

Science Notes Part 21 To 25

21] Respiration In Plants And Animals

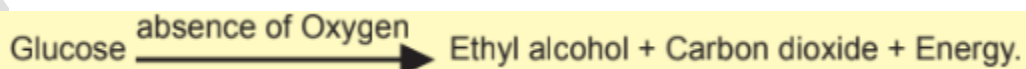
- ✓ Living things need energy to do any kind of work. They stop doing work, when their energy levels drop. Our body needs energy to carry out all its activities. Even when we are idle, certain organs of our body, such as the heart, brain, kidneys and lungs keep working. Hence, our body needs energy all the 24 hours.
- ✓ We eat food. Food contains energy. The food is broken into simpler forms in the alimentary canal. They are then absorbed by the small intestine and carried by the blood to all parts of the body. The energy supply of food is of no use until it is released from the food.
- ✓ We get energy from food. Energy is released from the food during respiration. So, respiration is a vital process in living organisms.
- ✓ When we breathe, oxygen is transported to the lungs and gets mixed with blood. The oxygen-mixed blood flows to all parts of the body and finally to all the cells. When oxygen combines with the food in cells, oxidation (burning) of food takes place. During this process, energy is released along with water and carbon dioxide as waste.
- ✓ The process of oxidation of food to release energy along with water and carbon dioxide as wastes in living cells is called **respiration** or **cellular respiration**.

Types of respiration

Respiration is of two types: (a) Aerobic respiration and (b) Anaerobic respiration. Most of the living organisms use oxygen to break up the food in order to get energy. So, the respiration that requires usage of oxygen is called aerobic respiration. It is represented by the equation below:

**Anaerobic respiration**

Some microorganisms like yeast and bacteria obtain energy from food in the absence of oxygen. So, the respiration that takes place in the absence of free oxygen is called anaerobic respiration. Anaerobic respiration takes place in our skeletal muscles.

**Differences between breathing and respiration**

Breathing	Respiration
1. It is a physical process because only the air moves from one place to another .	1. It is a chemical process because the food undergoes chemical changes.
2. Energy is not released.	2. Energy is released.
3. It takes place in breathing organs.	3. It takes place in living cells.

Respiration is the process of burning food with the help of oxygen to release energy. Then, what is the difference between the burning of food in cells and burning of wood?

Respiration	Burning of wood
1. It takes place in living cells.	1. It takes place outside.
2. Heat energy is liberated.	2. Heat and light energy are liberated.
3. Energy is released step by step in small quantities.	3. Energy is released all of a sudden in a large quantity.

Distinguish respiration from photosynthesis:

Respiration	Photosynthesis
1. It takes place during day and night.	1. It takes place only during day time.
2. All living organisms respire.	2. Only green plants prepare food through photosynthesis.
3. Food is consumed.	3. Food is synthesized.
4. During this process oxygen is taken in and carbon dioxide is given out.	4. During this process, carbon dioxide is taken in and oxygen is given out.

RESPIRATION IN MAN:

The human respiratory system consists of nose, nasal cavity, trachea, bronchi and lungs. The lungs are present in the chest cavity. We have muscles in our chest that help us breathe. Some are fixed to our ribs and make the ribcage move in and out. Below the lungs is a strong, flat sheet of muscle called the diaphragm.

Our nose has two openings called nostrils. Nostrils lead to nasal cavity which in turn leads to trachea (wind pipe). The trachea divides into two branches called bronchi. (singular – bronchus). Each bronchus enters the lungs and divides into small tubes called bronchioles. The bronchioles end up in air sacs called alveoli. (singular – alveolus).

The walls of alveoli are supplied with thin blood vessels called capillaries which carry blood in them. Oxygen from the lungs enters the blood and carbon dioxide from the blood reaches the lungs in the regions of alveoli.

Breathing involves both inhalation and exhalation. It is a continuous process which takes place all the time and throughout the lifespan of organisms. The number of times a man breathes in a minute is called the **breathing rate**.

As we breathe in, the diaphragm moves down and ribs move up and expands. This movement increases the space in our chest cavity. Then the air, rich in oxygen rushes into our lungs from outside through the route given below:

Nose → Nasal Cavity → Trachea → Bronchi → Bronchiole → Alveoli

As we breathe out, the diaphragm moves up to its original position and the ribs move down. This reduces the size of the chest cavity and air is pushed out of the lungs through bronchi, trachea and nose.

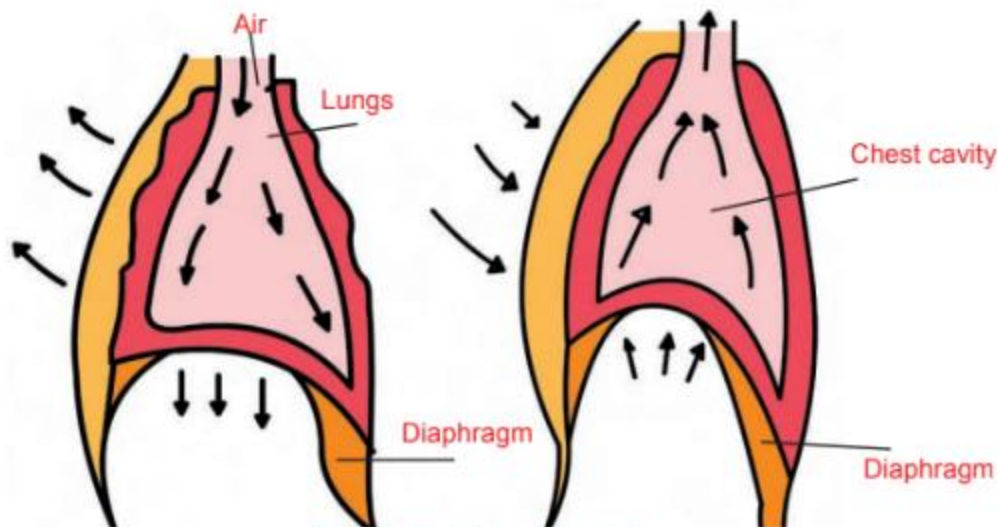


Fig 2.2 Inhalation - Exhalation

Exchange of gases

When oxygen-rich air reaches the alveoli, oxygen is absorbed by the blood and it combines with the haemoglobin. It is then carried as oxy-haemoglobin to all cells of the body. In the cells, oxygen is used for oxidation of food to release energy along with water and carbon dioxide. This carbon dioxide is absorbed by the blood and is transported to the lungs, where it is exhaled.

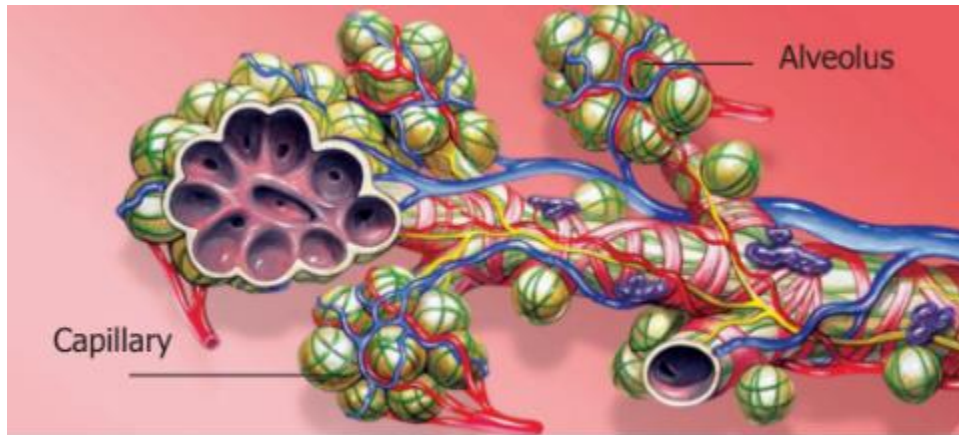


Fig 2.3 Structure of alveoli

RESPIRATION IN ANIMALS

Like human beings, animals and plants also breathe and respire. The basic process of respiration is the same in all organisms. Let us study the structures of some animals and how they enable them to respire.

(a) In unicellular and smaller multicellular animals, all the cells take in oxygen from the surrounding air or water and give out carbondioxide by diffusion.

eg. Amoeba, Paramecium

(b) Creatures like the earthworm and the leech respire through their skin, which is moist and slimy.

(c) In insects, there are several small openings called spiracles on the lateral side of their bodies. These spiracles lead to air tubes called trachea. Exchange of gases takes place through spiracles into trachea.

(d) Fishes have special organs called gills, which are used to absorb oxygen dissolved in water.

(e) Animals like reptiles, birds and mammals have lungs for breathing.

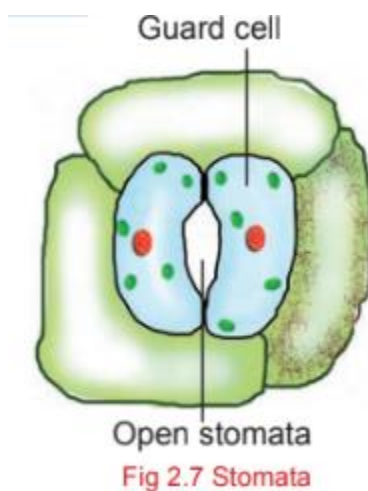
(f) Animals such as frogs respire through their skin and lungs.

RESPIRATION IN PLANTS

Like other living organisms, plants also respire to get energy from food. Generally, plants do not have any special organ for breathing. They do not show breathing movements like that of animals.

Plants breathe through tiny pores in the leaves called stomata. Oxygen from the air diffuses into the leaves and carbon dioxide from the leaves diffuses out through stomata. Stems have minute openings on their surfaces. These openings help in the exchange of gases. Roots also respire independently. Roots draw in air from the air spaces present between the soil particles. Thus, all parts of the plant like the root, stem and leaf respire independently. Aquatic plants directly exchange gases with the water that surrounds their leaves, roots and stems.

The process of photosynthesis in plants takes place during the day. During this process, carbon-di-oxide is used and oxygen is released. A part of the oxygen released during photosynthesis is used by the plants for respiration and the rest is sent out through the stomata. Carbon dioxide released during respiration is used up by the plant for photosynthesis. During the night, photosynthesis does not take place.



The carbon dioxide that is released as a result of respiration is sent out through the stomata into the atmosphere. The oxygen in the atmosphere is taken in and used for respiration.

Types of Respiration

Respiration is of two types depending upon the presence or absence of oxygen.

- 1) Anaerobic respiration and
- 2) Aerobic respiration.

In lower organisms like the yeast and the bacteria, anaerobic respiration takes place. In higher organisms like plants, aerobic respiration takes place.

22] Matter And Its Nature

Everyday we notice a variety of changes that takes place around us. These changes may involve one or more substances. For example, ice melts, water evaporates, sugar dissolves in water and milk turns into curd.

A change occurs in all these instances. 'A rubber band that is stretched' also represents a change since the action causes the change. Changes in matter occur under certain conditions. The changes that take place around us are of two types:

1. Physical changes
2. Chemical changes

1. Physical Changes

We found that no change had taken place in the chemical composition and no new product was formed. Only a physical change had taken place in all the cases. From this we understand that a physical change does not involve the formation of any new substance and it is readily reversible.



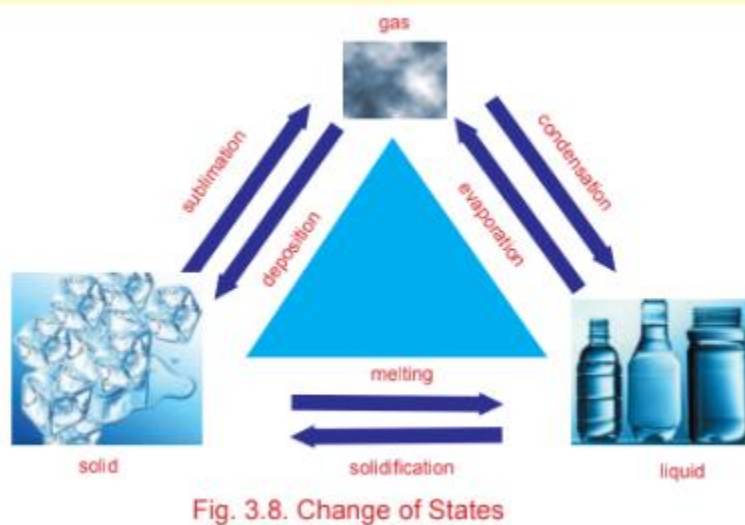
Fig. 3.3. Separation of iron fillings from sand using magnet



Fig. 3.2. Melting of ice stick

From this activity we observe that the copper sulphate crystals that we dissolved in water have turned into crystals again. Therefore, dissolution of copper sulphate is a physical change. We also observe that the newly formed crystals have definite geometrical shape and size. Thus crystals of pure substance can be obtained from their solution. This process of crystal formation is known as **crystallization**.

From this activity, we observed that the camphor first got vapourised, but it was deposited back as camphor on the sides of the funnel. Also, the chemical composition of camphor had not changed and the reaction was reversible. Therefore, we understand that heating of camphor is a physical change. The process of converting a solid directly into its gaseous state is known as **sublimation**.



On heating, water changes from solid state (ice) into liquid state (water) and from liquid into gas (vapour) and then gas changes into a liquid. Water (liquid) can be changed into a solid (ice), again when it is frozen.

- In all these changing processes, the chemical composition of water does not alter. Therefore, this is a physical change. Solids change into liquids on heating. This process is called melting.

Liquids change to gas on heating. This process is called **evaporation**.

The vapour, when allowed to cool, condenses into its liquid state. This process is called **condensation**.

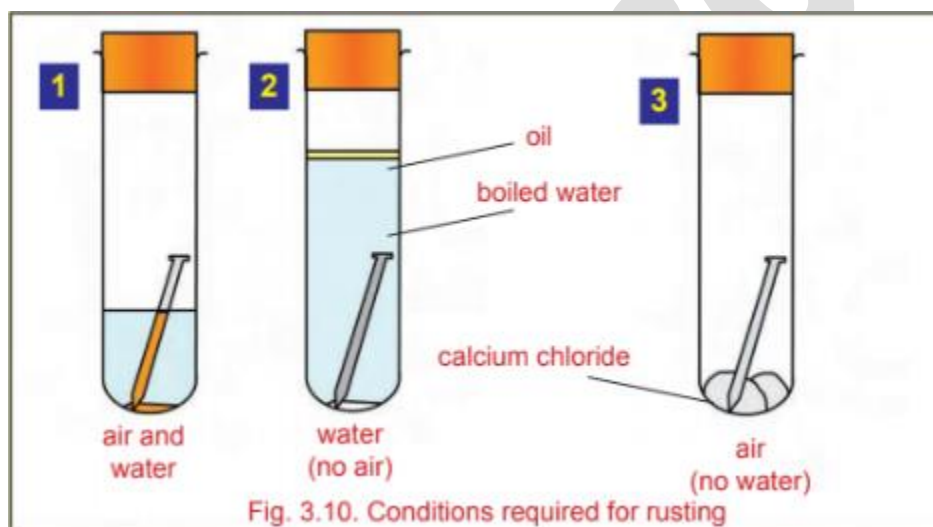
Water, when cooled to zero degrees, changes into ice. This process is called **freezing**.

In all the above activities, the changes take place only in the physical properties of a substance, such as shape, size, colour and temperature. A physical change occurs when the substance changes its physical state but does not change its chemical composition. A change in which a substance undergoes changes only in its physical properties is called a physical change. A physical change is generally reversible and no new substance is formed.

CHEMICAL CHANGES:

If we leave an iron object such as bolt or iron rod in the open air or in the rain, a reddish brown layer is deposited on its surface. The layer thus formed is called rust and the process is called **rusting**.

In the presence of moisture, iron reacts with oxygen present in air to form hydrated 'iron oxide' known as rust. Oxygen and water are two essential ingredients for the rusting of iron.



We notice that the nails in test tube-2 and 3 have not rusted, while the nail in test tube-1 has rusted. From this activity, you can infer that both oxygen and water are essential for rusting.

Rust is a brittle substance that flakes off easily from the surface. Rust is different from the iron on which it gets deposited. It means a new substance has formed.

In all the above activities, you can see that one or more new substances are formed. The properties of the new substances are not the same as that of the original ones. These processes are also irreversible. This type of change is called a **chemical change**. Any change that results in the formation of one or more new substances is called a chemical change. A complete and permanent change in the properties of the substance is produced in the process. A chemical change is also referred to as a **chemical reaction**.

Chemical changes are very important in our day- to- day life. A medicine is a product of chemical reaction. Useful materials like plastic, detergents, dyes and paints. are also produced by chemical reactions.

In addition to the new products formed, the following may also accompany a chemical change.

- Heat or light may be given off or absorbed
- Sound may be produced
- Colour change may occur.
- A change in smell may take place.

Differences between physical change and chemical change

S.No	Physical change	Chemical change
		
1	The physical changes are reversible.	The chemical changes are irreversible.
2	New substances are not formed.	New substances are formed.
3	The molecular composition of the substance remains the same.	The molecular composition of the substance changes.
4	No energy change is involved.	Energy change is involved.
5	Temporary change.	Permanent change.

ACIDS, BASES AND SALTS

In our daily life, we use substances such as lemon, tamarind, tomato, common salt, sugar and vinegar.

ACIDS, BASES AND SALTS USED IN OUR DAILY LIFE

Curd, lemon juice, orange juice and vinegar taste sour. These substances taste sour because they contain acids. The chemical nature of such substances is acidic. The word 'acid' comes from the Latin word 'acidus' which means sour.

In general, acids are chemical substances which contain replaceable hydrogen atoms. Acids can be classified into two categories namely organic acids and mineral acids or inorganic acids.

Organic acids

Acids which are obtained from animal and plant materials are called organic acids. Many such acids are found in nature. Lemon and orange contain citric acid. Hence they are called citrus fruits. Milk that has turned to curd tastes sour. It contains an acid called Lactic acid. The acids found in food stuffs are weak. Soft drinks contain some carbonic acid which gives a tingling taste. Apple contains malic acid. Some common organic acids are shown in Fig.

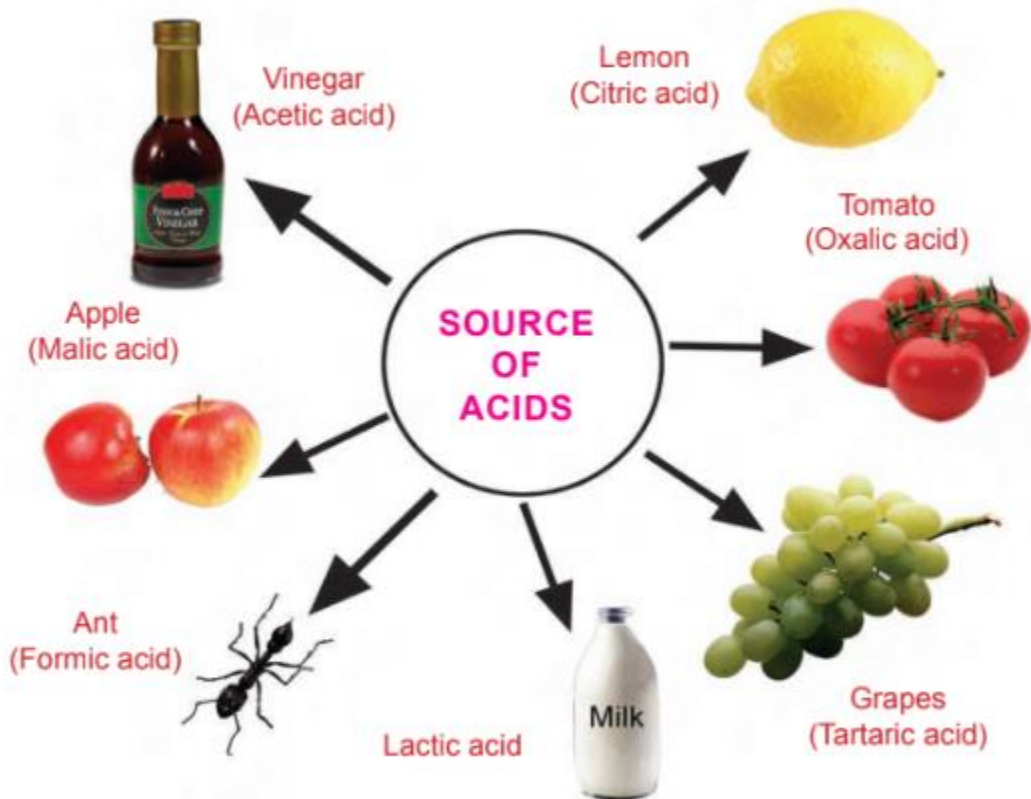


Fig. 3.19. Acids and their sources

Mineral acids

Acids that are obtained from minerals are called mineral acids or inorganic acids. For example, Hydrochloric acid, Nitric acid, Sulphuric acid which are commonly available in the laboratory must be handled with a lot of care. They are corrosive. It means that they can eat away metal, skin and clothes. But they cannot corrode glass and ceramic. Hence they are stored in glass bottles. An acid is a substance which contains replaceable hydrogen ions.

Bases and alkalies in our daily life

Substances such as baking soda does not taste sour. It is bitter in taste. It shows that it has no acid in it. If you rub its solution with your fingers, it is soapy. Substances like these which are bitter in taste and are soapy to touch are known as bases.

The nature of such substances is said to be basic. Bases are oxides or hydroxides of metals. They are chemically opposite to acids. Some bases like caustic soda [Sodium hydroxide] and caustic potash [Potassium hydroxide] are very corrosive.

Bases give hydroxyl ions when treated with water. Bases which are soluble in water are called Alkalies. The hydroxides of Sodium and Potassium are examples of alkalies. They are water soluble bases. All alkalies are bases, but not all bases are alkalies. The word 'alkali' is derived from the Arabic word 'alquili' which means plant ashes. Ashes of plants are composed mainly of sodium and potassium carbonates.

Some common bases used in our daily life are given

No	Name	Other Name
1	Quicklime	Calcium oxide
2	Potassium hydroxide	Caustic potash
3	Calcium hydroxide	Slaked lime
4	Sodium hydroxide	Caustic soda
5	Magnesium hydroxide	Milk of magnesia

Table 3.4

Name of Base	Found in
Calcium hydroxide	Lime water
Ammonium hydroxide	Window cleaner
Sodium hydroxide/ Potassium hydroxide	Soap
Magnesium hydroxide	Antacid

Test for identifying acids and bases

We should never touch or taste a substance to find out whether it is an acid or base because, both acids and bases are harmful and will burn the skin. A safe way to find it out is to use an indicator.

Indicators are a group of compounds that change colour, when added to solutions containing either acidic or basic substances. The common indicators used in the laboratory are litmus, methyl orange and phenolphthalein. Apart from these, there are some natural indicators like turmeric, red cabbage juice and beetroot juice.

Indicator	Colour in Acid	Colour in base
Litmus	Red	Blue
Phenolphthalein	Colourless	Pink
Turmeric powder	Yellow	Brick red
Beetroot juice	Pink	Pale yellow
Red cabbage juice	Pink/Red	Green

Litmus: A natural dye

The most commonly used natural indicator is litmus. It is extracted from lichens (Fig. 3.21) and it has a purple colour when put in distilled water. When added to an acidic solution, it turns red and when added to a basic solution, it turns blue. It is available in the form of solution or in the form of strips of paper known as litmus paper. Generally, it is available as red and blue litmus paper.

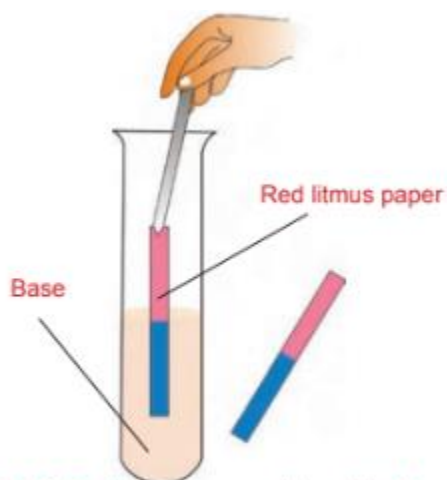


Fig. 3.22. Red litmus paper dipped in Base solution changes to blue

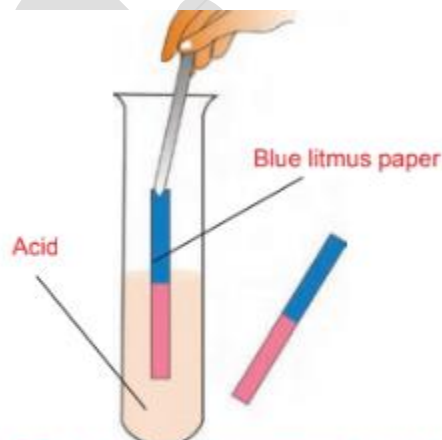


Fig. 3.23. Blue litmus paper dipped in Acid solution changes to red

Properties of Acids

1. They have a sour taste.
2. Strong acids are corrosive in nature.
3. Hydrogen is the common element present in all acids. However, all compounds containing hydrogen are not acids. For instance, ammonia, methane and glucose are not acids.
4. They react with metals and produce hydrogen.

Metal + Acid $\rightarrow$ Salt + Hydrogen gas

5. Acids turn blue litmus in to red.
6. The indicator phenolphthalein is colourless in acids.
7. The indicator methyl orange is red in acids.
8. They are good conductors of electricity.

Uses of Acids**Inorganic acids are used in:**

1. Chemical laboratories as reagents.
2. Industries for manufacturing dyes, drugs, paints, perfumes, fertilizers and explosives.
3. The extraction of glue from bones and metals from their ores.
4. Preparation of gases like Carbon dioxide, Hydrogen sulphide, Hydrogen, Sulphurdioxide etc.
5. Refining petroleum.

Organic Acids like carboxylic acids are used:

- as food preservatives.
- as a source of Vitamin C.
- for preparation of baking soda.
- to add flavour to foodstuffs and drinks.

Properties of Bases

1. Bases are bitter in taste.
2. Strong bases are highly corrosive in nature.
3. Generally, they are good conductors of electricity.
4. Basic solutions are soapy to touch.
5. Bases turn red litmus paper into blue.
6. Bases are compounds that contain hydroxide ions.

Uses of Bases

1. in chemical laboratories, as a reagent
2. in industries, for manufacturing soap, textile and plastic.

3. for the refining of petroleum.
4. for manufacturing paper, pulp and medicine.
5. to remove grease and stains from clothes.

Neutralisation

Acids turn blue litmus into red and bases turn red litmus into blue; hence they have different chemical properties.

When an acidic solution is mixed with a basic solution, both solutions neutralise the effect of each other. When an acid solution and a base solution are mixed in suitable amounts, both the acidic nature of the acid and the basic nature of the base are destroyed. The resulting solution is neither acidic nor basic. Touch the test tube immediately after neutralisation.

In the process of neutralisation, heat is always evolved or liberated. The evolved heat raises the temperature of the mixture. In neutralisation reaction, a new substance is formed. It is known as salt. Salt may be acidic, basic or neutral in nature.

Neutralisation can be defined as a chemical reaction that takes place between an acid and a base. In this process, salt and water are produced with the evolution of heat.

Acid + Base $\rightarrow$ Salt + Water & heat is evolved.

Salt

A salt is a substance formed by the neutralisation of an acid with a base.

Sodium hydroxide + Hydrochloric acid $\longrightarrow$ Sodium chloride + Water + Heat
(Base) (Acid) (Salt)

Name of acid	Salt formed	Names of salts
HCl	Chloride	Sodium chloride, Copper chloride, Ferric chloride
HNO ₃	Nitrate	Sodium nitrate, Copper nitrate, Ferric nitrate

Uses of Salt

Name of Salt	Uses
For the human body Calcium phosphate, Calcium lactate, Ferrous sulphate, Sodium chloride etc.	For the proper functioning of the human body.
For domestic purposes 1. Sodium chloride 2. Sodium bicarbonate 3. Hydrated potassium, aluminium sulphate	Used as a preservative/ To add taste to our food In baking/ in effervescent drinks. In purification of water.
For Industrial Purposes 1. Sodium carbonate 2. Copper sulphate 3. Potassium nitrate	In manufacture of washing powder. As an insecticide. In manufacture of gunpowder.

Neutralization in Everyday Life

Indigestion: Our stomach contains hydrochloric acid. It helps us digest the food we eat. Secretion of excess acid in the stomach will cause stomach upset or indigestion. Sometimes indigestion becomes painful. We take an antacid such as milk of magnesia to neutralise the excess acid.

Ant bite:

When an ant bites, it injects acidic liquid (Formic acid) into the skin. The effect of the acid can be neutralized by rubbing the bitten area with moist baking soda or calamine solution (Zinc Carbonate).

Factory wastes:

The wastes of many factories contain acids. If they are allowed to flow into the water bodies, the acids will kill the fish and other organisms. The factory wastes are therefore, neutralised by adding basic substances.

Soil treatment:

Excess use of chemical fertilizers makes the soil acidic. When the soil is acidic, plants do not grow well. So it is treated with bases. If the soil is basic, the organic matter releases acids, which neutralises the basic nature of soil.

23] Electricity

“Electricity plays an important role in our day to day activities. It is almost impossible to imagine life without electricity. Electricity has made our tasks easier and our lives more comfortable.

The electricity we use at home comes from the substation in the neighbourhood which draws power from the larger power stations. These power stations get electricity from the electrical plants. From the power station, electricity flows through cables and wires to the step up transformers where the voltage is raised to facilitate long distance travel.

The substation transformers receive the current, lower the voltage and send it to pole transformers. From these transformers, electricity is supplied to homes, schools and buildings, wherever required. Inside the power stations, there are huge rotating wheels called turbines.

Each turbine is made of curved blades arranged like the sails of a windmill. These turbines are made to rotate by flowing water or steam. They are attached to the coils of electric generators.

Generator

A simple generator consists of a coil of wire that rotates between the poles of a strong magnet. As the coil rotates, electric current is generated.

At Thermal power stations, steam is used to rotate the coil. Hot steam is allowed to fall on the blades of a turbine that spin and turn the shaft, which in turn makes the coil to rotate. Steam is made by heating water, burning fossil fuels like coal, oil or natural gas.

In Nuclear power stations, splitting of uranium atom produces energy to heat water and thereby produces steam, which in turn is used to rotate the turbines.

In Hydro-electric power stations, fast flowing water is used to rotate the turbines.

Tamilnadu Leads

Wind energy is an important, free, renewable, clean and non-polluting energy source. In a wind farm, huge windmills convert wind energy into electrical energy. **Tamilnadu is the No.1 state in India**, with the highest wind power generating capacity of about **5,000 MW**. Most wind farms are in **Thoothukudi, Kanyakumari and Thirunelveli Districts of Tamilnadu**.

ELECTRIC CELL

The electric cell is a source of electric current. **It is a device which converts chemical energy into electrical energy.** An electric cell has two different metal plates called electrodes kept inside a chemical called electrolyte. Due to chemical reaction, one plate develops a positive charge and the other plate develops a negative charge and produces electric current.

TYPES OF ELECTRIC CELLS

There are two types of electrical cells.

PRIMARY CELLS:

Primary cells are intended to be used only once and then discarded. They cannot be reused as the chemicals get used up, when the cells are in use and cannot be recharged.

Example: Cells used in clocks, torches, digital watches, calculators etc.

Secondary cells (Storage cells)

Secondary cells can be recharged and reused many times. They are also called Storage cells.

Example: Batteries used in automobiles, cell phones, emergency lights etc.

The first electric cell was developed by an Italian scientist Luigi Galvani and then improved by Alessandro Volta. It has been further developed into the modern day cell or torch battery. Now, we also have rechargeable alkali cells and solar cells. These solar cells convert light energy into electrical energy.

ELECTRIC CIRCUIT

An **electric circuit** is the continuous or unbroken closed path along which electric current flows from the positive terminal to the negative terminal of the battery.

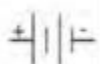
A circuit generally has:

- a) A source of electric current - a cell or battery.
- b) Connecting wires - for carrying current.
- c) A device that consumes the electricity - a bulb.
- d) A key or a switch – This may be connected anywhere along the circuit to stop or allow the flow of current. When the current flows, the circuit is said to be closed. When the current does not flow, the circuit is said to be open.

Galvanometer is an instrument used to detect the flow of current in electrical circuits. When current flows through the galvanometer, the needle gets deflected.

SYMBOLS of electric components

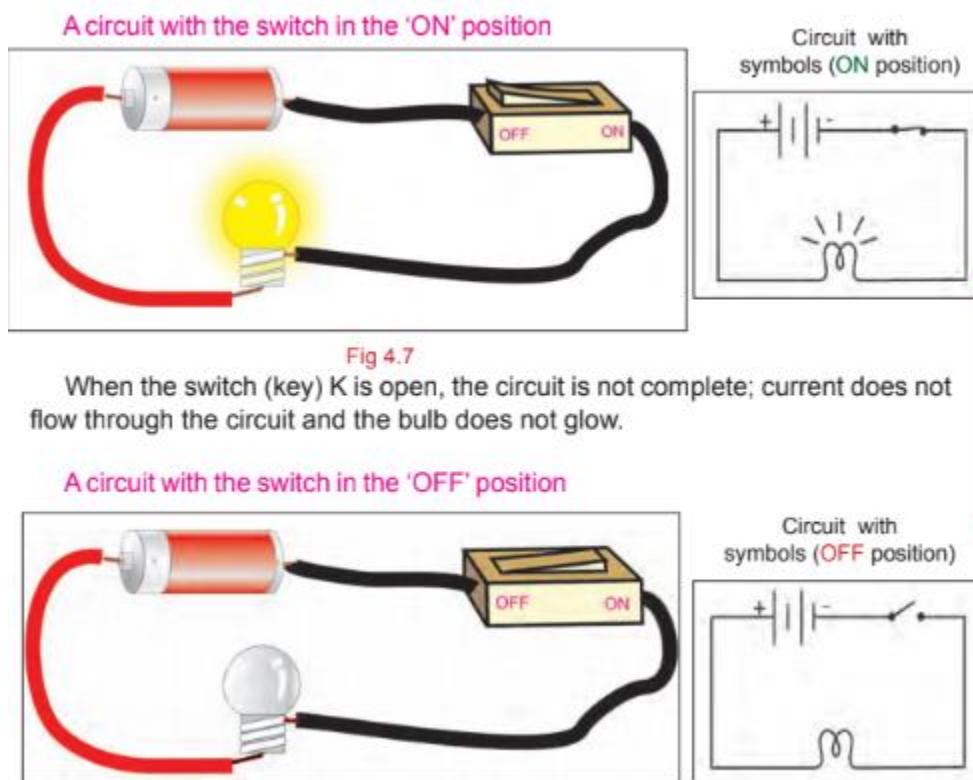
The given table shows the symbols of electric components commonly used in electric circuits.

S.No.	Name of the component	Picture	Symbol	Explanation
1.	Cell			The longer line denotes the positive terminal and the shorter line denotes the negative terminal.
2.	Battery			Two or more cells when joined together form a battery
3	Switch (Key)			Switch is OFF — circuit is OPEN
				Switch is ON — circuit is CLOSED
4.	Bulb			Bulb does not glow
				Bulb glows
5.	Connecting Wire			used for connecting different components

ELECTRIC SWITCH

What is used to turn the light or fan ON and OFF ?

The device used is called a switch or a key. **An electric switch is a device that opens or closes an electric circuit.** When the switch (key) K is closed, the circuit is complete; current flows through the circuit and the bulb glows.



CONDUCTORS AND INSULATORS

The materials that allow electric current to pass through them are conductors. Examples: All metals like Copper, Iron, Silver, besides the Human body and the Earth.

The materials which do not allow electric current to pass through them are insulators. Examples: Plastic, Wood, Rubber and Glass.

HEATING EFFECT OF ELECTRIC CURRENT

Lightning is nothing but a discharge of a huge spark of electricity between two charged clouds in the sky. When lightning strikes, it can burn trees and demolish buildings.

Burning of trees is due to the passing of electricity through them.

In an electric wire, we do not see the flow of current. We only feel the effects of the flow of current.

The current flowing through a wire produces heating effect.

How is heat produced in these appliances?

All heating appliances have a wire which produces heat, when current is passed. It is known as the heating element. This is the most important part of a heating appliance.

The element is a coil of wire made of a special material called nichrome which becomes very hot when current is passed. This heat is used to cook food (as in an electric stove), heat water (as in an electric kettle, electric heater) etc.

Inside an electric bulb, is a thin coil of wire made of tungsten called filament. It gets heated and glows, when the current flows.

ELECTRIC FUSE

When a large amount of electric current passes through an appliance. Means, The wires will get overheated and the appliance will get damaged. This situation arises as a result of some fault in the circuit and can be extremely dangerous as it could cause fire.

To prevent electric appliances from getting damaged as a result of excessive flow of current through them, a safety device called fuse is used.

The fuse is a safety device used in an electric circuit.

PRINCIPLE AND WORKING

The electric fuse works on the principle of heating effect of electric current. An electric fuse consists of a wire usually placed inside a glass or a ceramic cartridge. The wire is made of a material that melts easily when heated. It is designed such that only certain amount of maximum current can flow through it. If the flow of current exceeds this maximum amount, the heating in the wire causes it to melt. This breaks the circuit and stops the flow of current in the circuit.

MINIATURE CIRCUIT BREAKER

A miniature circuit breaker is an automatically operated electric switch that protects an electric circuit during overload or short circuit.

Circuit breakers are available in different sizes, and can protect small household appliances as well as high voltage devices.

The circuit breakers have an advantage over fuses. They can be reset manually or automatically to restore normal position, whereas the fuses need to be replaced after every single operation.



MAGNETIC EFFECT OF ELECTRIC CURRENT

In the year 1820, Christian Oersted, a Danish scientist was giving a lecture in a classroom. He noticed that a magnetic needle kept on the table was not pointing in the North-South direction. He was surprised. On looking closely, he found that the needle was kept near a wire carrying current. When he

took the needle away from the wire, it pointed in the North-South direction. He brought the needle near the wire once again and noticed that it deflected. Then he concluded that there is a magnetic field around the wire carrying current.

Magnetic compass

Compass, which has a magnetic needle pivoted at its centre, so that it can rotate horizontally. The pivoted magnetic needle will always point in the North-South direction.

ELECTROMAGNET

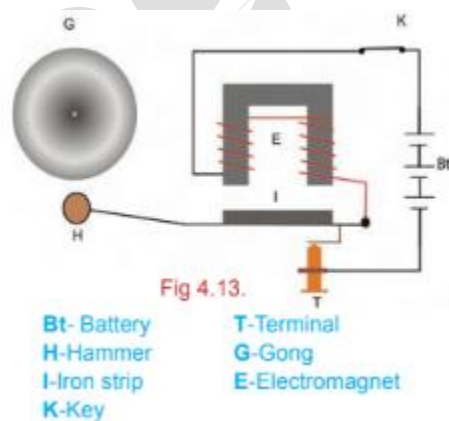
A material that becomes a magnet when current is passed is called an **electromagnet**.

Electromagnets are used in many appliances like electric motors, telegraphs, telephones, electric bells, etc.

Many toys have electromagnets inside. Doctors use small electromagnets to remove tiny pieces of magnetic materials that accidentally enter our eyes.

ELECTRIC BELL (DOORBELL)

The picture of an electric bell circuit is shown:



Working

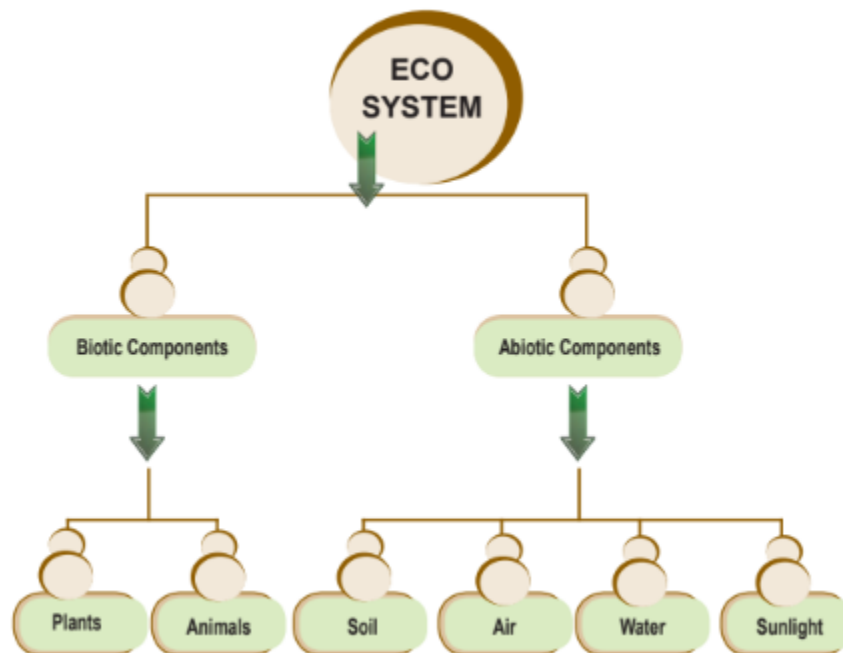
When the key is closed, current flows through the coil and the electromagnet gets magnetised. It pulls the iron strip and the hammer strikes the gong of the bell to produce a sound.

Now the circuit breaks and the current stops flowing through the coil. The electromagnet is no longer magnetized and the iron strip comes back to its original position. It touches the contact terminal again, completing the circuit and the process is repeated. The hammer keeps on striking the gong producing a ringing sound.

24] Eco System

ECO SYSTEM

Forest is an ecosystem. Forests are the natural habitats of elephants. People have been cutting down trees and reducing forest cover for cultivation and other purposes. The elephants lose their habitations in the reduced forest area. So they are forced to come out of their forest homes (ecosystems) and move in the areas where people live.



A community of living organisms with the physical environment of a definite geographical region form an **eco system**.

Eco-systems may be natural or artificial. A pond, a grassland, a forest, a lake, a desert etc. are examples of natural eco-systems. An aquarium, a park, a paddy field, etc. are examples of artificial eco-systems.

Components of Eco-system

An eco-system consists of two main components. They are biotic (living) and abiotic (non-living) components.

Biotic Components

The living components are broadly classified into three categories.

1. **Producers:** They are green plants that prepare their own food by the process of photosynthesis.

2. **Consumers:** We know that animals eat plants and they in turn are eaten by other animals. Hence the food produced by green plants is directly or indirectly consumed by all kind of animals, which are called consumers. eg. Goat.

3. **Decomposers:** They are organisms which feed upon dead matter to get energy and give back the nutrients to the soil. eg. bacteria and fungi.

Abiotic Components

These include the soil, water, air and climatic factors such as temperature, sunlight, humidity etc.

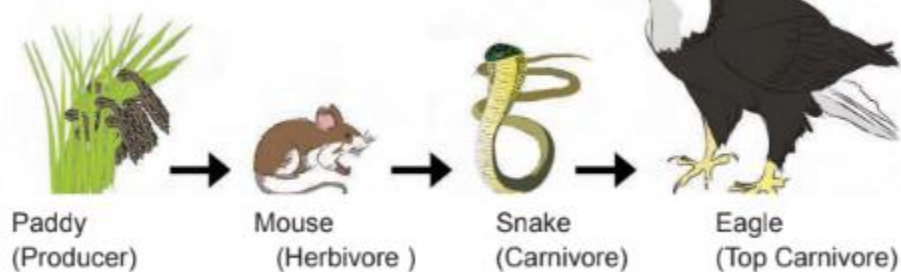
FOOD CHAIN

The sun is the ultimate source of energy to all living things. Green plants capture solar energy and convert carbon-dioxide and water into food by photosynthesis. This food energy is transferred to the primary consumer when they eat plants.

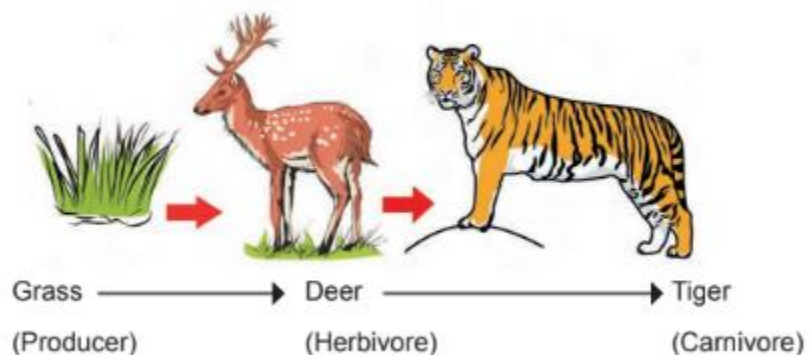
Then the primary consumer is eaten by the secondary consumer which in turn is eaten by a tertiary consumer. So, in a given ecosystem, there is a process of organisms eating some others or being eaten by some other organisms. The path of energy transfer from one organism to another in a single direction is called a food chain.

Food chain in a grassland

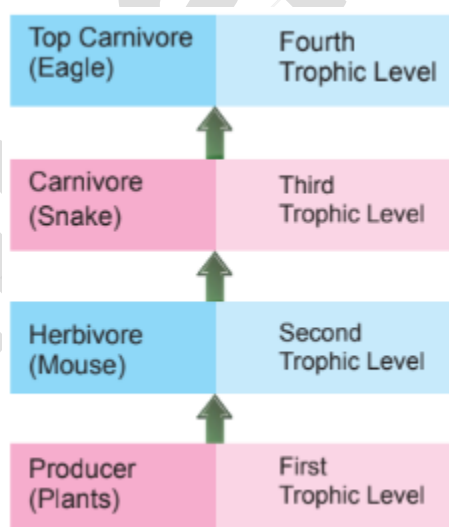
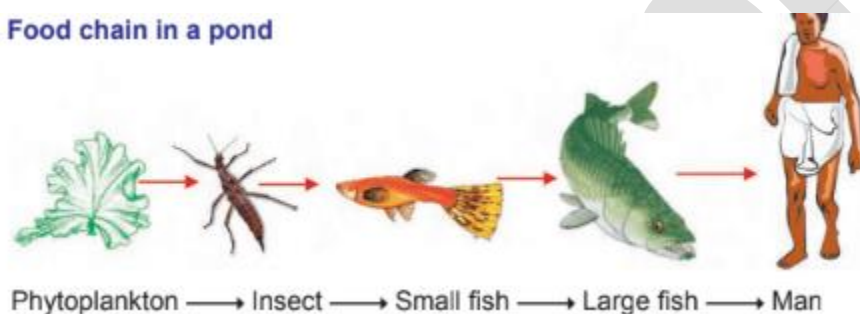
1. Food chain in a grassland



2. Food chain in a forest



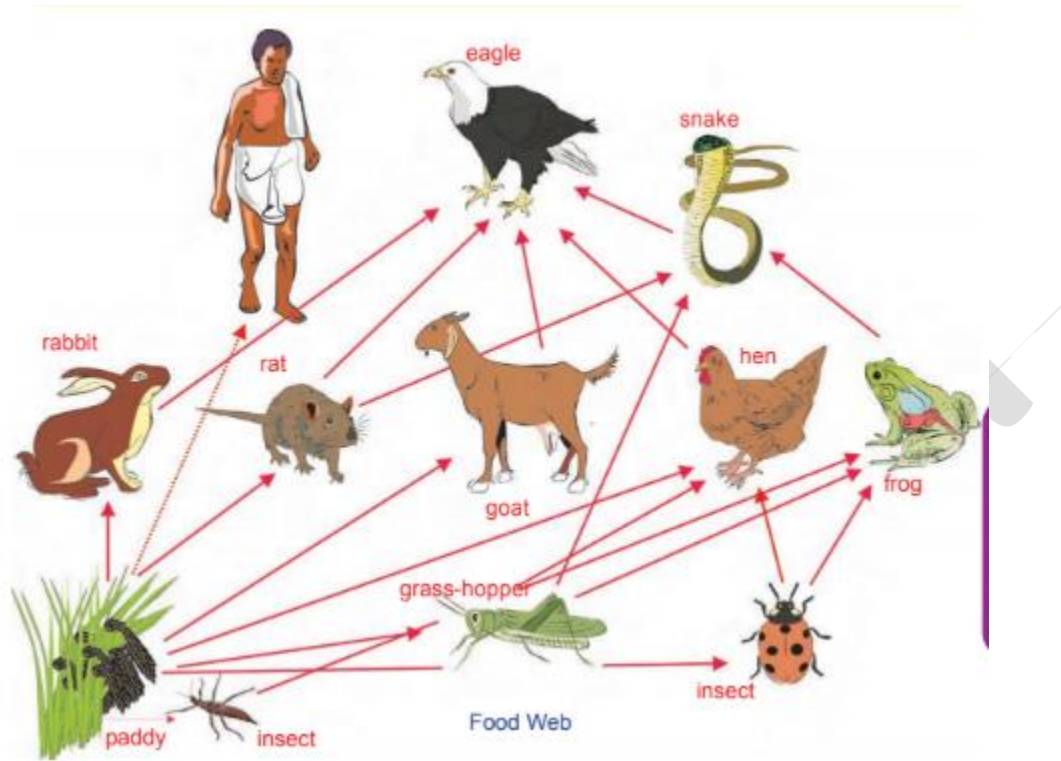
3. Food chain in a pond



In a food chain, each group of organisms occupies a particular position. The position of organisms in a food chain is called trophic level. Plants are producers and form the first **trophic level**.

The second trophic level comprises of plant eaters the herbivores. Carnivores which eat the herbivores form the third trophic level. The fourth trophic level is occupied by the large carnivores.

FOOD WEB



In a given ecosystem, a single food chain may not exist separately. An animal can eat more than one kind of food. For eg. an eagle can eat a rabbit, a mouse or a snake and a snake can feed on a mouse or a frog. So, many food chains get interlinked.

A network of interlinked food chains is called a food web.

FLOW OF ENERGY

The sun is the ultimate source of energy for all living things. At first, the solar energy flows from the sun to the surface of the earth. Green plants trap the solar energy and convert it into chemical energy (food).

The amount of energy decreases from one trophic level to another. The flow of energy is always in one direction only.

BIOME

We know that all organisms acquire energy from the sun directly or indirectly. But, does the sun have any other effect on us? Yes. The rotation of the earth around the sun has an effect on the climate of a place. An ecosystem may be small or big. When small ecosystems are put together, they form a vast geographical area which supports a wide variety of flora and fauna. At the same time such a vast area has a different type of climate. Such a vast geographical area is called **biome**.

THE DIFFERENT BIOMES

We can view our earth as various biomes based on their climate and also the latitude and longitude on which they are present. Based on the types of flora and fauna, the biomes are classified into many types.

TYPES OF FORESTS

- 1) **Tropical Rain Forest:** They are found in South America, Africa and Indo Malaysia region near the equator. The weather is warm (20o C-25o C). Rainfall is plentiful, 190 cm per year. In India, they are found in Andaman and Nicobar Islands, Western ghats, Assam and West Bengal.
- 2) **Savannah:** They are found South Africa, Western Australia, North West India and Eastern Pakistan. They love a dry weather alternating with wet weather. The rainfall is about 25cm per year. Frequent fires occur during the dry season. In India, grassy plains are found in the Nilgiris, Khasi hills and Naga hills.
- 3) **Deserts:** They are found Africa, Arizona in America and Mexican desert in Mexico. The days are hot and nights are cold. The annual rainfall is less than 25 cm. In India, it is found in Rajasthan (The Thar Desert).
- 4) **Temperate Grassland:** It is found in North and South America and parts of Europe. The annual rainfall is 25cm to 100 cm. They have two very severe dry seasons. They have windy hot summers and cold winters. In India, It is found in Uttar Pradesh.
- 5) **Deciduous Forests:** They are found in North America, Eastern Asia and Europe. They receive 75 to 100 cm of rainfall. The climate is moderate with mild winters. In India, it is found in Punjab, Tamil Nadu, Uttar Pradesh, Bihar, Odisha and Madhya Pradesh.
- 6) **Taiga:** It is found Canada, Europe and Russia. They are also called Boreal Forests. The climate is of a short cool summer and a long winter with abundant snowfall. The annual rainfall is 20cm to 60 cm. Most of it is covered with snow and ice. It is found in Himachal Pradesh, Punjab and Kashmir in India.
- 7) **Tundra:** It is found south of the ice covered poles in the Northern hemisphere. Though it receives 25 cm of rainfall, it has permanently frozen soil. The climate is extremely cold and windy. The temperature is less than 10o C. In India, it is found in the Himalayas.

IMPORTANCE OF FORESTS

1. Forests are the sources for the formation of rivers.
2. They increase the rainfall.
3. They prevent soil erosion and floods.
4. They become habitats to animals.

5. They maintain the oxygen and carbon dioxide balance in nature. Forests are considered as God's first temples. They play an important role in our day-to-day life.

DIFFERENT FLORA AND FAUNA

Biomes have a variety of plants and animals. The flora and fauna found in one biome is completely different from that in the other biome due to the different climatic conditions. The kind of flora and fauna found in different biomes are given below: India is one of the 12 mega biodiversity centres in the world with immense flora and fauna.

S.NO	BIOME	FLORA	FAUNA
1.	Tropical Rain Forest	Lofty trees like teak, rubber, lianas, epiphytes, orchids, ferns	herbivores, insects rodents, monkeys, bats, birds, large cats, snakes
2.	Savannah	Grasses	birds, kangaroos, lions, zebras, giraffes, cheetahs, elephants, termites
3.	Desert	Succulent plants like cactus, acacia, calotropis, datepalm etc	chinkara, lizards, scorpions, camels
4.	Temperate grassland	Perennial grasses	wolves, bisons, coyotes, antelopes, insects etc
5.	Deciduous forest	Oak, maple, mosses, acacia, pine, fir	squirrels, black bears, beetles, birds, small mammals
6.	Taiga	Spruce, fir, pine, aspen, birch, willows, mosses, lichens, fungi	porcupines, red squirrels, hares, grey wolves, insects etc
7.	Tundra	Sedge, broad leafed herbs, lichens	reindeers, owls, foxes, wolves, migratory birds, polar bears, penguins

25] Water - A Precious Resource

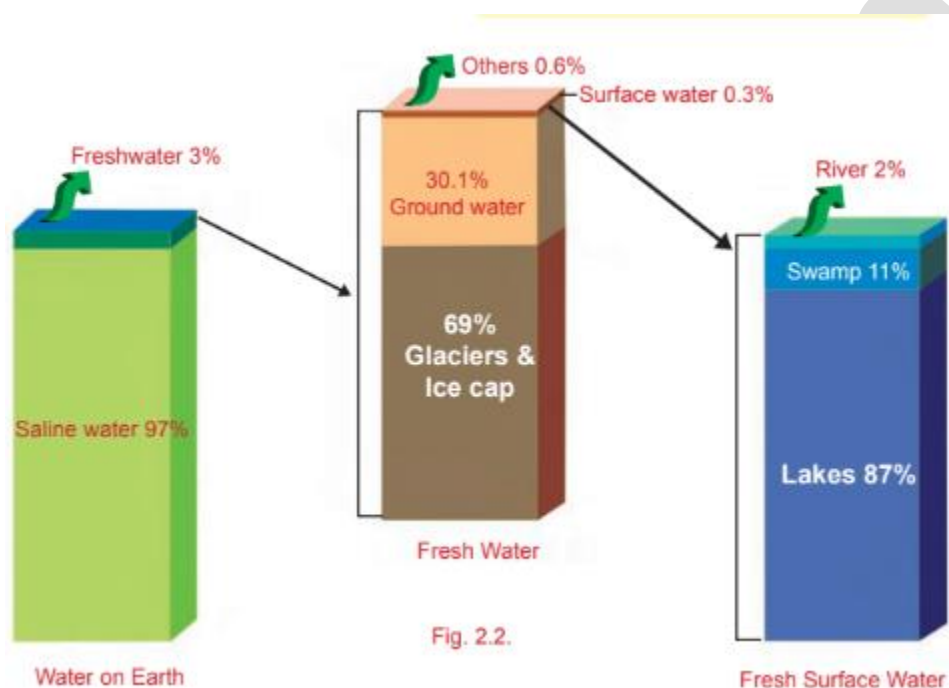
70% of our Earth is made of water but only 3% of it is fresh water. Hence only a fraction of it is fit for human consumption.

AVAILABILITY OF WATER

Water is a natural resource that is vital for both plants and animals. Water exists in abundance on our planet Earth. However, only a very small fraction of it is fit for human consumption.

Most of the water that exists on the earth is found in the seas and oceans. Sea water and ocean water are highly salty and hence unfit for drinking. Most of the fresh water is frozen glaciers as in the polar regions and thus not readily available.

The United Nations states that “the amount of water for drinking, washing, cooking and maintaining proper hygiene is a minimum of 50 litres per person per day”. This amount is about two and a half buckets of water for a person for a day.



SOURCES OF WATER

1. Rain water

Rain water is the purest form of water. Pure water evaporates under sunlight from the seas and rivers leaving behind the impurities. It rains due to the precipitation (condensation) of tiny water droplets present in the clouds. The first showers dissolve certain gases present in air and bring down them along with the suspended impurities. Subsequent showers contain only pure water.

2. Glaciers, ice and snow

Of the 3 percent of fresh water that is fresh, about three – fourths are tied up in glaciers, ice caps and snowfields. They occur only at high altitudes or high latitudes.

3. River water

The water in the rivers is obtained either from rainfall or melting of snow (glaciers) on the mountains.

4. Sea and Ocean water

Ocean is a large body of water. Million litres of water is present in Ocean, but the water is salty and is not fit for any domestic or agricultural use.

5. Lake and Pond water

Lakes are inland depressions that hold standing fresh water almost all the year round. Ponds are small, temporary or permanent bodies of shallow water. They are still a minor component of the total world water supply.

FORMS OF WATER

We already know that water exists in three states i.e. solid, liquid and gas. All the three states are reversible or interchangeable.

All the three states of water are also present in our natural environment at any given time.

1. Solid: Ice is the solid form of water. It can be found in the atmosphere in the form of ice crystals, snow, ice pellets, hail and frost. It is also found in the polar regions and on high mountain peaks.

2. Liquid: Rain and dew are in the form of water droplets. Also liquid water covers three quarters of the surface of the earth in the form of lakes, rivers and oceans.

3. Gas : Water vapour is the gaseous form of water and exists as mist, fog, steam and clouds.

GROUND WATER

- Precipitation in the form of rain or snow provides fresh water to our earth.
- Most of the fresh water returns to the oceans through rivers.
- A small portion of rain water seeps into the soil and is stored as underground water.
- Underground water is also called an aquifer.
- The top level of this underground water is called the water table. If we dig a hole in the ground near a water body we find that the soil is moist there.
- The moisture in the soil indicates the presence of underground water.
- If we dig deeper and deeper, we would reach a level where all the space between the particles of soil and the gaps between rocks are filled with water. The upper limit of this layer is called the water table.
- The water table varies from place to place and it may even change at a given place.
- Water in the aquifers can usually be pumped out with the help of tube wells or hand pumps.

DEPLETION OF WATER

1. Natural forces Scanty rainfall and hot winds are natural forces that may deplete the water table.

2. Human causes Deforestation, increased population, rapid urbanization, overgrazing by cattle, excess tapping of ground water are human causes.

3. Salt water intrusion Many parts of the world are losing freshwater sources due to saltwater intrusion. Over use of underground freshwater reservoirs often allows salt water to intrude into aquifers and affect the water table.

4. Commercialization of water Resources Some of the private companies suck a large quantity of water from rivers and underground aquifers.

5. Sand grabbing from rivers Some rivers are deeply affected by sand grabbing. eg. Palar river

DISTRIBUTION OF WATER

Water availability in India depends greatly on the seasonal monsoons. The monsoons bring heavy rains over most of the country between June and September, except Tamil Nadu, which receives over half of its rain in October and November. India has places of dry condition of deserts. (Thar desert) and places with rainforest climate (North Eastern States) too. In general, the northern half of the country is subjected to extremes of rainfall. India has a large network of rivers too. The three major rivers the Indus, the Ganga and the Brahmaputra originate in the Himalayas and drain nearly two-thirds of the land area.

During the monsoon, water level in rivers increase greatly that some times it may result in floods. On the other hand, during the dry season, water level goes down quite a bit in most of the large rivers. Smaller tributaries and streams generally dry up completely.

To regulate water flow in these rivers and to distribute water more evenly throughout the year, large dams have been built across a number of rivers.

SCARCITY OF WATER

Scarcity of water is defined as a situation where there is insufficient water to satisfy normal requirements. Though water is a renewable resource, we, the humans, are using it at a faster rate than it is being replenished.

Factors contributing to the depletion of water table.

- Growing population has resulted in a growing demand for houses, offices, shops, roads etc. As a result, open areas like parks and playgrounds are used for construction of buildings. This reduces the seepage of water into the ground.
- Growing population has also resulted in an increase in the number of industries. Water is used in almost every stage of production of things that we use.

- As we already know India is an agricultural country and farmers have to depend on rains for irrigating their fields. However, erratic monsoons result in excess use of groundwater thereby decreasing the underground water.
- Uncontrolled use of bore well technology for extracting groundwater.
- Pollution of freshwater resources. This is due to the flow of untreated sewage from homes, toxic chemicals from industries and of pesticides and insecticides used by farmers into water bodies
- No effective measures for water conservation.

WATER MANAGEMENT – RAIN WATER HARVESTING

The activity of collecting rainwater directly or recharging it into the ground to improve ground water storage in the aquifer is called rain water harvesting. To recharge the groundwater, rainwater that falls on the terrace of the buildings and in the open space around the buildings may be harvested. Roof top rain water can be diverted to the existing open / bore well.

Rainwater available in the open spaces around the building may be recharged into the ground by simple but effective methods. The Government of Tamilnadu leads the nation in implementing rainwater harvesting programme. It has been made mandatory for all houses and buildings in the state to install rainwater harvesting facility

Rain water harvesting techniques

There are two main techniques of rain water harvesting.

1. Storage of rainwater on the surface for future use.

2. Recharging the ground water.

Surface water is inadequate to meet our demand and we have to depend on ground water.

Due to rapid urbanization, infiltration of rain water into the sub-soil has decreased drastically and recharging of ground water has diminished.

Advantages of rainwater harvesting

- Rainwater harvesting can reduce flooding in city streets.
- Sea water intrusion in coastal areas can be arrested.
- The ground water can be conserved.
- Rainwater Harvesting can reduce top soil loss.
- It can improve plant growth.

SCIENCE TODAY

DRINKING ICE BERG WATER

Icebergs are pieces of glaciers that have drifted into the ocean and would otherwise melt and become saltwater. Icebergs are mostly white because the ice is full of tiny air bubbles. The bubble surfaces reflect white light giving the iceberg an overall white appearance. Ice that is bubble free has a blue tint which is due to the same light phenomenon that tints the sky. Drinking iceberg water is one of the most environmentally conscious methods of meeting the world's increasing demand for clean fresh water. It is a noteworthy fact that all the North Indian Rivers originate in the glaciers of Himalayas.

There are two very positive environmental impacts from the use of drinking water from icebergs:

1. It decreases human dependency on traditional watersheds such as rivers and lakes, and therefore decreases human impact on these delicate and overstressed ecosystems.
2. It helps to reduce rising sea levels, which have been caused by polar icecap melting. Since most of the glaciers were formed thousands of years ago from falling snow, and snow results from condensed water vapour in the atmosphere, the water from icebergs is quite pure. Icebergs are comprised of pure fresh water.

DESALINATION OF SEA WATER

Desalination is an artificial process by which saline water (sea water) is converted into fresh water.

The most common desalination processes are :

1. Distillation
2. Reverse Osmosis

1. Distillation

The process in which both evaporation and condensation go side by side is called **distillation**

2. Reverse Osmosis

The process of forcing water under pressure through a semi permeable membrane whose tiny pores allow water to pass but exclude most salts and minerals is called **reverse osmosis**.

The State Government of Tamil Nadu has taken up a venture to convert sea water into potable water by the Reverse Osmosis process to solve the problem of water scarcity in Chennai.

The Minjur Desalination Plant

It is the largest desalination plant in India. It is located in Kattupalli village near Minjur, about 35km north of Chennai. The plant is established on a 60 acre site at a cost of Rs.600 crore. It consists of 8,600 Sea Water Reverse Osmosis (RO) membranes to convert sea water into potable water.

The RO technology of the plant produces 100 mld (million-litres-a-day) of freshwater from 273 million litres of sea water. The Minjur Desalination Plant supplies 100 mld of fresh water to the Chennai Metro

Water Corporation at the rate of Rs.48.66 per 1,000 litres. The Desalination Plant serves potable water to an estimated population of 5 lakh in Chennai.

The Nemmeli desalination plant

The State Government has decided to alleviate the freshwater problems by the desalination of sea water. Besides the Minjur plant, the Chennai Metropolitan Water Supply and Sewage Board (CMWSSB) is also constructing a Desalination Plant at Nemmeli at a total cost of Rs.908.28 crore.

The plant has a capacity to convert 100 million litres per day as potable water from sea water. Water from the Nemmeli plant would be carried over 40 km to the city, to be supplied to its residents.

SWEET WATER ON EARTH

1. The 2006 Mumbai “sweet” seawater incident was a phenomenon during which the residents of Mumbai claimed that the water at Mahim Creek had suddenly turned “sweet”. Mahim Creek is one of the most polluted creeks in India that receives thousands of tonnes of raw sewage and industrial waste every day.

2. Within few hours of the Mumbai “sweet” seawater incident, residents of Gujarat claimed that seawater at Teethal beach had turned sweet as well.

Geologists at the Indian Institute of Technology in Mumbai offered the explanation that water turning sweet is a natural phenomenon. Continuous rainfall over the preceding few days had caused a large pool of fresh water to accrue in an underground rock formation near to the coast. Then this water discharged into the sea as a large “plume”, as fractures in the rocks widened.

Because of the differences in density, the discharged fresh water floated on top of the salt water of the sea and spread along the coast. In course of time, the two would mix to become normal sea water once more.