallowed by the tongue and goes down the food pipe called oesophagus.

3. Stomach:

- The stomach is a J-shaped organ present on the left side of the abdomen.
- The stomach walls contains three tubular glands in it walls which secrete gastric juice.
- The gastric juice contains three substances: Hydrochloric acid, the enzyme pepsin and mucus.
- The **hydrochloric** creates an acidic medium which facilitates the action of the enzyme **pepsin i.e. digestion of protein**.
- The **mucus** helps to protect the stomach wall from its own secretions of hydrochloric acid.
- The partially digested food then goes from the stomach into the small intestine.

4. Small Intestine:

- From the stomach, the partially digested food enters the small intestine.
- The small intestine is the largest part (about 7.5m) of the alimentary canal.
- The small intestine is very narrow and arranged in the form of a coil in our belly.
- The small intestine in human beings is the site of complete digestion of food (like carbohydrates, proteins and fats)
- The small intestine receives the secretion of two glands: Liver and Pancreas.
- Liver secretes bile (greenish yellow liquid made in the liver and stored in gall bladder).

Bile performs two functions:

1. Makes the acidic food coming from the stomach alkaline so that pancreatic enzymes can act on it.
 2. Bile salts break the fats present in the food into small globules making it easy for the enzymes to act and digest them.
- The pancreas secretes pancreatic juice which contains enzymes like **pancreatic amylase** for breaking down starch, **trypsin** for digesting proteins and **lipase** for breaking down emulsified fats.
 - The walls of the small intestine contain glands which secretes intestinal juice.
 - The enzymes present in it finally convert the proteins into amino acids, complex carbohydrates into glucose and fats into fatty acids and glycerol. In this way the process of digestion converts the large and insoluble food molecules into small water soluble molecules.

Absorption:

- The small intestine is the main region for the absorption of digested food.
- The inner surface of the small intestine has numerous finger-like projections called villi which increase the surface area for rapid absorption of digested food.
- The digested food which is absorbed through the walls of the small intestine goes into our blood.

Assimilation:

- The blood carries digested and dissolved food to all the parts of the body where it becomes assimilated as part of the cells and is utilized for obtaining energy, building up new tissues and the repair of old tissues.

Egestion:

- The unabsorbed food is sent into the large intestine where villi absorb water from this material.
- The rest of the material is removed from the body via the anus.
- The exit of this waste material is regulated by the anal sphincter.

Tooth Decay / Dental Caries -

Tooth Decay / Dental caries is a **demineralization** of the tooth surface caused by bacteria.

Respiration -

The process of releasing energy from food is called respiration. The process of respiration involves taking in oxygen (of air) into the cells, using it for releasing energy by burning food, and then eliminating the waste products (carbon dioxide and water) from the body.

Food + Oxygen → Carbon dioxide + Water + Energy

The process of respiration which releases energy takes place inside the cells of the body. So, it is also known as cellular respiration.

Respiration is essential for life because it provides energy for carrying out all the life processes which are necessary to keep the organism alive.

Types of Respiration -

In most of the cases, the organisms carry out respiration by using oxygen. However there are some organisms which carry out respiration without using oxygen. Based on this, we have two types of respiration:

1. Aerobic respiration 2. Anaerobic respiration

1. Aerobic Respiration: The respiration which uses oxygen is called aerobic respiration.

In aerobic respiration, the glucose food is completely broken down into carbon dioxide and water by oxidation. Aerobic respiration produces a considerable amount of energy for use by the organism.

Glucose – Pyruvate - $6\text{CO}_2 + 6\text{H}_2\text{O} + \text{energy}$

Mitochondria are the sites of aerobic respiration in the cells. Thus, the breakdown of pyruvate to give carbon dioxide, water and energy takes place in mitochondria.

2. Anaerobic Respiration:

The respiration which takes place without oxygen is called anaerobic respiration.

The microscopic organisms like yeast and some bacteria obtain energy by anaerobic respiration (which is called fermentation). In anaerobic respiration, the microorganisms like **yeast break down glucose (food) into ethanol and carbon dioxide, and release energy.**

Anaerobic respiration produces much less energy.

Glycolysis In absence of oxygen

Glucose - Pyruvate - ethanol + $2\text{CO}_2 + \text{energy}$

In cytoplasm Yeast (Fermentation) (Ethanol)

Sometimes, **when there is lack of oxygen in our muscle cells**, another pathway for the breakdown of pyruvate is taken. Here **the pyruvate is converted into lactic acid** (which is also a three-carbon molecule) with the release of small amount of energy.

Glycolysis In absence of oxygen

Glucose - Pyruvate - Lactic acid + energy

In cytoplasm Muscle tissue

ATP (Energy Currency)

The energy produced during respiration is stored in the form of ATP molecules in the cells of the body and used by the organism as when required.

ADP (Adenosine Di-Phosphate, low energy content), Inorganic Phosphate (Pi) and ATP (Adenosine Tri-Phosphate, high energy content) are the substances present inside a cell.

The energy released during respiration is used to make ATP molecules from ADP and inorganic phosphate.

ADP + Phosphate + Energy → ATP

(Low energy) (For respiration) (High energy)

Thus, energy is stored in the form of ATP.

When the cell needs energy, then ATP can be broken down using water to release energy.

Thus:

ATP → ADP + Phosphate + Energy

(For use in cells)

The energy equivalent to 30.5KJ/mole is released in this process.

ATP is known as energy currency of cells.

Exchange of Gases during Respiration -

Animals

Unicellular animals like Amoeba,

Earthworm

Aquatic animals like Fish, Prawns

Insects like Grasshopper, Cockroach

Land animals like human, birds

Respiratory Organ

Cell membrane

Skin

Gills

Spiracles and tracheae

Lungs

Respiratory System in Humans –

In human beings, many organs take part in the process of respiration. These organs are called organs of respiratory system.

The main organs of human respiratory system are: Nose, Nasal passage, Trachea (wind pipe), Bronchi, Lungs and Diaphragm.

The human respiratory system begins from the nose. The air then goes into nasal passage.

The nasal passage is lined with fine hair and mucus.

When air passes through the nasal passage, the dust particles and other impurities present in it are trapped by nasal hair and mucus so that clean air goes into lungs.

The part of throat between the mouth and wind pipe is called pharynx.

From the nasal passage, air enters into pharynx and then goes into the wind pipe. Trachea does not collapse even when there is no air in it because it is supported by rings of soft bones called cartilage.

The trachea runs down the neck and divides into two smaller tubes called bronchi at its lower end.

The bronchi are connected to the two lungs. The lungs lie in the chest cavity or thoracic cavity which is separated from abdominal cavity by a muscular partition called diaphragm.

Each bronchus divides in the lungs to form a large number of still smaller tubes called 'bronchioles'.

The pouch-like air sacs at the ends of the smallest bronchioles are called alveoli.

The walls of alveoli are very thin and they are surrounded by very thin blood capillaries. It is in the alveoli that gaseous exchange takes place.

Mechanism of Respiration:

When we breathe in, we lift our ribs and flatten our diaphragm and the chest cavity becomes larger as a result.

Because of this, air is sucked into the lungs and fills the expanded alveoli.

The alveoli are surrounded by thin blood vessels called capillaries carrying blood in them. So, the oxygen of air diffuses out from the alveoli walls into the blood.

The oxygen is carried by blood to all the parts of the body. As the blood passes through the tissues of the body, the oxygen present in it diffuses into the cells.

The oxygen combines with the digested food present in the cells to release energy.

Carbon dioxide gas is produced as a waste product during respiration in the cells of the body tissues. This carbon dioxide diffuses into the blood.

Blood carries the CO₂ back to the lungs where it diffuses into the alveoli.

When we breathe out air, the diaphragm and muscles attached to the ribs relax due to which our chest cavity contracts and becomes smaller. This contraction movement of the chest pushes out CO₂ from the alveoli of lungs into the trachea, nostrils and then out of the body into air.

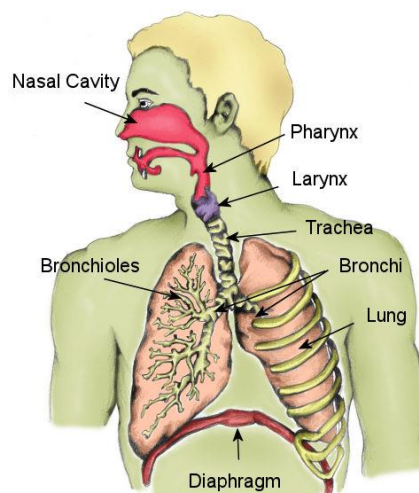
Note: During the breathing cycle, when air is taken in and let out, the lungs always contain a residual volume of air so that there is sufficient time for oxygen to be absorbed and for the carbon dioxide to be released.

Carbon dioxide is more soluble in water than oxygen is and hence is mostly transported in the dissolved form in our blood.

Rate of breathing:

The process of breathing pumps in oxygen into our body (and removes CO₂).

Breathing occurs involuntarily but the rate of breathing is controlled by the respiratory system of brain.



The average breathing rate in an adult man at rest is about 15 to 18 times per minute. This breathing rate increases with increased physical activity.

Oxygen required for breathing and respiration is carried by hemoglobin pigment present in our blood. The normal range of hemoglobin in the blood of a healthy adult person is from 12 to 18 grams per deciliter of blood.

The deficiency of hemoglobin in the blood of a person reduces the oxygen carrying capacity of blood resulting in breathing problems, tiredness and lack of energy.

Exchange of gases in plants -

Like animals, plants also need energy. The plants get this energy by the process of respiration. Plants also use oxygen of air for respiration and release carbon dioxide.

The respiration in plants differs from the animals in three respects:

Respiration in plants	Respiration in animals
All the parts of a plant (like root, stem and leaves) perform respiration individually.	Animal performs respiration as a single unit.
During respiration in plants, there is a little transport of respiratory gases from one part of the plant to the other.	Respiratory gases are usually transported over long distance inside an animal during respiration.
The respiration in plants occurs at a slow rate.	The respiration in animals occurs at a much faster rate.

Plants get Oxygen by Diffusion:

Plants have a branching shape, so they have quite a large surface area in comparison to their volume. Therefore, diffusion alone can supply all the cells of the plants with as much oxygen as they need for respiration.

Diffusion occurs in the roots, stems and leaves of plants.

Respiration in Roots:

Air occurs in soil interspaces. Root hairs of the roots are in direct contact with them.

Oxygen of the soil air diffuses through root hair and reaches all internal cells of the root for respiration.

Carbon dioxide produced by root cells diffuses in the opposite direction.

In water-logged conditions, soil air becomes deficient. In the absence of oxygen, metabolic activity of the root declines and the plant may wither.

Respiration in Stems:

The stems of herbaceous plants have stomata. The oxygen from air diffuses into the stem of a herbaceous plant through stomata and reaches all the cells for respiration.

The carbon dioxide gas produced during respiration diffuses out into the air through the same stomata.

In woody stems, the bark has lenticels for gaseous exchange.

Respiration in Leaves:

The leaves of a plant have tiny pores called stomata. The exchange of respiratory gases in the leaves takes place by the process of diffusion through stomata.

Net gaseous exchange in the leaves of the plant:

I. During day time when photosynthesis occurs oxygen is produced. The leaves use some of this oxygen for respiration and rest of the oxygen diffuses out into air. Again, during the day time, carbon dioxide produced by respiration is all used up in photosynthesis by leaves. Even more carbon dioxide is taken in from air. Thus, net gas exchange in leaves during day time is: O₂ diffuses out; CO₂ diffuses in.

II. At night time, when no photosynthesis occurs and hence no oxygen is produced, oxygen from air diffuses into leaves to carry out respiration. And carbon dioxide produced by respiration diffuses out into air. Thus, net gas exchange in leaves at night is: O₂ diffuses in; CO₂ diffuses out.