TEST FOR THE MONTH OF APRIL
TEST – I PORTIONS

6th Term (II)	Unit (4) – Air
6th Term (III)	Unit (2) – Water
	Unit (4) – Our Environment
8th Term (II)	Unit (3) – Air
9th Full Book	Unit (24) – Environmental Science
10th Full Book	Unit (22) - Environmental Management

6TH TERM II
4. Air

Introduction

Air is present everywhere around us. We cannot see air. But we can feel its presence in so many ways. For example, we feel air when the trees rustle, clothes hanging on a clothes-line sway, pages of an open book flutters when the fan is switched on, when kites fly in the sky. We cannot see, touch or taste air but we can feel it. It is the air that makes all these movements possible. Thus, we can understand that air is present all around us.

Air is necessary for us to live. We can live without food for some days, without water for a few hours, but cannot survive without air for more than a few minutes. So, air is very important for all living beings to survive.

When air is moving it is called wind. It is cool and soothing as breeze. When air moves with force it can even uproot trees and blow off the roof tops. Air is necessary for breathing and also for combustion. Shall we do an activity?

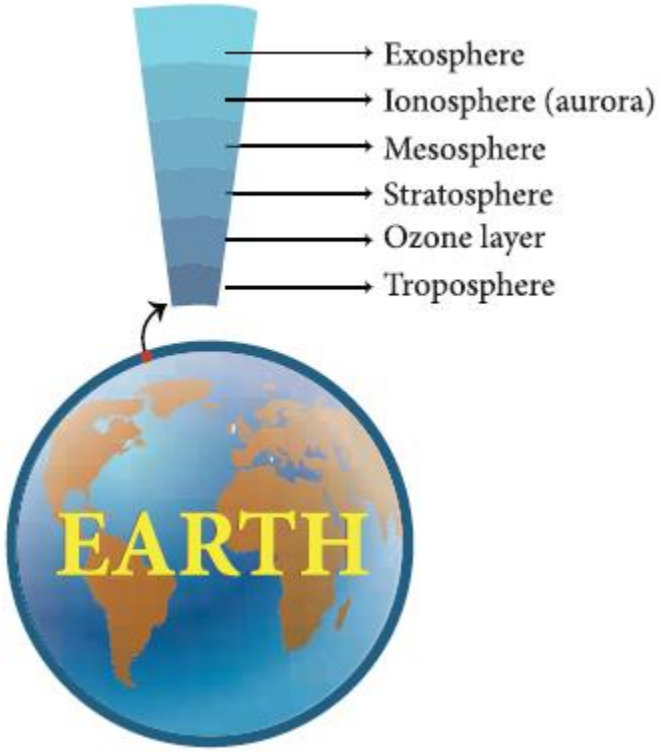
Atmosphere

Our earth is surrounded by a huge envelope of air called the atmosphere. Atmosphere extends to more than 800km above the surface of earth and is held in place by the earth's gravity. The atmosphere protects us from many harmful rays coming from the sun. The air envelope is thicker near the earth's surface and as we go higher the density and the availability of air gradually decreases. This is because, as we go higher, the force of gravity decreases, so it is not able to hold large amount of air.

The atmosphere is made of five different layers – the troposphere, the stratosphere, the mesosphere, the ionosphere and the exosphere.

The troposphere is the layer closest to the earth. It is the layer in which we live. It extends upwards for about 16km above the surface of the earth. Movement of wind takes place in this layer. It also contains water vapour, which is responsible for making clouds. This layer is responsible for the weather we experience on earth.

Aircrafts usually fly above this layer to avoid strong winds and bad weather



The stratosphere lies above the troposphere. This layer has the ozone layer in it. The ozone layer protects all life on earth from the harmful ultraviolet rays of the sun.

A weathercock shows the direction in which the air is moving at a particular place. You can also make a wind sock to find the direction of the wind. Can you try it yourself?

Experimental verification of presence of Oxygen, Carbon-di-oxide and Nitrogen in Air

Is air a thing or a composite mixture?

For long time, that is, until eighteenth century, human thought 'air' as a fundamental constituent of matter. However an ingenious experiment conducted by Joseph Priestley in 1774 showed that "air is not an elementary substance, but a composition," or mixture of gases. He was also able to identify a colourless and highly reactive gas which was later named 'oxygen' by the great French chemist Antoine Lavoisier.

Priestley took a tub of water and made a float and placed a candle on it. He covered the candle with a glass jar. [As the bottom portion of the jar was filled with water, no air can enter or exit and hence the jar was completely sealed (Fig-1)]. As you would have guessed the candle flame was extinguished in a very short time. He used a magnifying glass to focus the sun rays to light the candle. Thus he tried to to relight the candle many times without opening the sealed jar (Fig-2). The candle could not be relit. What can we make out of it?

It was clear that something in the air was being used for burning and being converted into another substance. Once the substance in the air that was aiding the burning was completely used by the burning flame and converted into another substance, the flame went out.

[Later chemist named the substance necessary for burning as oxygen and during the process of burning oxygen is converted mostly into carbon dioxide.]

Now as the jar was inside the water, Priestley could gently lift the jar and place a live mouse inside it without allowing outside air to enter the jar (Fig-3). Without oxygen, as you would have guessed, the mouse died (Fig-4). It was clear that oxygen was necessary for the survival of the mouse.

In the next step, he gently lifted the jar and placed a mint plant (Fig-5). (Note: Look at the Figure- 5; you could see that the plant is inserted into the bell jar when the jar is very much inside the water. This is done to ensure that the outside air is not entering into the bell jar.) Plant being a living thing like mouse, perhaps he thought,

would die. Instead, the plant survived. After placing the mint plant, he lit up the candle and it continued to burn (Fig-6).

In fourth experiment, he took a jar, burned a candle and converted all oxygen into carbon dioxide. He placed a mint plant and a mouse into this jar. Both the plant and the mouse survived (Fig-7). He found that plants and animals have a synergy. Animals consume oxygen and release carbon-di-oxide and plants take up carbon dioxide and release oxygen.

During 1730 – 1799, Jan Ingenhousz showed that sunlight is essential to the plant to carry out photosynthesis and also to purify air that is fouled by breathing animals or by burning candles.

From these experiments i**t was clear that "air" was a composite mixture of many gases like oxygen and carbon-di-oxide.**

More to Know!

Daniel Rutherford, a Scottish chemist, discovered nitrogen. He removed oxygen and converted it into carbon-di-oxide using an inverted bell jar using a burning candle. He passed this air without oxygen through lime water and removed carbon-di-oxide also.

Once the carbon-di-oxide was removed in that air, neither a candle burned nor a plant breathed. Hence he was sure that the remaining air he had did not have oxygen and carbon-di-oxide. He was able to produce a gas, which showed the same property of the air without oxygen and carbon-di-oxide. Hence this gas was named 'nitrogen'.

Test for Carbon-di-oxide in air

Pour some lime water in a glass tumbler. Bubble some air using a straw through the limewater. After a few minutes, look at the lime water carefully. The lime water will produce a white precipitate and that the lime water will eventually turn to a milky white solution. This shows the presence of carbon-di-oxide in air.

Composition of Air

From Priestley's experiment which was followed by Ingenhousz and Rutherford, we came to know that air was not just one substance. We will now describe what air is made up of. This is called composition of air.

The major component of air is nitrogen. Almost four – fifth of air is nitrogen. The second major component of air is oxygen. About one – fifth of air is oxygen. In addition to nitrogen and oxygen gases, air also contains small amount of carbon–di–oxide, water vapour and some other gases like argon, helium etc. The air may also contain some dust particles.

The composition of air in terms of percentage of its various components can be written as follows:

The composition of air changes slightly from place to place and also from season to season. For example,

- Air over industrial cities usually has a higher amount of carbon-di-oxide in it than the air over open spaces.
- Air in coastal areas may have more water vapour than inland areas.
- Air also contains more water vapour in rainy season.
- The amount of dust in the air is more in windy places than other areas.

Test for the presence of dust particles in air

You might have seen the sunlight entering into a dark room through a narrow slit and making shiny dust particles dancing merrily on the path of sunlight. Actually, the air in a room always contains some dust particles, but they are so small that normally they are not visible to us. When a beam of sunlight falls on them, the tiny dust particles become visible.

Shall we do an activity to calculate the amount of dust particles in air from our area?

Take a graph sheet. Using marker pens draw a 5x5 cm square on the graph. Apply a thin film of grease on the graph sheet. This sheet will serve as dust collector. Make four or five graph sheets.

Discuss in the whole class, as where to place the dust collectors, how long to collect dust particles and place the dust collectors in agreed positions.

Ensure that the dust collectors do not get blown away. After the time scheduled for performing this activity is reached, remove the paper and count the number of collected dust particles in the marked area in all the sheets, using a magnifying glass at the dust collector. We can see something similar to the diagram below:-

Then, calculate the mean number of dust particles in the marked area.

$$Mean = \frac{total\ number\ of\ dust\ particles\ on\ collector}{number\ of\ squares\ on\ collector}$$

The range of the dust can also be calculated as given below:-

Range = Maximum value – minimum value

Collect details from all the areas where we have kept the dust collector sheets. Tabulate the recordings in the table given below:-

Test for water vapour in air

Take a few ice cubes in a glass. Keep it on the table for a few minutes. Observe what happens. You could see tiny droplets of water all over the outer surface of the glass. From where do these droplets come? The water vapour present in the air condenses on the cold surface of the glass. This shows that air contains water vapour.

Burning and Combustion

When we burn a candle, paper, kerosene, coal, wood or cooking gas (LPG), oxygen is needed. The oxygen needed for the burning of candle, paper, kerosene, coal, wood and cooking gas comes from the air around us. Thus, for burning a substance continuously so as to make fire, a continuous supply of fresh air is needed. If we cut off the supply of fresh air to a burning substance, then the burning substance will not get oxygen necessary for burning to continue and hence the substance will stop burning. In rockets, as they go high in the atmosphere, the availability of oxygen is considerably reduced. Therefore in rockets along with the fuel, oxygen is also carried for combustion.

The process of burning of a substance in the presence of oxygen and releasing a large amount of light and heat is called burning. If the process does not emit flame then it is called combustion.

Importance of air for survival of plants and animals

Respiration in plants

Plants require energy for their growth and hence respiration also occurs in plants. During respiration, plants take in oxygen and release carbon–di–oxide, just as animals do. Gaseous exchange with air in atmosphere takes place in plants with the help of tiny holes called stomata present on their leaves.

Photosynthesis

Plants manufacture food by a process called photosynthesis. During photosynthesis, Carbon-di-oxide from the air and water from the soil react in the presence of sunlight to produce food. Most plants possess a green pigment called chlorophyll and it is also used-up in the process of photosynthesis. The word equation given below explains the process of photosynthesis.

$$\text{Carbon-di-oxide + water} \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} \text{Food + Oxygen}$$

Plants release oxygen during photosynthesis which is much more than the oxygen consumed by the plants, during respiration.

Respiration in Animals

When we breathe in air, the oxygen present in the air reacts chemically with digested food within the body to produce carbon-di-oxide gas, water vapour and energy.

This energy is required to carry out many processes in the body such as movement, growth and repair. This process by which oxygen reacts with digested food to form carbon-di-oxide, water vapour and energy is called respiration. The process can be represented by a word equation as given below :-

$$\text{Food + Oxygen} \longrightarrow \text{Carbon-di-oxide + water + Energy}$$

Carbon-di-oxide formed during respiration dissolves in the blood and is exhaled out of the body through the lungs. The inhaled and exhaled air thus contain the same substances but in different proportion, except nitrogen which is present in the same amount. Inhaled air contains more oxygen while the exhaled air contains more carbon-di-oxide.

Let us have a look at the following table to compare the composition of air in inhaled and exhaled air.

Component	Inhaled air	Exhaled air
Nitrogen	78%	78%
Oxygen	21%	16%
Carbon-di -oxide	0.03%	4%
Water vapour	Variable amount	amount increases in exhaled air
Noble gases	0.95%	0.95%
Dust	Variable amount	none
Temperature	Room temperature	Body temperature

Respiration of plants and animals in water

The water of ponds, lakes, rivers and seas have some amount of dissolved air containing oxygen in it. The plants and animals that live in water use the oxygen dissolved in water for breathing. For example, frogs respire through their skin, fish respire using their gills.

When carbon-di-oxide is cooled to -570 C, it directly becomes a solid, without changing to its liquid state. It is called dry ice and is a good r e f r i g e r a t i n g agent. Dry ice is used in trucks or freight cars for refrigerating perishable items such as meat and fish while transporting them.

Uses of Air

- Air is used by plants and animals for breathing.
- Air is used for burning fuels like wood, coal, kerosene, LPG etc.
- Compressed air is used to fill tyres of various kinds of vehicles.
- Air plays an important role in maintaining the water cycle in the nature.

- ❖ Ozone layer, present in the atmosphere, helps in preventing harmful radiations of the sun from reaching the earth's surface.
- ❖ Under extra – ordinary conditions such as:
- ❖ Blowing air is used to turn the blades of wind mills.

The wind mills are used to draw water by running pumps, run flour mills and to generate electricity.

Points to Remember

- ❖ Air is all around us.
- ❖ Our earth is surrounded by a huge envelope of air called the atmosphere.
- ❖ The process of burning of a substance in the presence of oxygen and releasing a large amount of light and heat is called combustion.
- ❖ Priestley helped us in understanding the presence of oxygen in air that is produced by plants during photosynthesis which can be used by animals for respiration.
- ❖ Ingenhousz experiment helped us to know the role of sunlight in evolving Oxygen during photosynthesis.
- ❖ Air contains 78% Nitrogen, 21% Oxygen, 1% of carbon-di-oxide, water vapour, Noble gases, and dust particles.
- ❖ Composition of air changes slightly from place to place and also from season to season.
- ❖ In plants,

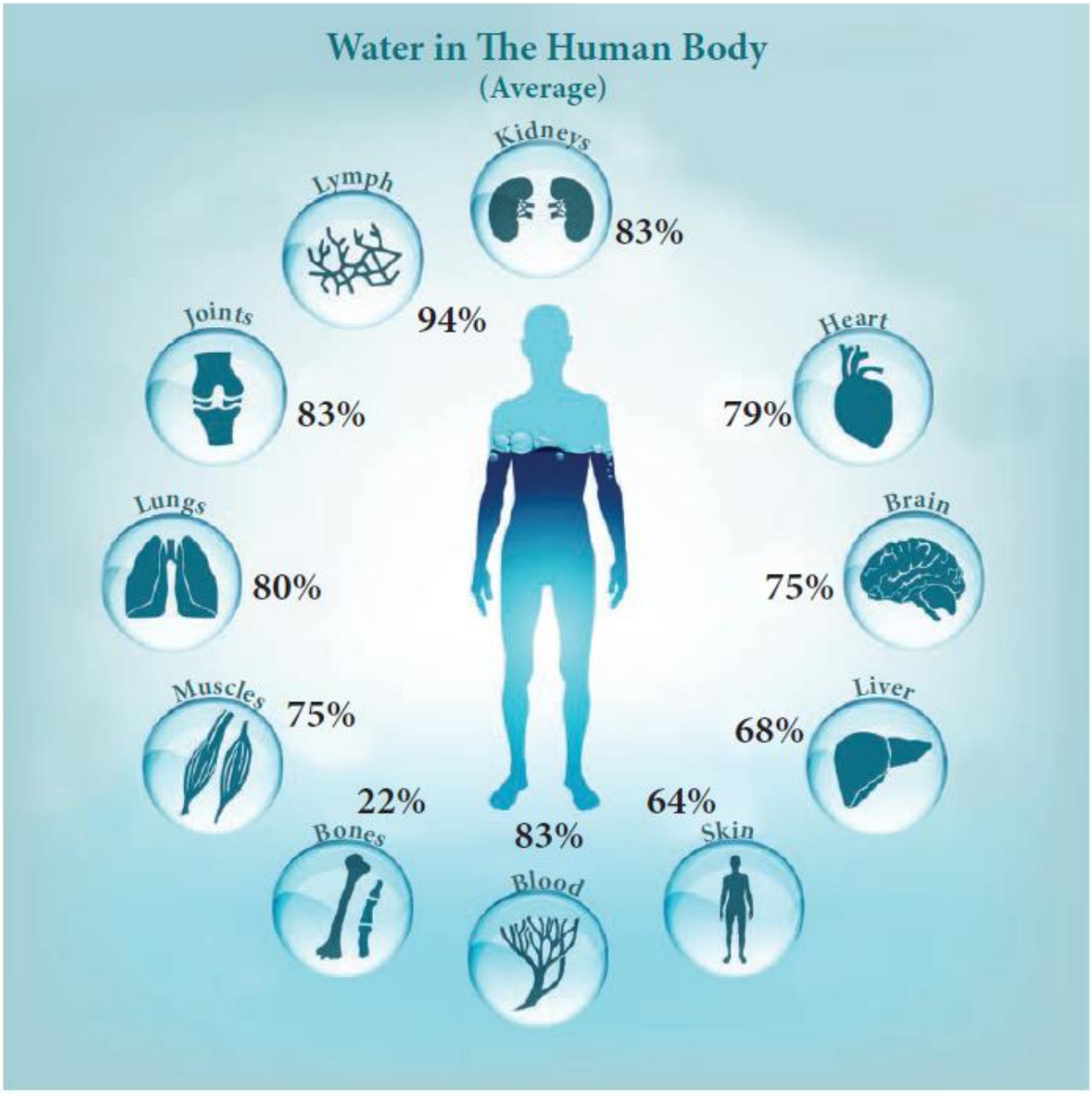
$$\text{Carbon-di-oxide + water} \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} \text{Food + Oxygen}$$

$$\text{Food + Oxygen} \longrightarrow \text{Carbon-di-oxide + water + Energy}$$

- Aquatic plants and animals use oxygen dissolved in water for breathing.

Ozone layer, present in the atmosphere helps in preventing harmful radiations hitting the earth directly.

6TH TERM III
UNUT 2. WATER



Introduction

Water is one of the basic substance present in the earth. It plays a vital role in the evolution and survival of life. It is impossible to imagine life on the earth without water. Water helps to regulate the temperature of our planet. It also helps to maintain the temperature in organisms.

Where do we get water from?

We need water to perform several day to day activities like cooking food, washing clothes, cleaning utensils etc.

We get water from different water sources in our surroundings. In villages / towns wells, canals, tanks, ponds, rivers, water tanks, hand pipes are the main sources of water.

List out the sources from where you get water in your village/town.

For example Ramu says he and his family get water from the pipes in washrooms and kitchens. Sankar says he has to use handpump daily both in the morning and evening to collect the water. Raja says his mother used to get up early and walks to pond to get water.

Where do you get water for your household uses?

Where and how water is found on the earth?

Water is available in nature in three forms – Solid, Liquid, Vapour.

- Solid form of water - Ice - It is present in ice bergs and ice caps on top of tall mountains, glaciers and polar regions.
- Liquid form of water – Water – It is present in oceans, seas, lakes, rivers and even underground.
- Gaseous form of water – Vapour – It is present in the air around us.

Availability of water

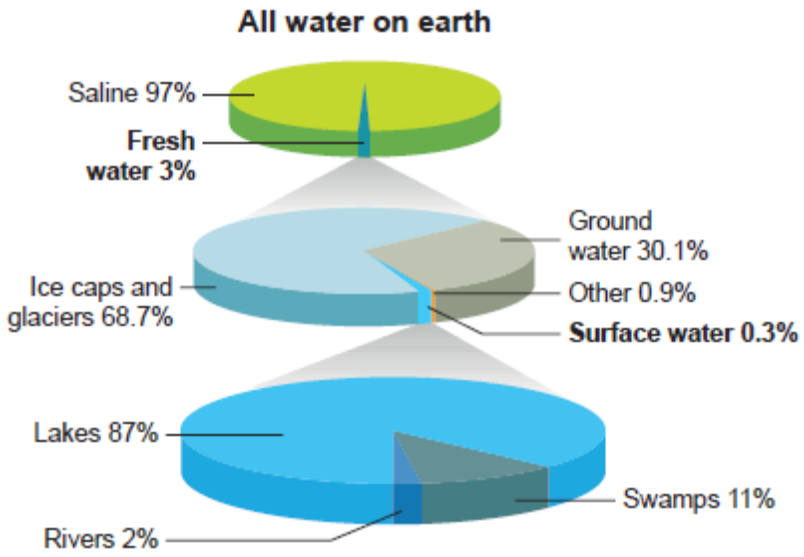
We know that nearly ¾th of the surface of the earth is occupied by water. Most of the water, that is 97% of the total amount of water that exits on earth is found in seas and oceans.

Can we drink the water available in the sea?

Sea water is salty. But water used for our daily purposes is not salty. It is known as fresh water. Water obtained from ponds, puddles, river, tube-wells and taps at home is usually fresh water.

If the total water on earth be 100%, let's see what percent would be the availability of fresh water.

Look at the pie chart given below.



From the pie chart, it can also be noted that 97% water is saline water. Only 3% found is the freshwater and that too in polar ice caps and glaciers. So this portion of water is not readily available for drinking.

The distribution of the totally available (3%) freshwater is as follows:

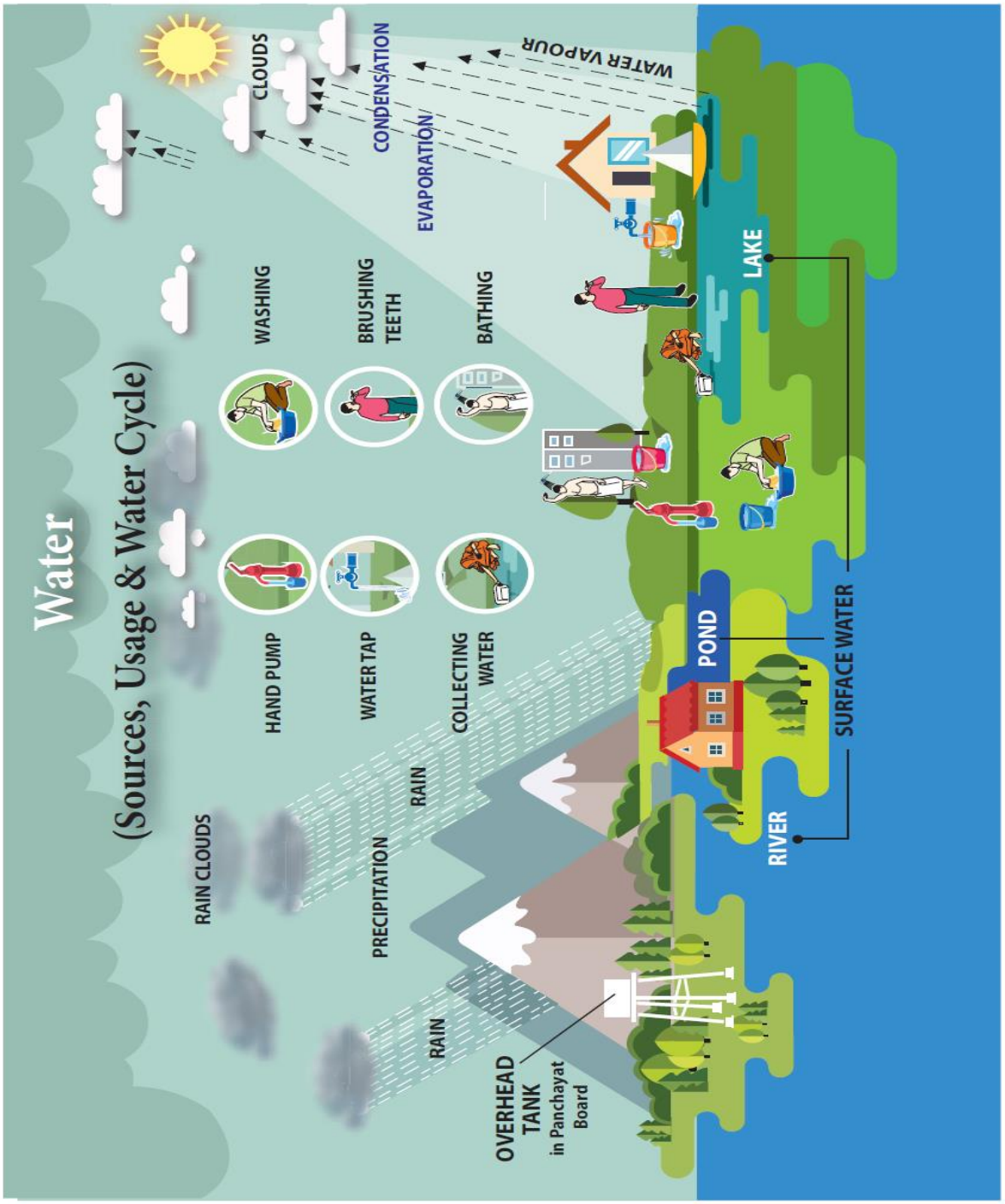
Polar ice caps and glaciers 68.7%
Ground water 30.1%
Other sources of water 0.9%
Surface water 0.3 %

The distribution of total 0.3% of surface water is as follows:

Lakes 87%
Rivers 2%
Swamps 11%

Thus the above pie chart explains that we have a very small amount of fresh water available for human usage and so maintaining the water table and the conservation of water is very essential. Isn't it?

Water while passing through layers of soil dissolves salts and minerals to a maximum extent. These salts and minerals have been deposited in seas and oceans for millions of years and are still being deposited. In addition, the oceanic volcanoes which are present inside, also add salts to the sea. Water with large amounts of dissolved solids is not potable or suitable for drinking. Such water is called saline water.

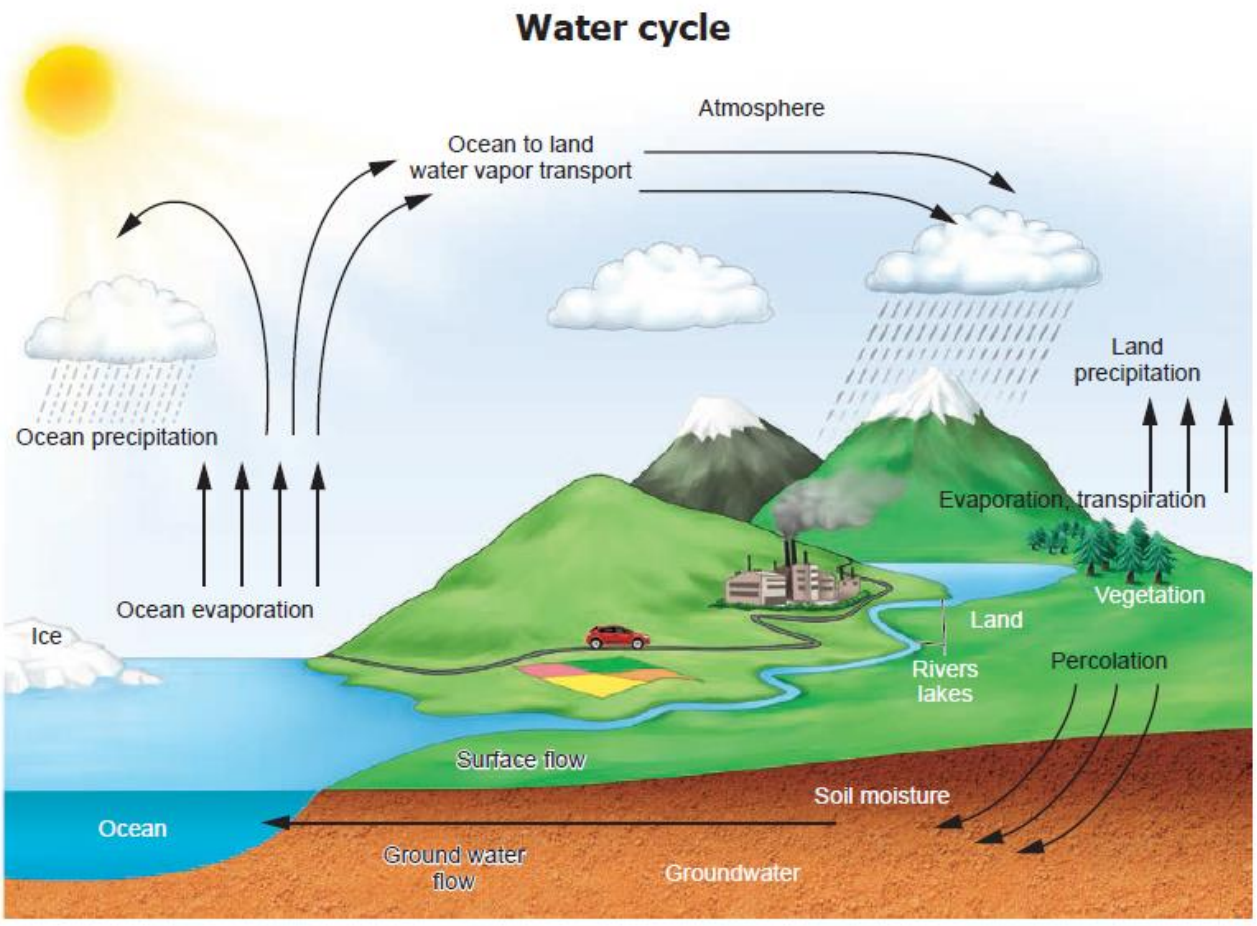


Composition of water

Water is a transparent, tasteless, odourless and nearly colourless chemical substance. It is composed of two atoms of hydrogen combined with one atom of oxygen. The molecular formula of water is H_2O.

However, the physical composition of water changes from place to place. It can be clear or cloudy, oxygenated or not very oxygenated and it can be fresh or salty. The amount of salt in water is termed as salinity. Based on its salinity water is classified into three main categories such as freshwater, brackish water and sea water. Fresh water contains 0.05% to 1% of salt. Brackish water contains upto 3% of salt and seawater contains more than 3% of salt. Ocean water is composed of many substances. The salts include sodium chloride, magnesium chloride and calcium chloride.

Water freeze at 0° Celsius at normal pressure. Every year march 22nd is observed as the world water day.



Water cycle The water on the earth evaporates into the atmosphere due to the heat of the sun. The water vapour in the atmosphere forms clouds. From the clouds water falls on the earth in the form of rain or snow. By this natural process, water gets renewed. This is called water cycle.

Water cycle is a continuous process. It involves three stages - evaporation, condensation and precipitation. It is also called the hydrological cycle.

Evaporation : Water from oceans, lakes, ponds and rivers evaporates due to the heat of the sun.

Condensation : Water vapour which enters into the atmosphere by evaporation moves upward with air, gets cooled and changes into tiny water droplets that form clouds in the sky.

Precipitation : The millions of tiny droplets collide with one another to form larger droplets. When the air around the clouds is cool these drops of water fall in the form of snow or rain.

Have you heard of transpiration?

It is the process of loss of water from the aerial parts of a plant in vapour form.

There is a continuous cycling of water and it exists in three forms in nature.

Water evaporating from lakes, rivers and oceans forms the gaseous state. Rain water forms the liquid state. Snow on mountains and polar ice caps forms the solid state.

These three states occur in nature, keep the total amount of water on the earth constant even when the whole world is using it!

How do you know that atmosphere has water vapour?

Let us do the following activity...

Natural Sources of fresh water

Three types of natural sources of fresh water are available on the earth.

Surface water

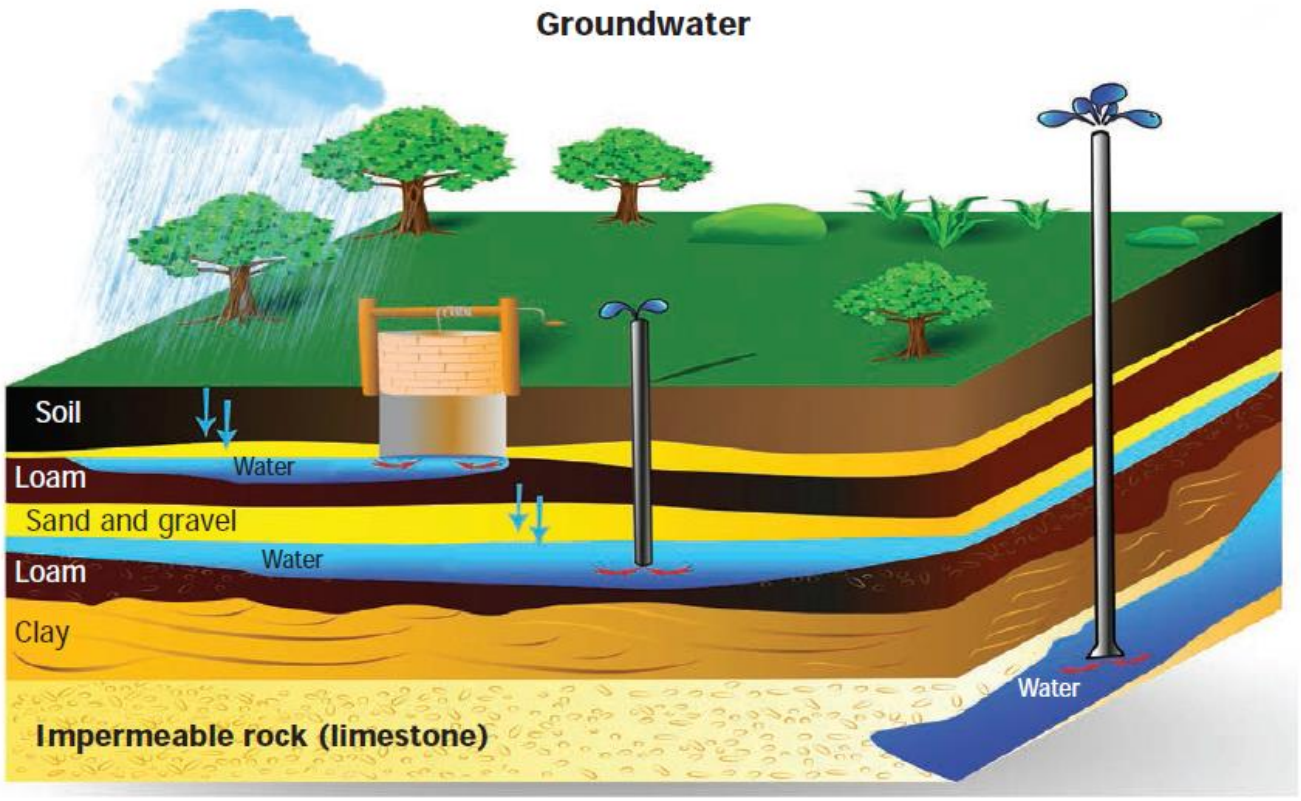
Water present on the surface of the earth such as river, lake, ponds, streams or fresh water wetland is called surface water

Frozen water

Water that is present in the frozen form as polar ice-caps and glaciers are called frozen water. A larger portion of water is 68.7% of the total available fresh water is in frozen state.

Ground water

Ground water is the water present beneath Earth's surface in soil. This water is obtained through springs, open wells, tube wells, or hand pumps etc.,



The Himalayas
The Himalayas, contain ice caps, ice bergs and glaciers. Ten of Asia's largest rivers flow from the Himalayas and more than a billion people's livelihoods depend on those rivers.

More to know: Water, is measured in litre and millilitre. Gallon is also a measure of volume of liquids.
1 Gallon = 3.785 litre
Water level in the reserviors is measured in TMC/feet. Water released from dams is measured in cusec (cubic feet/sec).

Aquatic animals
During winter, water in lakes and ponds in the cold countries will be frozen and a solid layer of ice is formed on the surface of water. Still aquatic animals living

under the ice do not die. This is because the floating layer of ice acts as a protective coat, and doesn't permit heat to escape from water. So as the water at the surface alone turns to ice, it the existence of aquatic animals.

Conservation of water

There is no change in the total quantity of water available on the earth. It remains the same. But the water useful for plants, animals and man is decreasing day by day. It is called scarcity of water.

What are the reasons for scarcity of water?
The main reasons for water scarcity

1. Population explosion
2. Uneven distribution of rainfall
3. Decline of ground water table
4. Pollution of water
5. Careless use of water

We should take care to prevent scarcity of water. Otherwise, it is impossible for organisms to live on the earth. The only method of preventing scarcity of water is conservation of water. Saving water for the future generations by using water carefully and in a limited way is conservation of water.

Methods of water conservation:

Mainly, two methods can be followed for the conservation of water.

1. Water management

Water management consists of the following factors:

a. Bringing awareness about the bad effects of throwing wastes into the water bodies
b. Recycling of water by separating pollutants.
c. Minimizing the use of chemical fertilizers in agriculture. It reduces the pollution of underground water.
d. Controlling deforestation
e. Adopting drip irrigation and sprinkler irrigation in agriculture. By this way lesser amount of water can be used for the irrigation

2. Rainwater harvesting

Direct collection and use of rain water is called rainwater harvesting.

There are two types of rainwater harvesting.

a. Collecting water from where it falls.
   (e.g): Collecting water from the roof tops of the houses or buildings (Roof water harvesting).
b. Collecting flowing rain water
   (e.g): Collecting rainwater by constructing ponds with bund.

Importance of water

Human body: Our body uses water in all its cells, organs and tissues to help regulate its temperature and maintain other bodily functions. On an average, the human body requires 2 – 3 litres of water per day for proper functioning. Water helps in digestion of food and removal of toxins from the body.

Domestic: Apart from drinking, people use water for many other purposes. These include: cooking, bathing, washing clothes, washing utensils, keeping houses and common places clean, watering plants, etc.

Agriculture: Water is also essential for the healthy growth of farm crops and farm stock and is used in the manufacture of many products.

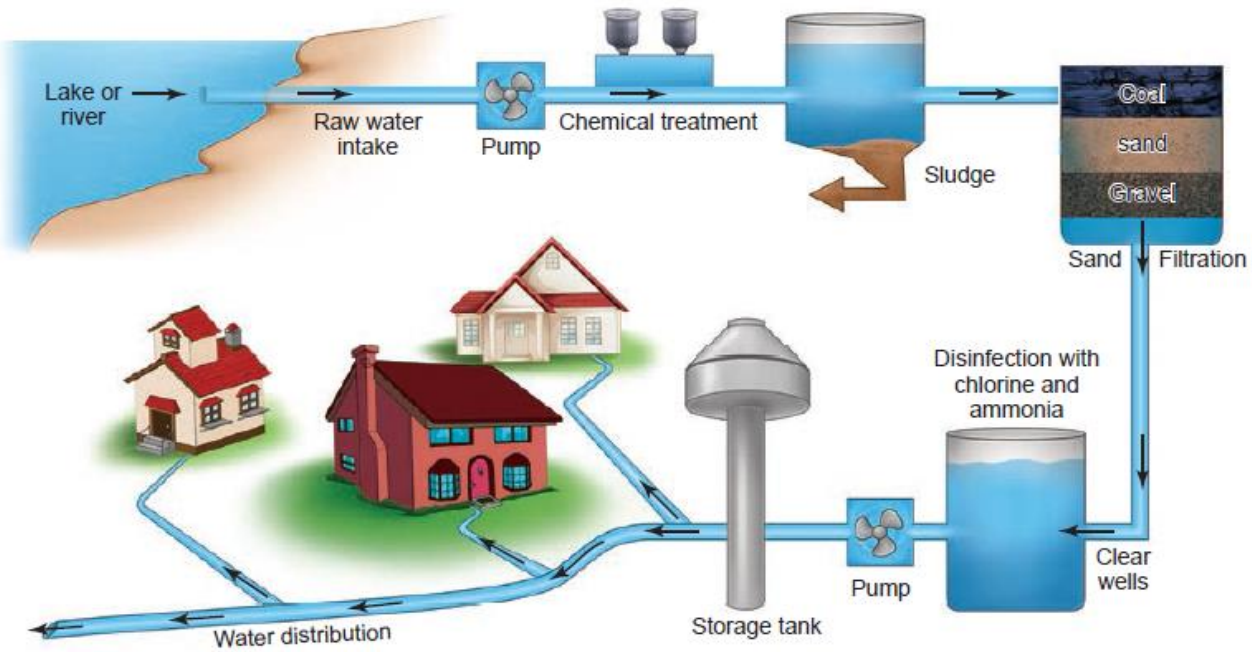
Industry: Industry depends on water at all levels of production. It is used as a material, a solvent and for generating electricity.

Swamps are wetlands that are forested. They occur along large rivers or on the shores of large lakes. The water of a swamp may be freshwater, brackish water or seawater. Swamps are important for providing fresh water and oxygen to all life. Pichavaram Mangroves in Chidambaram, Muthupet mangrove wetland. Pallikkaranai wetland in Chennai, Chembarambakkam in Kancheepuram are a few examples of swamps in Tamilnadu.

Water distribution and treatment system

We know that water is distributed by local bodies. In some areas which water is obtained from river, lake and ground water is treated and distributed. Model of water distribution and treatment plant is shown in figures.

The Water distribution and water treatment system



Let us avoid wasting water

When you happen to see any leaking tap in your school or home, keep a bucket to collect the water that is leaking and measure the amount of water and the time taken to fill the bucket. After noting the time taken to fill a bucket, you can estimate the amount of water getting wasted on a day.

Can you please think over the amount of water getting wasted all around the world from the leaking taps?

Points to remember

- ❖ Water is one of the most important components that all animals including human beings and plants depend on for their livelihood.
- ❖ To an extent of 97% of the total water that exists on Earth is found in seas and oceans.
- ❖ Only 3% of the freshwater is available in polar ice caps and glaciers.
- ❖ Lakes, rivers, swamps constitute only 0.3% of the surface water.
- ❖ The moisture in the soil indicates the presence of underground water.
- ❖ The continuous circulation of water in nature is called the water cycle. It is effected by evaporation, condensation, precipitation and transpiration.
- ❖ Ground water is the water present beneath Earth's surface in soil.

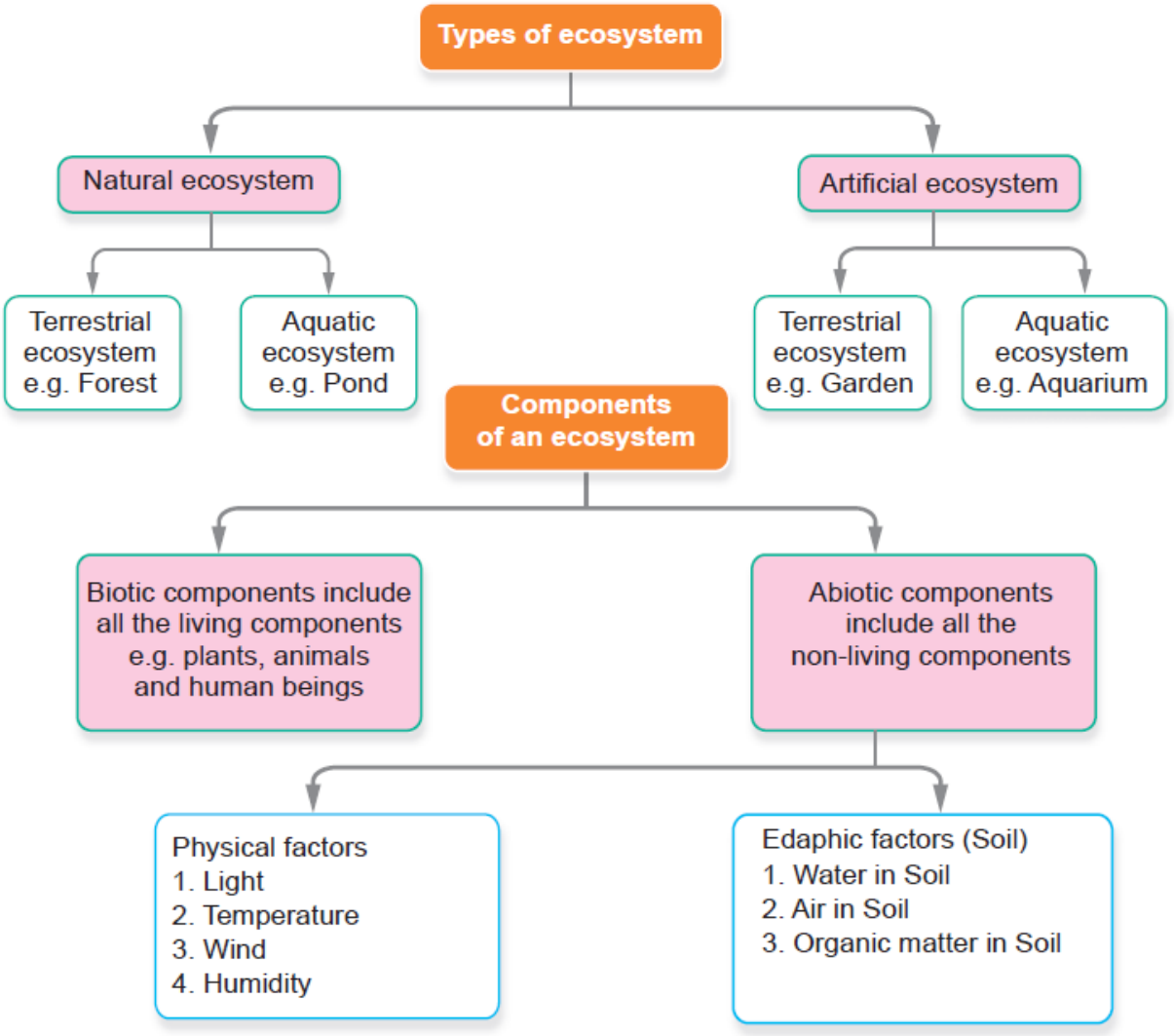
UNIT 4. OUR ENVIRONMENT

Introduction

The surroundings or space in which a person, animal, or plant lives, is known as on environment. Environment is everything that is surround us. It can have both living (biotic) and non-living things (abiotic). Abiotic factors are non-living parts such as sunlight, air, water and minerals in soil. Biotic factors are living things of our environment such as plants, animals, bacteria and more. Organisms live, constantly interact with one another and adapt themselves to conditions to their environment.

The Ecosystem

Ecosystem is a community of living and non-living things that work together. Each part of an ecosystem has a role to play. Any changes in the environment such as increased temperature or heavy rains, can have a big impact on an ecosystem. Ecosystems can be either natural or artificial.



Natural ecosystem

Ecosystem originated without human intervention is called a natural ecosystem. This can be an aquatic ecosystem or a terrestrial ecosystem. The ecosystem in water is called aquatic ecosystem. Sea, river, lake, pond and puddle are some examples of natural aquatic ecosystem. Ecosystems outside the water body and on land are called terrestrial ecosystems.

Forests, Mountain regions, deserts etc., are examples of natural terrestrial ecosystems.

Artificial ecosystem

Artificial ecosystems are created and maintained by human. They have some of the characteristics of natural ecosystems. They are much simpler than the natural ecosystems. These can be the terrestrial ecosystems such as paddy fi elds, gardens etc. or the aquatic ecosystem such as fish tank.

Aquarium:

Aquarium is a place in which fish and other water creatures and plants are maintained. An aquarium can be a small tank, or a large building with one or more large tanks.

Terrarium:

Terrarium is a place in which live terrestrial animals and plants are kept. Plants and animals are kept in a terrarium with controlled conditions that copy their natural environment

Aquariums and Terrariums are used to observe animals and plants more closely. They are also used for decorations.

Food Chain and Food Web

Living organisms need food to perform their life processes. Some organisms can produce their own food, such as plants, while other organisms cannot do this and need to feed on other organisms to obtain their energy.

We can therefore identify different feeding types in an ecosystem, based on how the organism obtain (gets) its food. They are producers and consumers.

Producers

Producers are organisms that are able to produce their own organic food. They do not need to eat other organisms to do this. Producers are also called autotrophs. Can you name an organism that prepare it's own food?

Plants are producers because they make their own food by photosynthesis.
What do plants need in order to photosynthesis?

Consumers

Organisms which cannot produce their own food, need to eat other organisms as food. These organisms are called consumers. All animals are consumers as they cannot produce their own food. Consumers are also called heterotrophs.

There are many types of consumers and we can classify them into specific groups depending on the food that they consume. These are:

Herbivores
Animals which eat plants or plant products e.g: cattle, deer, goat and rat.

Carnivores

Animals that eat other animals e.g: Lion, tiger, frog and owl.

Omnivores

Animals that eat both plants and animals e.g: Humans, dog and crow

Decomposers

Micro-organisms that obtain energy from the chemical breakdown of dead organisms (both plants and animals). They break complex organic substances into simple organic substances that goes into the soil and are used by plants. (e.g) Bacterium, Fungi

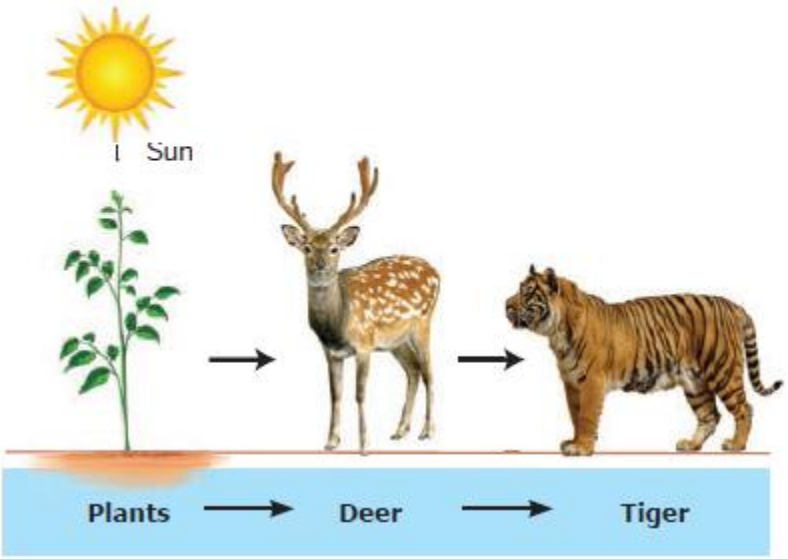
Food chain

In a forest, deer eats grass; and in turn we know tiger eats deers. In any ecosystem there is a chain like relationship between the organisms that live there. This sequence of who eats whom in an ecosystem is called as food chain.

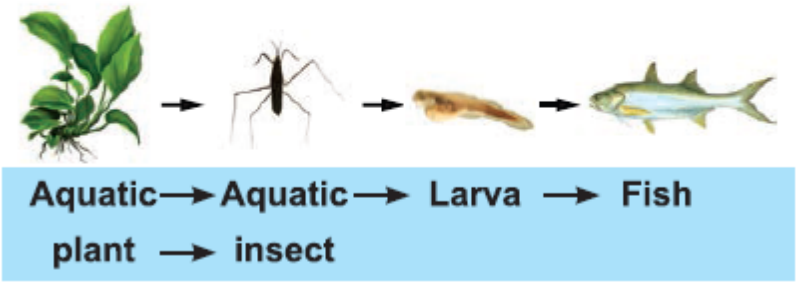
It describes how organisms get energy and nutrients by eating other organisms.

A food chain shows the relationship between producers (e.g. grass) and consumers (e.g. deer, goats, cows and tiger).

E.g. Food chain in a terrestrial (grassland) ecosystem



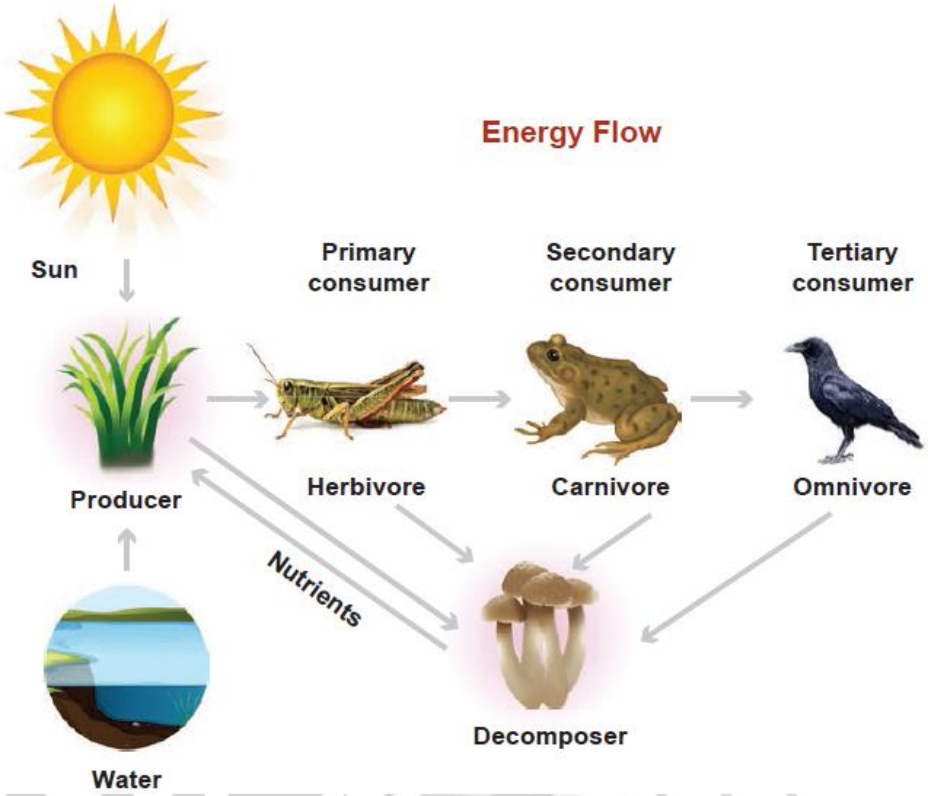
E.g. Food chain in an aquatic (lake) ecosystem



Energy flow

The food chain begins with the energy given by the Sun. Sunlight triggers photosynthesis in plants. The energy from the Sun is stored in the plant parts. When the grasshopper eats the grass, the energy flows from grass to grasshopper. Frog gets energy by eating grasshopper. This energy is transferred to a crow, when the frog is eaten by a crow. Thus we conclude the primary energy production in the world of living things is made by plants; that is by photosynthesis.

The micro organism reduce the excreata and the dead bodies of animals into primary simple components and puts them back into soil. It is this material that help the plants to grow. Thus we can see that there is a cycle of materials from primary producers to highest level predators, then back to soil.



Trophic levels

We see that the energy is passed along from the producer to the consumers. But, there are three different consumers in any food chain. How can we distinguish different consumers?

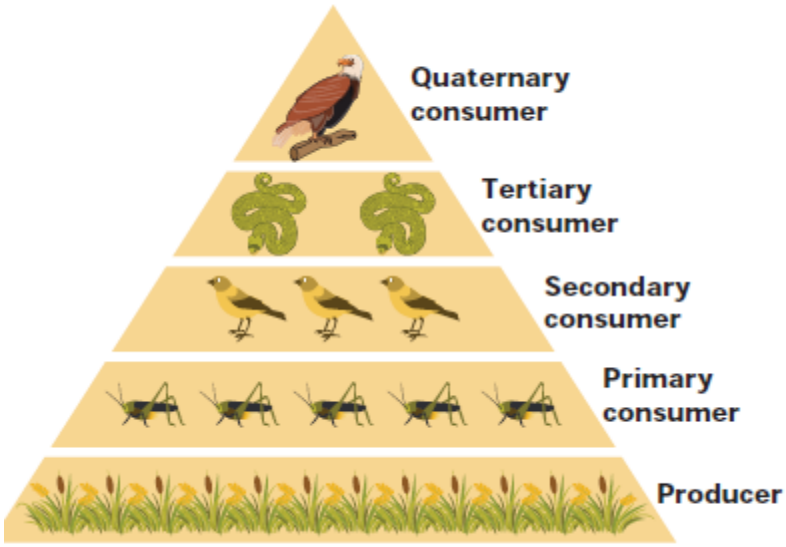
Animals that eat plants are **primary consumers.**

Animals that eat primary consumers are called **secondary consumers.**

Animals that eat the secondary consumers (mostly predators) are the **tertiary consumers.**

There may even be large predators that eat tertiary consumers. They are called as **quaternary consumers**.

Each of these levels in the food chain is called a **trophic level**.



Organism uses up to 90% of its food energy for its life processes. Only about 10% of energy goes into new body cells and will be available to the next animal when it gets eaten. This loss of energy at each trophic level can be shown by an energy pyramid.

A rat eats grains; and in turn we know snake eats rat. Now snake is a prey for peacock and in turn peacocks are easy prey for tigers and leopards. Now think? Do tigers have any natural predators?

In all food chain there is a top level predator that has no natural predators. In an aquatic ecosystem there are no natural predator for alligator; in a forest there are no natural predators for tigers.

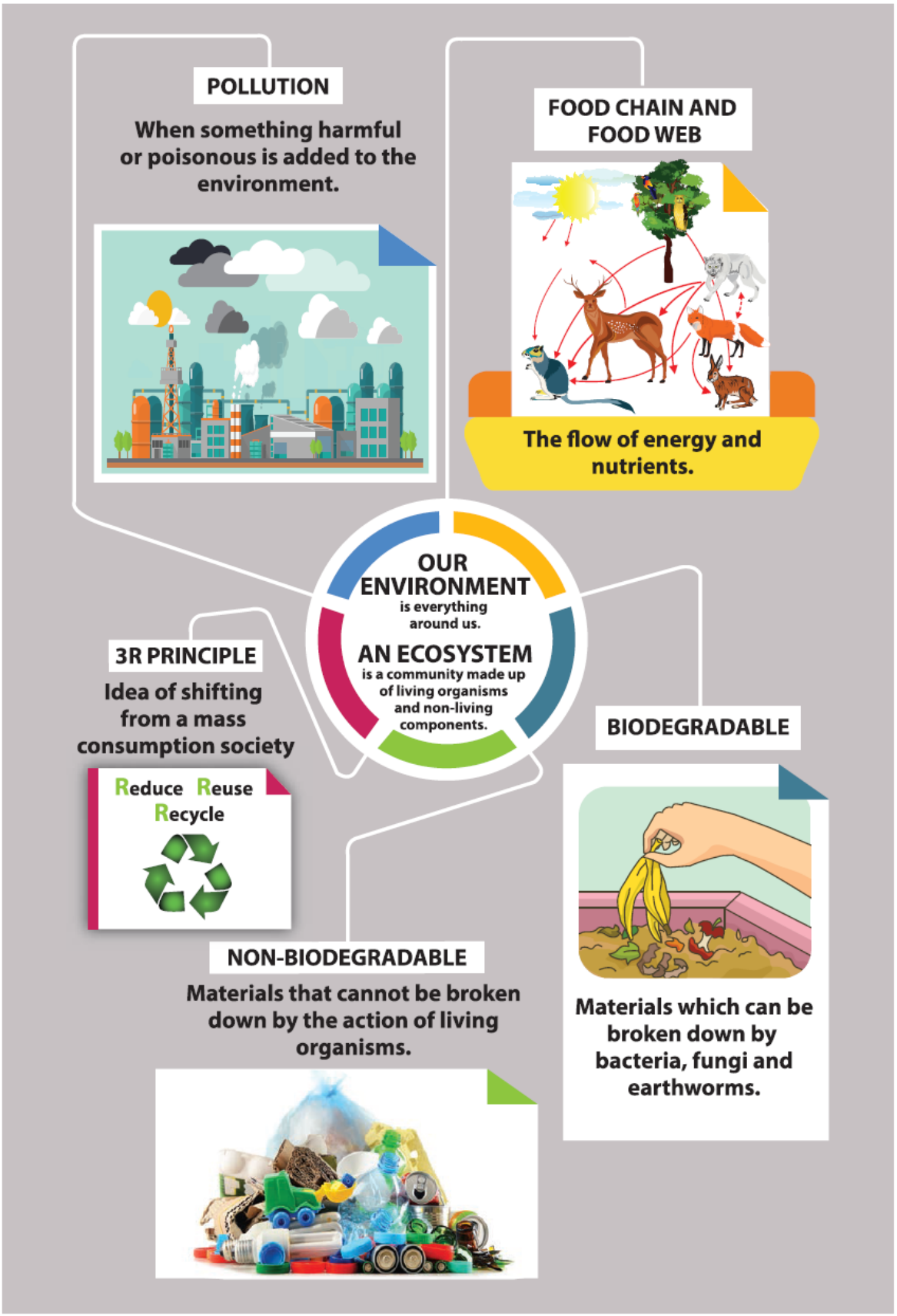
Importance of food chain

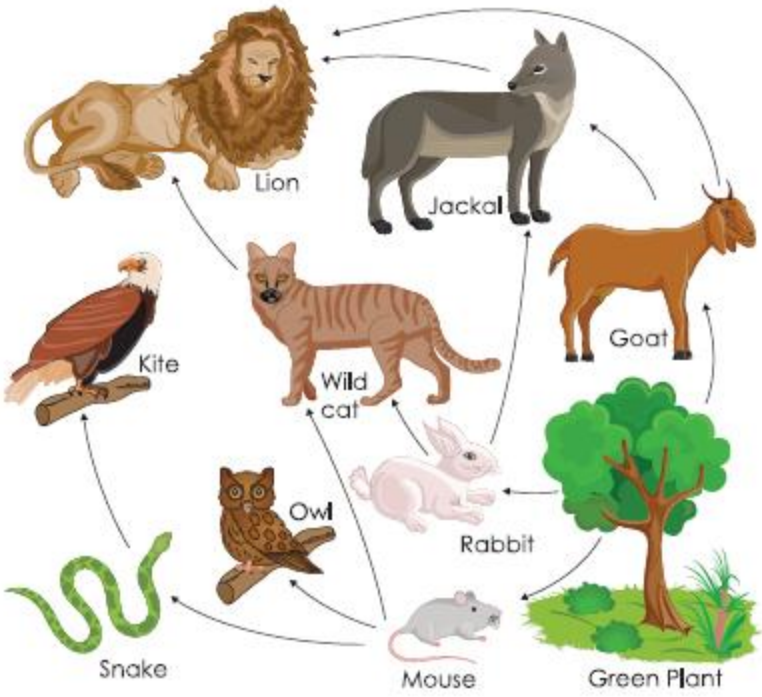
1. Learning food chain help us to understand the feeding relationship and interaction between organisms in any ecosystem.
2. Understanding the food chain also helps us to appreciate the energy flow and nutrient circulation in an ecosystem. This is important because pollution impacts the ecosystem. The food chain can be used to understand the movement of toxic substances and their impacts.

Food web

Consumers have different sources of food in an ecosystem and do not rely on only one species for their food. If we put all the food chains within an ecosystem together, then we end up with many interconnected food chains. This is called a food web

A food web is very useful to show the many different feeding relationships between different species within an ecosystem.





Food Web

Waste Management and Recycling

To protect our environment, it is very important to reduce waste, manage it properly and maximise recycling. Waste is any substance or material that has been used but is not wanted anymore. This is either because it is worn out, broken or no longer has any purpose. Everyone produces waste and our waste has an impact on all ecosystems. However, most of us do not know where our garbage goes. There are many types of waste. There is liquid waste (in our drains), there are gases hiding in the air (like pollutants from factories), and there is solid waste (garbage) we put in our waste bins.

Biodegradable and Non- biodegradable Waste

Solid waste we generate can be classified into two major types:

1. Biodegradable waste
2. Non-biodegradable waste

Biodegradable waste

The term 'Biodegradable' is used for those things that can be easily decomposed by natural agents like water, oxygen, ultraviolet rays of the sun, micro-organisms, etc.

One can notice that when a dead leaf or a banana peel is thrown outside it is acted upon by several micro-organisms like bacteria, fungi or small insects in a time period. Biodegradable waste includes vegetable and fruit peels, leftover food and garden wastes (grass, leaves, weeds and twigs).

Natural elements like oxygen, water, moisture, and heat facilitate the decomposition thereby breaking complex organic forms to simpler units. Decomposed matter eventually mixes or returns back to the soil and thus the soil is once again nourished with various nutrients and minerals.

Non-biodegradable waste

Those materials which cannot be broken down or decomposed into the soil by micro-organisms and natural agents are labeled as non-biodegradable. These substances consist of plastic materials, metal scraps, aluminium cans and bottles, etc.

These things are practically immune to the natural processes and thus cannot be fed upon or broken down even after thousands of years.

Rani and her garbage

Rani gets home from school. She is hungry. She eats a banana and a packet of chips. She puts the banana peel and plastic chips packet into the waste bin. In the waste bin, the waste mixes together and the banana peel makes the plastic chips packet dirty. The waste bin starts to smell and Rani's mother puts the waste outside on the street. The municipality collects the waste from outside Rani's house and many other houses in a tractor. The tractor drives to a big open dump and leaves all mixed wastes there.

Sometimes, there are fires in the open dump. When waste like Rani's chips packet burns, unhealthy chemicals pollute the ecosystem. These chemicals are present in the air we breathe. The leftover ash from burning waste pollutes the soil.

When it rains, some of the dangerous chemicals goes into the ground. Some of the rain never reaches the ground as it collects in the plastic garbage at the dump. Little pools of water let mosquitoes to breed and they can spread unwanted diseases like dengue and malaria. Cows and dogs go into the open dump looking for food. As the waste is mixed, many things that are not good to eat such as plastics, smell like food. The animals get confused and eat some plastics by accident. This makes them sick.
Rani is a student like you. She does not want to make animals sick. She does not want to pollute beautiful Town. She does not like mosquitoes and wishes that no one ever gets sick from them. So Rani takes this decision "I plant trees and reduce all type of pollution".

Do you want the same as Rani does? Become a detective. Learn about the 3R's and how you can start to solve these problems.

Solid Waste Management

It is our duty to reduce creating waste and protect environment. 3R's are important in protecting environment. The first R is reduce and the second R is reuse and the last R is recycle.

The waste hierarchy or pyramid shows the best ways to manage solid waste.

3R-Cycle

1. Avoid

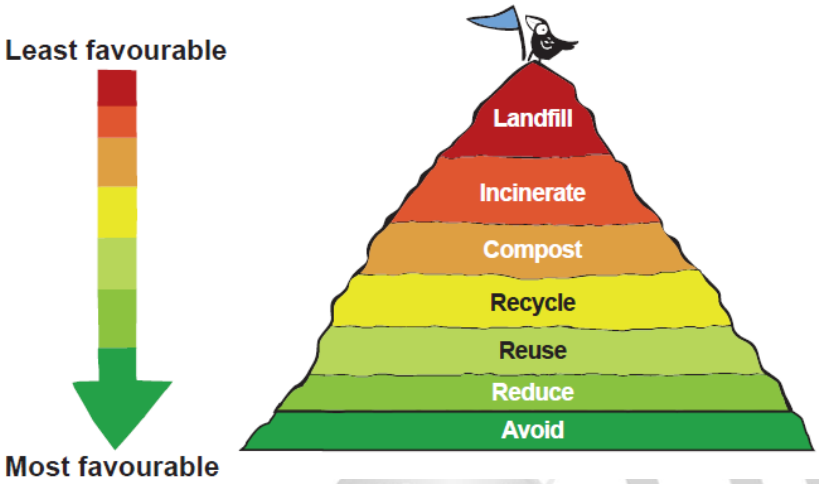
Avoid the usage of unwanted materials which create more debris. Before you buy anything, think that "Do I really need it?" (e.g) Avoid buying packaged foods. Refuse to buy use and throw plastic products.

2. Reduce

We can reduce the waste by using durable goods that last longer instead of things that are used once and thrown away. (e.g) Write on both sides of papers. Instead of unnecessary printing, use electronic facilities. Share newspapers, magazines and other things with others.

3. Reuse

Reusing means using a thing again and again, rather than using and throwing after a single use. (e.g) Instead of using plastic bags, use and throw pens and batteries, use cloth bags, fountain pens and rechargeable batteries. Reuse glass bottles for other purposes. Repair foot wears and use them.



4. Recycle

The process by which waste materials are used to make new products is called recycling. (e.g) Using old clothes to make paper and melting some plastics to make floor mats, plastic boards and hose pipes.

5. Compost

The process of degradation of organic wastes into manure by the action of microorganism is called composting. The manure thus obtained becomes natural fertilizer for the plants as well as increases the soil fertility.

Creative reuse Creative reuse or Up- cycling is the process of converting waste materials or useless products into new materials or products of better quality or for better environmental value. When you upcycle, you are giving an item a new purpose. (e.g) Used tyres into chairs. Used PET bottle into pen stand.

6. Incinerate

The burning of solid waste in incinerator is called incineration. Human anatomical wastes (discarded medicines, toxic drugs, blood, pus) are disposed by means of incineration. During incineration, the enormous heat kills all contagious disease-causing germs. We can also produce electricity with the help of this heat.

7. Landfill

Landfilling is a method in which wastes are dumped into naturally occurring or man-made pits and covered with soil. Garbage buried inside landfills remain here for a long time as they decompose very slowly and become manure. These places can be converted into parks, gardens, etc.,

Earlier in the chapter, you learn about Rani and how she did not want to cause pollution. Simple steps in your daily life can make big differences. There are two steps you should remember.

1. The first step should always be to reduce waste. Think of the 3R's and the waste pyramid and remember the order of the levels.
2. The second step is to keep waste separate. This way the waste will remain clean and can be easily reused or recycled. Mixing different types of waste together (e.g. biodegradable and non-biodegradable) makes waste dirty. Dirty waste gets sent to a landfill or open dump.

Waste separation exercise

The Solid Waste Management (SWM) rules, 2016 say that,

1. Every Household should segregate and store the waste generated by them in three separate streams – namely bio-degradable, non bio-degradable and domestic hazardous waste in suitable bins and handover segregated wastes to authorised waste pickers or waste collector as per the direction or notification by the local authorities from time to time.
2. No body shall throw, burn, or bury the solid waste on streets, open public spaces outside his premises or in the drain or water bodies.

Domestic hazardous waste means discarded paint drums, pesticide cans, CFL bulbs, tube lights, expired medicines broken mercury thermometers, used batteries, used needles and syringes and contaminated gauge, etc., generated at the household level.

Learn how to separate waste correctly into 3 waste bins so you can keep Tamilnadu clean and beautiful!

How much waste does each person make around the world every day?

The average person in India produces 0.45kg of waste every day. It may be small amount of waste. But, India has a large population and imagine you collected all the waste today and put it into tractors. You would fill so many tractors that you

could create a traffic jam approximately 2,800 kilometres long. Imagine, a road all the way from Kanyakumari to New Delhi completely blocked with tractors carrying garbage and no space to walk in between. This is how much waste we create in India each day! If we reduce the waste, we reduce the pollution.
India produces 532 million kilos of solid waste every day.

Pollution

Pollution occurs when the environment gets contaminated by waste, chemicals and harmful substances.

Pollution is the damage caused to the environment mainly because of human activities. Any substance that causes pollution is known as a pollutant. Pollution is an unwanted change in the physical, chemical and biological characteristics of our land, air and water.

Types of Pollution

There are four major kinds of pollution:

1. Air pollution
2. Water pollution
3. Land (soil) pollution
4. Noise pollution

Air pollution

Most air pollution is caused by the burning of fossil fuels (e.g. oil, petrol, coal and natural gas). These fossil fuels are used in factories (industries), power plants and motor vehicles. Burning these fossil fuels release toxic gases and fine particles (such as ash and soot) into the air causing air pollution. Air pollution is also caused by burning solid waste (especially some plastics), gases or chemicals released from factories and fumes from aerosols (like deodorant spray cans) or paints.

Certain toxic gases produced by industries mix with raindrops high in the atmosphere and make rain unusually acidic. This is called acid rain. It damages plants, washes the nutrients out of soils and kills fish. Air pollution is harmful to all living organisms including humans. Polluted air affects skin, eyes and respiratory system.

How can we reduce air pollution?

1. Cycle or walk short distances instead of using a motor vehicle.
2. Travel by public transport (bus or train)
3. Do not burn solid waste.
4. Avoid fireworks.

Water pollution

Water pollution occurs when wastes from factories, houses and farms mixes with the water in rivers, lakes, ponds, the ocean or even groundwater. Contaminated or polluted water can spread diseases and chemicals which are not good for our health.

The most significant sources of water pollutants are

1. Sewage (water we use at home for bathing, cleaning, cooking).
2. Industrial effluents (liquid wastes from factories).
3. Agricultural pollutants (chemical pesticides and fertilisers that get washed from farms).
4. Solid waste (when waste gets dumped into water bodies).

How can we reduce water pollution?

1. Do not pour leftover oil, old medicines or waste down the drain or into the toilet.
2. Reduce the use of chemical pesticides and fertilizers to grow crops.
3. Use waste water for garden in home.
4. Do not litter or dump waste – always use a waste bin.

Land (soil) pollution

In the same way as water and air get polluted, land or soil pollution happens when toxic chemicals change the natural balance in soil. Land pollution comes from farming (Excess use of chemical pesticides and fertilisers), mining (digging up metals and other materials), factories (industrial waste) and the solid waste from our own homes like plastics and broken electronics. Soil pollution affects animals, humans and even plants because soil or land acts like a sponge. When it rains, pollutant sinkss into the soil. If we grow plants to eat in polluted soils, these dangerous chemicals can get into our food.

How can we reduce land pollution?

1. First try to reduce waste, then recycle the rest.
2. Always use a waste bin and never litter.
3. Do not burn waste, the ash mixes easily with soil.

Noise pollution

Noise pollution affects the environment. We all like a quiet and peaceful place since unpleasant or loud sounds disturb us. Loud music, the sounds of motor vehicles, fireworks and machines cause noise pollution. Continuous noise disturbs our sleep and does not let us to study. Noise pollution has been directly linked to stress and health impacts such as high blood pressure and hearing loss. Loud noise or even loud music can damage our ears. Noise pollution also disturb animals. Birds have to communicate (talk) louder so that, they can hear each other in noisy areas. Even underwater noise pollution from ships, can make whales lose their way as they use sounds to navigate.

How do we reduce noise pollution?

1. Turn off your electronics when you do not use them.
2. Lower the volume when you watch TV or listen to music.
3. Remind drivers not to use the horn too much.
4. Avoid fireworks.
5. Speak, do not shout (try to set an example).

Points to remember

- ❖ Living (biotic) and non-living (abiotic) components interact with one another.
- ❖ There are two types of ecosystems terrestrial (on land) and aquatic (in water).
- ❖ The feeding relationship in an ecosystem is called a food chain.
- ❖ Biodegradable and non-biodegradable waste should be kept separate
- ❖ The 3R's are in a certain order: First reduce, then reuse and finally recycle.
- ❖ Waste should never be burned as it causes air and soil pollution.
- ❖ Pollution occurs when the environment gets contaminated by waste, chemicals and harmful substances.
- ❖ Major types of pollution are four: air pollution, water pollution, land pollution, and noise pollution.
- ❖ There are many small habits, any student can practice to reduce pollution, manage waste correctly and protect the environment

8TH TERM II UNIT 3 AIR

Introduction

Air is a mixture of gases that surrounds our planet earth. It is essential for the survival of all the living things. Air contains 78.09% nitrogen, 20.95% oxygen, 0.93% argon, 0.04% carbon dioxide and small amount of other gases. We breath in oxygen and breath out carbon dioxide. Plants in turn use carbon dioxde for photosynthesis and release oxygen into the atmosphere. Since men have been cutting down trees for their needs, the amount of carbon dioxide in the atmosphere is increasing. This is responsible for the raising of atmospheric temperature. Industries and vehicles release gases like carbon monoxide and sulpher dioxide into the atmosphere. This has resulted in effects like global warming and acid rain which affect us in many ways. In total, the quality of air is gone in the modern days. In this lesson we are going to study about the effects like green house effect, global warming and acid rain. We will also study about occurrence and properties of the gases oxygen, nitrogen and carbon dioxide.

Oxygen

All living things in the world need oxygen. We cannot imagine the world without oxygen. Swedish chemist C.W. Scheele first discovered oxygen in 1772. He called the gas fire air or vital life because it was found to support the process of burning. It was independently discovered by the British scientist Joseph Priestley in 1774. Lavoisier named oxygen. The name oxygen comes from the Greek word 'oxygenes' which means 'acid producer'. It is called so because early chemists thought that oxygen is necessary for all acids.

Occurrence of Oxygen

Oxygen is the most abundant element on the earth by mass and the third most abundant element after Hydrogen and Helium in the universe. It occurs both in free state and combined state. It is present in free state as dioxygen molecule (O2) in the atmosphere. Most of this has been produced by the process photosynthesis in which the chlorophyll present in the leaves of plants uses solar energy to produce glucose.

Oxygen in free state		**Oxygen in combined state**	
Source	Percentage	Source	Percentage
Atmospheric air	21 %	Plants and animals	60 – 70 %
Water	88 – 90 %	Minerals in the form of silicates, carbonates and oxides	45 – 50 %

$6CO_2 + 6H_2O$ + Energy from the Sun $C_6H_{12}O_6 + 6O_2$.

In combined state it is present in the earth's crust as silicates and metal oxides. It is also found in the water on the surface of the earth. Tri oxygen molecule (O3) known as ozone is present in the upper layers of the atmosphere.

Physical properties of Oxygen

- ❖ Oxygen is a colourless, odourless and tasteless gas.
- ❖ It is a poor conductor of heat and electricity
- ❖ Oxygen dissolves readily in cold water.

Oxygen is about two times more soluble in water than nitrogen. If it had the same solubility as nitrogen, then less oxygen would be present in seas, lakes and rivers that will make life much more difficult for living organisms.

- ❖ It is denser than air.
- ❖ It can be made into liquid (liquified) at high pressure and low temperature.
- ❖ It supports combustion.

Chemical properties of Oxygen

1. Combustibility

Oxygen is a non-combustible gas as it does not burn on its own. It supports the combustion of other substances.

If oxygen has the capacity to burn itself, striking a match stick will be enough to burn all the oxygen in our planet's atmosphere.

2. Reaction with metals

Oxygen reacts with metals like sodium, potassium, magnesium, aluminium, iron etc., to form their corresponding metal oxides which are generally basic in nature. But the metals differ in their reactivity towards oxygen.

Metal + Oxygen Metal oxide

Example

$4Na + O_2 \rightarrow 2Na_2O$

Sodium Oxygen Sodium oxide.

Reactivity of Oxygen with metals

Metal	Condition	Product formed
K	Room temperature	Potassium Oxide (K_2O)
Mg Heating	Heating slightly	Magnesium Oxide (MgO)
Ca	Heating slightly	Calcium Oxide (CaO)
Fe Cu Ag	High temperature	Iron Oxide (Fe_3O_4) Cupric Oxide (CuO) Silver Oxide (Ag_2O)
Au Pt	Even at high temperature	No action

3. Reaction with non metals

Oxygen reacts with various non-metals like hydrogen, nitrogen, carbon, sulphur, phosphorus etc., to give corresponding non metallic oxides which are generally acidic in nature.

Non-metal + Oxygen Non-metallic oxide

Example
$C + O_2$ CO_2
Carbon Oxygen Carbon dioxide

Reactivity of Oxygen with non metals

Non metal	Products formed
C	Carbon dioxide (CO_2)
N	Nitric oxide (NO)
S	Sulphur dioxide (SO_2)
P	Phosphorus trioxide (P_2O_3) or Phosphorus pentoxide (P_2O_5)

4. Reaction with Hydrocarbons

Hydrocarbons (compound containing C and H) react with oxygen to form carbon dioxide and water vapour. E.g. Wood, Petrol, Diesel, LPG, etc. When they burn in oxygen, they produce heat and light energy. Hence they serve as fuel.

Hydrocarbon + O_2 CO_2 + Water vapour + Heat energy + Light

5. Rusting

The process of conversion of iron into its hydrated form of oxide in the presence of air and moisture (humid atmosphere) is called rusting. Rust is hydrated ferric oxide.

$4Fe + 3O_2 \rightarrow 2Fe_2O_3$

$Fe_2O_3 + X\ H_2O \rightarrow Fe_2O3\ .\ X\ H_2O$
(rust)

(X = Number of water molecules which is variable)

- **Uses of Oxygen**

- It is used as oxy-acetylene light for cutting and welding metals.
- It is used to remove carbon impurities from steel.
- Plants and animals use oxygen from the air for respiration.
- It is used to oxidize rocket fuel.
- It is used for artificial respiration by scuba divers, mountaineers, astronauts, patients etc.
- Mixed with powdered charcoal it is used as explosives.
- It is used in the synthesis of methanol and ammonia.

Nitrogen

Nitrogen is one of the most important elements. Animals and plants need nitrogen for their growth. All living organisms (including us) contain nitrogen. It is an essential element present in proteins and nucleic acids which are the 'building blocks' of all living things. It was first isolated from the air by Swedish chemist Carl Wilhelm Scheele in 1772. The name 'nitrogen' is derived from the Greek words 'nitron' and 'gene' meaning 'I produce nitre'. Nitre is potassium nitrate compound of nitrogen. Antoine Lavoisier suggested the name azote, from the Greek word meaning 'no life

Occurrence of Nitrogen

Nitrogen is the fourth most abundant element in the human body by mass. It accounts for about three percent of the mass of the human body. It is thought to be the seventh most abundant element in the universe by mass. Titan, the largest moon of Saturn, has an atmosphere made up of 98% Nitrogen. Nitrogen occurs both in free state and combined state. Nitrogen exists in free state in the atmospheric air as

dinitrogen (N2).It is present in volcanic gases and gases evolved by burning of coal. Nitrogen is present in combined state in the form of minerals like nitre (KNO3) and chile salt petre (NaNO3). It is present in organic matters such as protein ,enzymes, nucleic acid etc.

Physical properties of Nitrogen

- ❖ It is a colourless, tasteless and odourless gas.
- ❖ It is slightly lighter than air.
- ❖ It is slightly soluble in water.
- ❖ Nitrogen becomes a liquid at low temperature and looks like water.
- ❖ When it freezes, it becomes a white solid.
- ❖ It is neutral to litmus like oxygen.

Chemical properties of Nitrogen

1. Chemical reactivity

Nitrogen is inactive at ordinary conditions. It combines with many elements at high temperature and pressure or in the presence of catalyst.

2. Combustibility

Nitrogen is neither combustible nor a supporter of combustion. So nitrogen in the air moderates the rate of combustion.

3. Reaction with metals

Nitrogen reacts with metals like lithium, calcium, magnesium etc., at high temperature to form their corresponding metal nitrides.

Metal + Nitrogen Metal nitride

Example

$3Ca + N_2 \xrightarrow{\Delta} Ca_3N_2$

Calcium Nitrogen Calcium nitride.

4. Reaction with non metals

Nitrogen reacts with non-metals like hydrogen, oxygen etc., at high temperature to form their corresponding nitrogen compounds.

Non-metal + Nitrogen $\xrightarrow{\Delta}$ Nitrogen compound

Example

$3H_2$ + N_2 $\xrightarrow{\Delta}$ $2NH_3$

Hydrogen Nitrogen Ammonia

Uses of Nitrogen

- Liquid nitrogen is used as a refrigerant.
- It provides an inert atmosphere for conducting certain chemical reactions.
- It is used to prepare ammonia (by Haber's process) which is then converted into fertilizers and nitric acid.
- It is used for inflating tyres of vehicles.
- It is used for filling the space above mercury in high temperature thermometer to reduce the evaporation of mercury.
- Many explosives such as TNT (Trinitrotoluene), nitro-glycerine, and gun powder contain nitrogen.
- It is used for the preservation of fresh foods, manufacturing of stainless steel, reducing fire hazards, and as part of the gas in incandescent light bulbs.

Now a days nitrogen is used as a substitute for compressed air in tyres. Have you noticed it? Why do people prefer nitrogen instead of compressed air in tyres?

Nitrogen fixation

Nitrogen gets circulated in the air, soil and living things as the element itself or in the form of its compounds. Just as there is a circulation of carbon in nature so also there is a circulation of nitrogen. It is essential for the proper growth of all plants. The plants cannot make use of the elemental nitrogen from the air as such. The plants require soluble compounds of nitrogen. Thus, plants depend on other processes to supply them with nitrates. Any process that converts nitrogen in the air into a useful nitrogen compound is called nitrogen fixation. Fixation of nitrogen is carried out both naturally and by man.

Carbon dioxide

Carbon dioxide is a chemical compound in which one carbon and two oxygen atoms are bonded together. It is a gas at room temperature. It is represented by the formula CO2. It is found in the earth's atmosphere and it sends back the solar energy which is reflected by the surface of the earth, to make it possible for living organisms to survive. When carbon dioxide accumulates more in the atmosphere it produces harmful effects.

Occurrence of Carbon dioxide

Carbon dioxide is present in air to the extent of about 0.03% in volume. It is evolved by the plants and animals during respiration and is produced during fermentation reactions. Much of the naturally occurring CO2 is emitted from the magma through volcanoes. CO2 may also originate from the bio degradation of oil and gases. Human CO2 emissions upset the natural balance of the carbon cycle. Man-made CO2 in the atmosphere has increased global temperatures which is warming the planet. While CO2 derived from fossil-fuel is a very small component of the global carbon cycle, the extra CO2 is cumulative because the natural carbon exchange cannot absorb all the additional CO2.

Physical properties of Carbon dioxide

- Carbon dioxide is a colourless and odourless gas.
- It is heavier than air.
- It does not support combustion.
- It is fairly soluble in water and turns blue litmus slightly red. So it is acidic in nature.
- It can easily be liquified under high pressure and can also be solidified. This solid form of CO2 is called dry ice which undergoes sublimation.

The process of conversion of solid into vapour without reaching liquid state is called sublimation.

Chemical properties of Carbon dioxide

1. Combustibility

It is non-combustible and not a supporter of combustion.

2. Reaction with metals

Lighter metals like sodium, potassium and calcium, combine with CO2 to form corresponding carbonates whereas magnesium gives its oxide and carbon.

Example

$4Na + 3CO_2 \longrightarrow 2Na_2CO_3 + C$
Sodium Sodium carbonate

$2Mg + CO_2 \longrightarrow 2MgO + C$

Magnesium Magnesium oxide

3. Reaction with sodium hydroxide (Alkali)

Sodium hydroxide (base) is neutralized by carbon dioxide (acidic) to form sodium carbonate (salt) and water.

Base + Acid $\longrightarrow$ Salt + Water

$2NaOH + CO_2 \longrightarrow Na_2CO_3 + H_2O$
Sodium carbonate.

4. Reaction with Lime water (Calcium hydroxide)

When a limited amount of CO_2 is passed through lime water, it turns milky due to the formation of insoluble calcium carbonate.

$Ca(OH)_2 + CO_2 \longrightarrow CaCO_3 + H_2O$
Calcium carbonate

When an excess amount of CO_2 is passed through lime water, it first turns milky and the milkiness disappears due to the formation of soluble calcium hydrogen carbonate, $Ca(HCO_3)_2$.

Venus' atmosphere consists of roughly 96-97% carbon dioxide. Because of the amount of carbon dioxide present, the surface of Venus continually retains heat and as such, the surface temperature of Venus is roughly 462°C, making it the hottest planet in our solar system.

Uses of Carbon dioxide

- CO_2 is used to prepare soft drinks or aerated drinks.
- It is used in fire extinguishers
- It is used in manufacturing sodium carbonate by Solvay process.
- Solid carbon dioxide, called as dry ice is used as a refrigerant. The gas is so cold that moisture in the air condenses on it, creating a dense fog which is used in stage shows and movie effects.
- It is used along with ammonia in the manufacture of fertilizers like urea.
- CO_2 can be used in the preservation of food grains, fruits etc.

Aerated water is nothing but carbon dioxide dissolved in water under pressure. This is also called 'soda water'.

Green House Effect and Global Warming

The solar radiation is absorbed by the surface of land and ocean. In turn, they release infra red radiation or heat into the atmosphere. Certain gaseous molecules present in the atmosphere absorb the infra red rays and reradiate the heat in all directions. Hence, these gases maintain the temperature of earth's surface. The gases which absorb these radiations are called green house gases and this effect is called green house effect.

The green house gases are CO_2, N_2O, CH_4, CFC (Chlorofluoro carbon) etc. The increase in the levels of these gases results in the gradual increase of temperature of the earth's surface. This increased green house effect is caused due to increase in the air pollutants and it results in the average increase of temperature of the atmosphere. This is called as Global warming.

Effects of Global warming

The following are the effects of global warming.

- Melting of ice cap and glaciers.
- Increase in frequency of floods, soil erosion and unseasonal rains.
- Loss of biodiversity due to the extinction of coral reefs and other key species.
- Spreading of waterborne and insect borne diseases.

Preventive measures

In order to save the earth and its resources we need to take certain measures. Some of the measures are given below.

- Reduction in the use of fossil fuels.
- Controlling deforestation.
- Restricting the use of CFCs.
- Planting more trees.
- Reducing, reusing and recycling resources.

Acid rain

Rain water is actually the purest form of water. However, pollutants such as oxides of nitrogen and sulphur in the air released by factories, burning fossil fuels,

eruption of volcanoes etc., dissolve in rain water and form nitric acid and sulphuric acid which adds up to the acidity of rain water. Hence, it results in acid rain.

Acid rain has pH less than 5.6 whereas pH of pure rain water is around 5.6 due to dissolution of atmospheric CO_2 in it.

Effects of Acid rain

Acid rain affects us in many ways. Some of the consequences are given below.

- It irritates eyes and skin of human beings.
- It inhibits germination and growth of seedlings.
- It changes the fertility of the soil, destroys plants and aquatic life.
- It causes corrosion of many buildings, bridges, etc.

Preventive measures

Acid rain and its effects can be controlled by the following ways.

- Minimizing the usage of fossil fuel such as petrol, diesel etc.,
- Using CNG (Compressed Natural Gas).
- Using non-conventional source of energy.
- Proper disposal of the industrial wastes.

9th STANDARD
UNIT 24 ENVIRONMENTAL SCIENCE

Introduction

"Nature has the power to refresh and renew" - Helen Keller

Elements of nature continuously undergo changes and transformations. Environmental protection provides holistic knowledge about natural processes, effects of human intervention and solutions to overcome environmental problems. Environmental issues such as pollution, global warming, ozone layer depletion, acid rain, deforestation, landslide, drought and desertification have gained major focus across the world. Natural resources are recycled over and over again on earth for continued availability. At the same time, it also reminds us of our responsibility to reduce and restrain our activities that will affect the natural processes.

Living organisms adjust themselves according to their habitat and changes in the ecosystem. All living organisms develop certain morphological, anatomical,

physiological and reproductive adaptations which help them to survive better and to withstand environmental conditions.

This lesson deals with bio-geo-chemical cycles, adaptations by the plants and animals, water conservation and recycling of water.

Biogeochemical Cycles (bio – life; geo – earth)

Biosphere is the part of the earth where life exists. All resources of biosphere can be grouped into two major categories namely:

i. Biotic or living factors which include plants, animals and all other living organisms.
ii. Abiotic or non-living factors which include all factors like temperature, pressure, water, soil, air and sunlight which affect the ability of organisms to survive and reproduce.

There is a constant interaction between biotic and abiotic components in the biosphere and that makes the biosphere a dynamic and stable system. Cyclic flow of nutrients between non-living and living factors of the environment are termed as bio-geo-chemical cycles. Some of the important biogeochemical cycles are:

1.Water cycle 2. Nitrogen cycle 3. Carbon cycle

Water Cycle

Water cycle or hydrological cycle is the continuous movement of water on earth. In this process, water moves from one reservoir to another by processes such as evaporation, sublimation, transpiration, condensation, precipitation, surface runoff and infiltration, during which water converts itself to various forms like liquid, solid and vapour.

Evaporation: Evaporation is a type of vaporization, where liquid is converted to gas before reaching its boiling point. Water evaporates from the surface of the earth and water bodies such as the oceans, seas, lakes, ponds and rivers.

Sublimation: Sublimation is conversion of solid to gas, without passing through the intermediate liquid phase. Ice sheets and ice caps from north and south poles, and icecaps on mountains, get converted into water vapour directly, without converting into liquid.

Transpiration: Transpiration is the process by which plants release water vapour into the atmosphere through stomata in leaves and stems.

Condensation: Condensation is the changing of gas phase into liquid phase and is the reverse of vaporisation. At higher altitudes, the temperature is low. The water vapour present there condenses to form very tiny particles of water droplets. These particles come close together to form clouds and fog.

Precipitation: Due to change in wind or temperature, clouds combine to make bigger droplets, and pour down as precipitation(rain). Precipitation includes drizzle, rain, snow and hail.

Run off : As the water pours down, it runs over the surface of earth. Runoff water combines to form channels, rivers, lakes and ends up into seas and oceans.
Infiltration: Some of the precipitated water moves deep into the soil. Then it moves down and increases the ground water level.

Percolation: Some of the precipitated water flows through soil and porous or fractured rock.

Infiltration and percolation are two related but different processes describing the movement of water through soil.

Human impacts on water cycle

Major human activities affecting the water cycle on land are urbanisation, dumping of plastic waste on land and into water, polluting water bodies and deforestation.

Nitrogen Cycle

Nitrogen is the important nutrient needed for the survival of all living organisms. It is an essential component of proteins, DNA and chlorophyll. Atmosphere is a rich source of nitrogen and contains about 78% nitrogen. Plants and animals cannot utilize atmospheric nitrogen. They can use it only if it is in the form of ammonia, amino acids or nitrates.

Processes involved in nitrogen cycle are explained below.

Nitrogen fixation : Nitrogen fixation is the conversion of atmospheric nitrogen, which is in inert form, to reactive compounds available to living organisms. This conversion is done by a number of bacteria and blue green algae (Cyanobacteria). Leguminous plants like pea and beans have a symbiotic relationship with nitrogen fixing bacteria

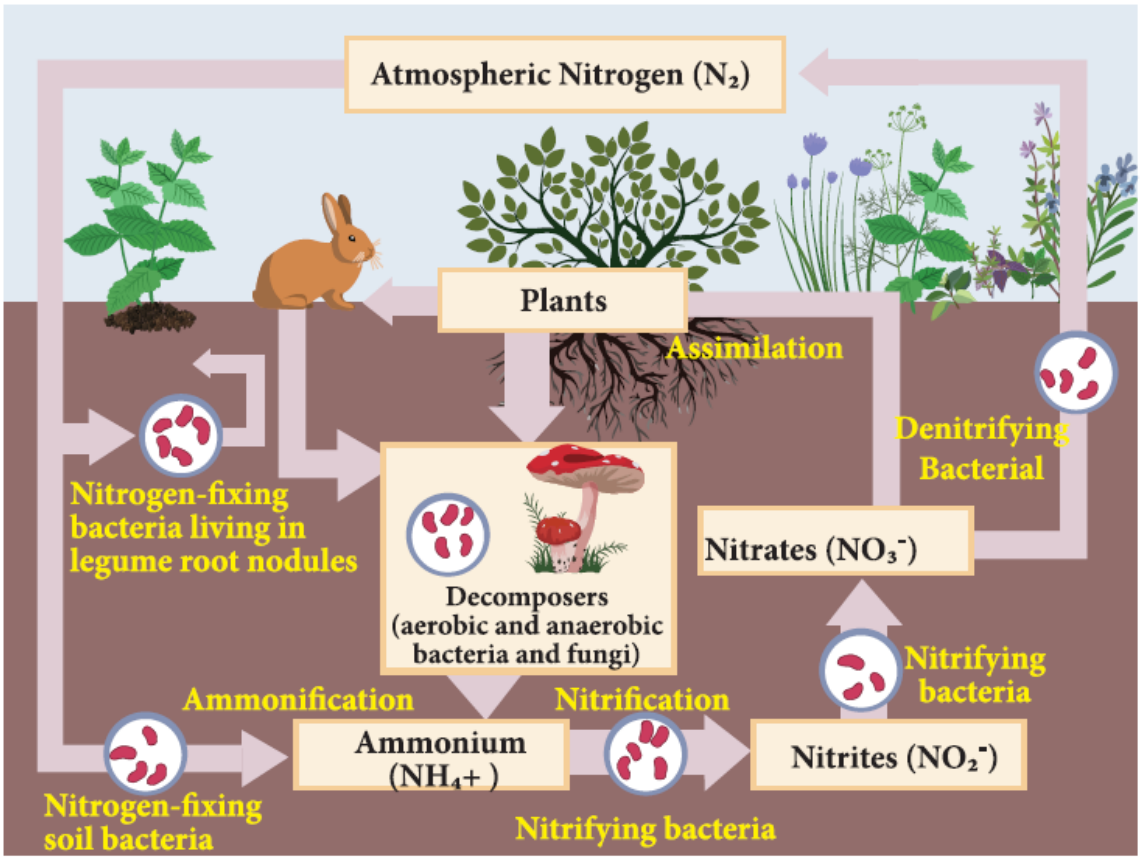
Rhizobium. Rhizobium occur in the root nodules of leguminous plants and fixes nitrogenous compounds.

Nitrogen assimilation: Plants absorb nitrate ions and use them for making organic matter like proteins and nucleic acids. Herbivorous animals convert plant proteins into animal proteins. Carnivorous animals synthesize proteins from their food.

Ammonification: The process of decomposition of nitrogenous waste by putrefying bacteria and fungi into ammonium compounds is called ammonification. Animal proteins are excreted in the form of urea, uric acid or ammonia. The putrefying bacteria and fungi decompose these animal proteins, dead animals and plants into ammonium compounds.

Nitrification: The ammonium compounds formed by ammonification process are oxidised to soluble nitrates. This process of nitrate formation is known as nitrification. The bacteria responsible for nitrification are called as nitrifying bacteria.

Denitrification: Free living soil bacteria such as Pseudomonas sp. reduce nitrate ions of soil into gaseous nitrogen which enters the atmosphere.



Nitrogen cycle

Microorganisms involved in nitrogen cycle

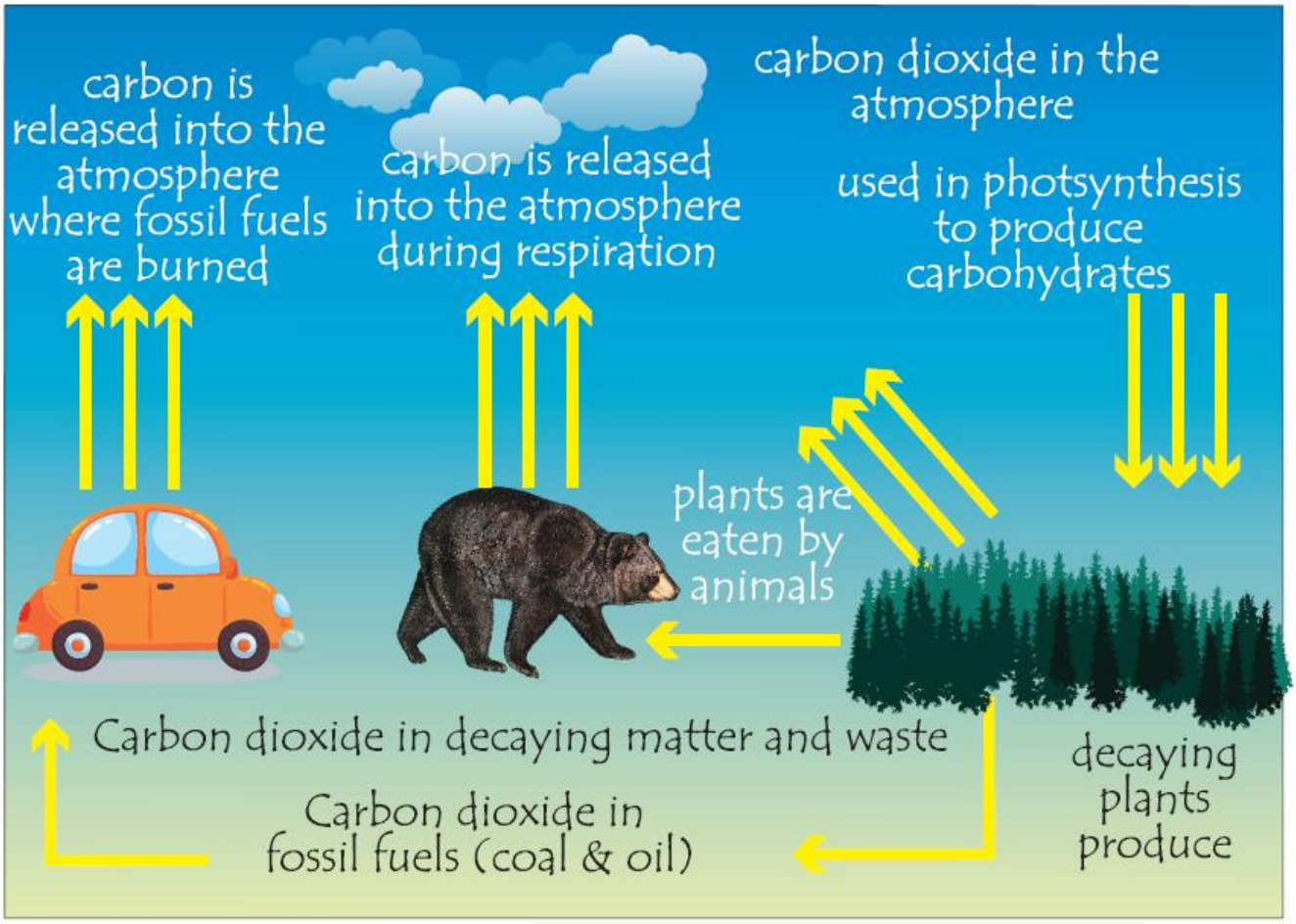
Role played in nitrogen cycle	Name of the microorganisms
Nitrogen fixation	*Azotobacter* (in soil) *Rhizobium* (in root nodules) Blue green algae- *Nostoc*
Ammonification	Putrefying bacteria, Fungi
Nitrification	Nitrifying bacteria *i. Nitrosomonas* *ii. Nitrobacter*
Denitrification	Denitrifying bacteria *Pseudomonas*

Human impacts on nitrogen cycle

Burning fossil fuels, application of nitrogen-based fertilizers and other activities can increase the amount of biologically available nitrogen in an ecosystem. Nitrogen applied to agricultural fields enters rivers and marine systems. It alters the biodiversity, changes the food web structure and destroys the general habitat.

Carbon Cycle

Carbon occurs in various forms on earth. Charcoal, diamond and graphite are elemental forms of carbon. Combined forms of carbon include carbon monoxide, carbon dioxide and carbonate salts. All living organisms are made up of carbon containing molecules like proteins and nucleic acids. The atmospheric carbon dioxide enters into the plants through the process of photosynthesis to form carbohydrates. From plants, it is passed on to herbivores and carnivores. During respiration, plants and animals release carbon into atmosphere in the form of carbon dioxide. Carbon dioxide is also returned to the atmosphere through decomposition of dead organic matter, burning fossil fuels and volcanic activities.



Carbon Cycle

Human impacts on carbon cycle

More carbon moves into the atmosphere due to burning of fossil fuels and deforestation. Most of the carbon in atmosphere is in the form of carbon dioxide. Carbon dioxide is a greenhouse gas. By increasing the amount of carbon dioxide, earth becomes warmer. This leads to greenhouse effect and global warming.

Adaptations of Plants

Any feature of an organism or its part that enables it to exist under conditions of its habitat is called adaptation. On the basis of water availability, plants have been classified as:

i. Hydrophytes
ii. Xerophytes
iii. Mesophytes

Hydrophytes

Plants growing in or near water are called hydrophytes. Hydrophytes may be free floating or submerged plants living in lakes, ponds, shallow water, marshy lands and marine habitat. Hydrophytes face certain challenges in their habitat. They are:

i. Availability of more water than needed.
ii. Water current may damage the plant body.
iii. Water levels may change regularly.
iv. Maintain buoyancy in water.

Adaptations of hydrophytes

1. Roots are poorly developed as in Hydrilla or absent as in Wolffia.
2. Plant body is greatly reduced as in Lemna.
3. Submerged leaves are narrow or finely divided. e.g. Hydrilla.
4. Floating leaves have long leaf stalks to enable the leaves move up and down in response to changes in water level. e.g. Lotus.
5. Air chambers provide buoyancy and mechanical support to plants as in Eichhornia (swollen and spongy petiole).

Xerophytes

Plants that grow in dry habitat are called xerophytes. These plants develop special structural and physiological characteristics to meet the following conditions:

i. To absorb as much water as they can get from the surroundings.
ii. To retain water in their organs for very long time.
iii. To reduce the transpiration rate.
iv. To reduce consumption of water.

Adaptations of xerophytes

1. They have well developed roots. Roots grow very deep and reach the layers where water is available as in Calotropis.
2. They store water in succulent water storing parenchymatous tissues. e.g. Opuntia, Aloe vera.
3. They have small sized leaves with waxy coating. e.g. Acacia. In some plants, leaves are modified into spines. e.g. Opuntia.
4. Some of the xerophytes complete their life cycle within a very short period when sufficient moisture is available

Mesophytes

Mesophytes are common land plants which grow in situations that are neither too wet nor too dry. They do not need any extreme adaptations.

Adaptations of mesophytes

1. The roots of mesophytes are well developed and are provided with root caps.
2. The stem is generally straight and branched.
3. The leaves are generally broad and thin.
4. The presence of waxy cuticle in leaves traps the moisture and lessens water loss.
5. Leaves have stomata which close in extreme heat and wind to prevent transpiration.

Adaptations of Animals

Animals can adapt themselves according to their habitat. Temperature and light are forms of energy which influence various stages of life activities such as growth, metabolism, reproduction, movement, distribution and behaviour. Animals develop special features or behaviour patterns to escape from extreme conditions of temperature and light. In this context, let us study about the adaptive features of bat and earthworm.

Adaptations of Bat

Bats are the only mammals that can fly. Mostly, bats live in caves. Apart from caves, bats also live in trees, hollowed logs and rock crevices. They are extremely important to humans as they reduce insect population and help to pollinate plants. Adaptations of bat in relation to their habitat are explained below.

Nocturnality

Bats are active at night. This is a useful adaptation for them, as flight requires a lot of energy during day. Their thin, black wing membrane (Patagium) may cause excessive heat absorption during the day. This may lead to dehydration.

Flight adaptation

Forelimbs are modified serve wings. Tail supports and controls movements during flight. Muscles are well developed and highly powerful and achieve in beating of wings. Tendons of hind limbs provide a tight grasp when the animals are suspended upside down at rest.

Hibernation

Hibernation is a state of inactivity in which the body temperature drops with a lowered metabolic rate during winter. Bats are warm blooded animals but unlike other mammals, they let their internal temperature reduce when they are resting. They go to a state of decreased activity to conserve energy.

Echolocation

Bats use a remarkable high-frequency system called echolocation. Bats give out high-frequency sounds (ultrasonic sounds). These sounds are reflected back from its prey and perceived by the ear. Bats use these echoes to locate and identify the prey.

Adaptations of Earthworm

It is commonly found in soil, feeding on live and dead organic matter. Earthworm plays a vital role in maintaining soil fertility. It facilitates aeration, water infiltration and producing organic matter to increase crop growth. Some of the adaptations of earthworm are:

Stream-lined body

The earthworm has a cylindrical, elongated and segmented body. This helps them to live in narrow burrows underground and for easy penetration into the soil.

Skin

Mucus covers the skin which does not allow soil particles to stick to it. Moist skin helps in oxygenation of blood.

Burrowing

Its body is flexible having circular and longitudinal muscles which help in movement and subsoil burrowing. Each segment on the lower surface of the body has number of setae. They help the earthworm to move through the soil and provide anchor in the burrows.

Aestivation

When the soil becomes too hot or dry, earthworms become inactive and undergo a process called aestivation. Earthworm moves deeper into the soil. It secretes mucus and lowers their metabolic rate in order to reduce water loss. They remain dormant until conditions become favourable. They come out of their burrow during rainy season.

Earthworms are referred as 'Farmer's friend'. After digesting organic matter, earthworms excrete a nutrient-rich waste product called castings which is used as Vermicompost.

Nocturnality

Earthworms are sensitive to light. It has no eyes but can sense light through light sensitive cells (Photoreceptors) present in their skin. They react negatively to bright light (Photophobic). It remains in its burrow during the day to avoid light.

Water Conservation

Water conservation is the preservation, control and management of water resources. It also includes activities to protect the hydrosphere and to meet the current and future human demand.

Importance of Water Conservation

- It creates more efficient use of the water resources.
- It ensures that we have enough usable water.
- It helps in decreasing water pollution.
- It helps in increasing energy saving.

Water Conservation Measures

Industrial conservation

Water conservation measures that can be taken by industries are:

- using dry cooling systems.
- if water is used as cooling agent, reusing the water for irrigation or other purposes.

Agricultural conservation

Agricultural water is often lost due to leaks in canals, run off and evaporation. Some of the water conserving methods are:

- using lined or covered canals that reduce loss of water and evaporation.
- using improved techniques such as sprinklers and drip irrigation.
- encouraging the development of crops that require less water and are drought resistant.
- mulching of soil in vegetable cultivation and in horticulture.

World Water Day on 22nd March every year, is about focusing attention on the importance of water.

Domestic conservation

All of us have the responsibility to conserve water. We can conserve water by the following activities:

- Using a bucket of water to take bath than taking a shower.
- Using low flow taps.
- Using recycled water for lawns.
- Repairing the leaks in the taps.
- Recycling or reusing water wherever it is possible.

Strategies adopted to conserve Water

i. Rain water harvesting.
ii. Improved irrigation techniques.
iii. Active use of traditional water harvesting structures.
iv. Minimising domestic water consumption.
v. Awareness on water conservation.
vi. Construction of farm ponds.
vii. Recycling of water.

Farm Ponds

Farm ponds are used as one of the strategies to support water conservation. Much of the rainfall runs off the ground. The run off not only causes loss of water but also washes away precious top soil. Farm ponds help the farmers to store water and to use it for irrigation.

Layout of a Farm Pond

Farm pond is a dugout structure with definite shape and size. They have proper inlet and outlet structures for collecting the surface runoff flowing from the farm area. The stored water is used for irrigation.

Advantages of Farm Ponds

The advantages of farm ponds are:

- They provide water to growing crops, without waiting for rainfall.
- They provide water for irrigation, even when there is no rain.
- They reduce soil erosion.
- They recharge ground water.
- They improve drainage.
- The excavated soil can be used to enrich soil in fields and levelling lands.
- They promote fish rearing.
- They provide water for domestic purposes and livestock.

Water Recycling

Water recycling, apart from rain water harvesting, is also one of the key strategies to conserve water. Water recycling is reusing treated wastewater for beneficial purposes such as agricultural and landscape irrigation, industrial processes, flushing in toilets and ground water recharge.

Wastewater Recycling Stages

Conventional waste water treatment consists of a combination of physical, chemical and biological processes which remove solids, organic matter and nutrients from waste water. The waste water treatment involves the following stages:

Primary treatment

Primary treatment involves temporary holding of the wastewater in a tank. The heavy solids get settled at the bottom while oil, grease and lighter solids float over the surface. The settled and floating materials are removed. The remaining liquid undergoes secondary treatment.

Secondary treatment

Secondary treatment is used to remove the biodegradable dissolved organic matter. This is performed in the presence of oxygen by aerobic microorganisms (Biological

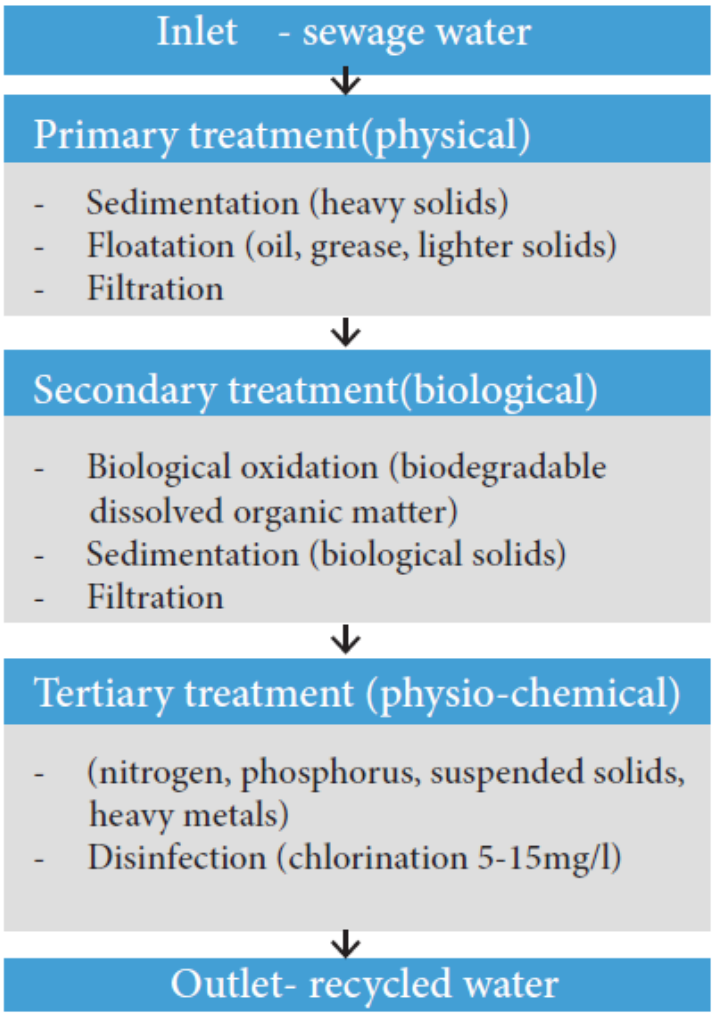
oxidation). The microorganisms must be separated from treated water waste by sedimentation. After separating the sediments of biological solids, the remaining liquid is discharged for tertiary treatment.

Tertiary treatment

Tertiary or advanced treatment is the final step of sewage treatment. It involves removal of inorganic constituents such as nitrogen, phosphorus and microorganisms. The fine colloidal particles in the sewage water are precipitated by adding chemical coagulants like alum or ferric sulphate.

Uses of Recycled Water

- ❖ Agriculture
- ❖ Landscape
- ❖ Public parks
- ❖ Cooling water for power plants and oil refineries
- ❖ Toilet flushing
- ❖ Dust control
- ❖ Construction activities



IUCN (International Union for Conservation of Nature and Natural Resources)

IUCN is an international organization working in the field of nature conservation and sustainable use of natural resources. IUCN is the global authority on the status of the natural world and the measures needed to safeguard it.

Vision of IUCN

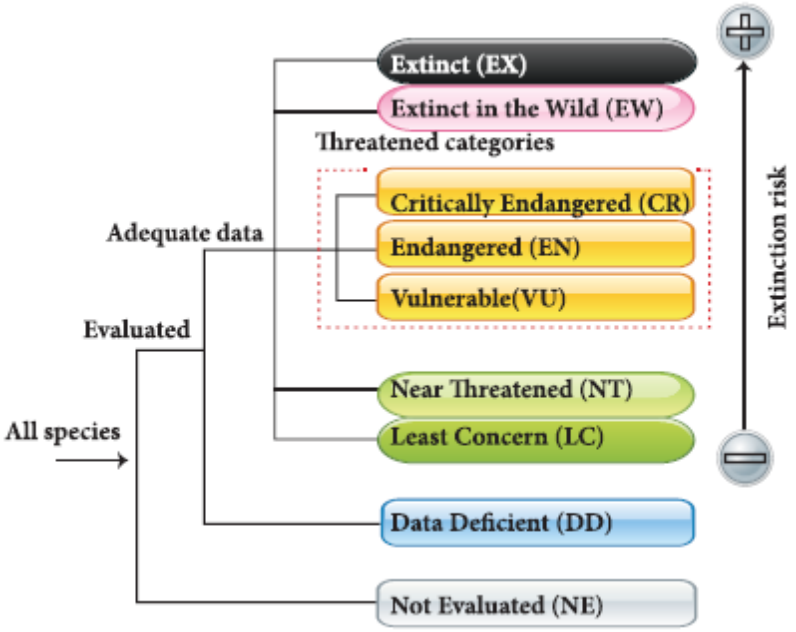
The vision of IUCN is 'A just world that values and conserves nature'.

Mission of IUCN

The mission of IUCN is to influence, encourage and assist societies throughout the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable.

The organization is best known to the wider public for compiling and publishing the IUCN red list of threatened species, which assesses the conservation status of species worldwide.
India, a mega diverse country with only 2.4 % of world's land area, accounts for 7-8% of all recorded species. It includes over 45,000 species of plants and 91,000 species of animals. The country's diverse physical features and climatic conditions have resulted in a variety of ecosystems such as forests, wetlands, grasslands, desert, coastal and marine ecosystems. Four of 34 globally identified biodiversity hotspots are found in India. They are:

- The Himalayas
- The Western ghats
- The North-East
- The Nicobar islands



Red List Categories of IUCN

India became state member of IUCN in 1969, through the Ministry of Environment, Forest and Climate change (MoEFCC).

IUCN was founded on 5th October 1948 at Gland, Switzerland.

Points to Remember

- ❖ Cyclic flow of nutrients between non-living environment and living organisms are termed as biogeochemical cycles.
- ❖ The ammonium compounds formed by ammonification process is oxidised to soluble nitrates. The process of nitrate formation is known as nitrification.
- ❖ Hydrophytes may be free floating or submerged plants living in lakes, ponds, shallow water, marshy lands and marine habitat.
- ❖ Plants that grow in dry habitat are called xerophytes.
- ❖ Mesophytes are common land plants which grow in situations that are neither too wet nor too dry.
- ❖ Animals develop special features or behaviour patterns to escape from the extreme conditions of temperature and light.
- ❖ Farm pond is a dugout structure with definite shape and size for collecting the surface runoff flowing from the area around the farm.
- ❖ Water recycling is reusing treated wastewater for beneficial purposes
- ❖ IUCN is the global authority on the status of the natural world and the measures needed to safeguard it.

10th STANDARD
UNIT 22 ENVIRONMENTAL MANAGEMENT

Introduction

Environmental management deals with the different aspects of environment, its structure, function, its quality and its maintenance including conservation of its living and non-living components. The diversified natural resources on this earth provide the necessities for survival of all forms of life including man. Everything that comes from nature has some utility for man but its utilization is possible based on the availability of appropriate technology.

Resources can be renewed simultaneously along with their exploitation (forests, crops, wildlife, groundwater, wind and solar energy). They can maintain themselves by natural recycling or can be replenished by proper management. Simultaneously, non-renewable resources cannot be recycled and can get exhausted by unlimited and continuous use (mineral ores, coal, petroleum etc). They cannot be replaced easily. This would lead to a situation where non-renewable resources may come to an end after a certain period of time.

Expanding human population resulted in expanding needs of man. With scientific and technological advancement man started utilizing natural resources at a much larger scale. Continuous increase in population caused an increased demand for resources. Therefore, conservation of natural resources makes important contributions to the social and economic development of the country.

Conservation and Judicious Use of Resources

Natural resources are conserved for their biological, economic and recreational values. The use of natural resources in excess and unplanned way leads to imbalance in the environment. A judicious balance should be maintained between exploitation of resources and its replenishment. Proper utilization and management of nature and its resources is termed as conservation.

We have to build a sustainable world, which should last forever. Some of the ways to sustain continuous use of resources are practices to utilise energy efficiently, avoid wastage of water, avoid usage of plastics and other non-biodegradable materials and to take care for the environment we live. It is important that we manage and use our resources carefully so as to preserve for the future generations.

Forest and its Importance

Forests are an important component of our environment and are dominated by microorganisms, flowering plants, shrubs, climbers, dense trees and provide a vast habitat for wild animals. Forests also contribute to the economic development of our country. Forests are vital for human life, it is a source for a wide range of renewable natural resource. They provide wood, food, fodder, fibre and medicine.
Forests are major factor of environmental concern. They act as carbon sink, regulate climatic conditions, increase rainfall, reduce global warming, prevent natural hazards like flood and landslides, protect wildlife and also act as catchments for water conservation. They also play a vital role in maintaining the ecological balance.

Deforestation and its Effects

Deforestation is the destruction of large area of forests. This happens for many reasons like intensive agriculture, urbanization, construction of dams, roads, buildings and industries, hydroelectric projects, forest fires, construction of mountain and forest roads. It is a threat to the economy, quality of life and future of the environment. India is losing about 1.5 million hectares of forest cover every year.

Chipko movement

The Chipko movement was a non-violent agitation in 1973 that was aimed at protection and conservation of trees. The name of the movement 'Chipko' comes from the word 'embrace', as the villagers hugged the trees and encircled them to prevent them from being cut. The movement originated in the Chamoli district of Uttar Pradesh (now Uttarakhand). The protest of Chipko movement achieved a major victory in 1980 with a 15 year ban on cutting trees in the Himalayan forests.

Effects of Deforestation

Deforestation gives rise to ecological problems like floods, drought, soil erosion, loss of wild life, extinction of species, imbalance of biogeochemical cycles, alteration of climatic conditions and desertification.

Conservation of Forests

India has an area of 752.3 lakh hectare classified as reserved forests and 215.1 lakh hectare as protected forests. The important measures taken for conservation of forests are as follows

Afforestation: Activities for afforestation programme (Van Mahotsav) includes planting and protecting trees with multiple uses which help in restoration of green cover. Destruction of trees should be curtailed.

Social forestry programme: It should be undertaken on a large scale with active participation of the public and utilization of common land to produce firewood, fodder and timber for the benefit of the rural community. This relieves pressure on existing forests and to safeguard future of tribals.

Forest Conservation through Laws: Adopting stringent laws and policies to conserve and protect forests are through National Forest Policy, (1952 and 1988) and Forest Conservation Act, 1980.

Wildlife and its Conservation

Wild life refers to the undomesticated animals living in their natural habitats (forests, grasslands and deserts) an area without human habitation. They are needed for maintaining biological diversity. It also helps in promoting economic activities that generates revenue through tourism. Conservation of forest and wildlife is interrelated with each other.

Decline in Wildlife Population

Wildlife of India is a great natural heritage. Exploitation of wildlife resources has decreased global wildlife population by 52% between 1970 and 2014. Over exploitation and shrinking of forest cover areas has resulted in animals becoming extinct, some are threatened and some are on the verge of extinction. In recent years, increase in human encroachment has posed a threat to India's wildlife.

Aims of Wildlife Management

The main aim of wildlife conservation are:

- To control and limit exploitation of species.
- To preserve the plants and animals from extinction.
- Maintenance of threatened species and protect species which are on the verge of extinction.
- Preserve the endangered species.
- To study the ecological relationship of the plants and animals in natural habitat.
- Hunting and poaching should be prohibited.

- ❖ Establishment of National parks, Wild life sanctuaries, protected areas and Biosphere reserves.

The Wildlife protection Act was established in 1972. The provisions of the act are

- ❖ Prohibit killing and hunting of specified animals.
- ❖ Constitute sanctuaries, national parks, and closed areas for wildlife conservation.
- ❖ Special schemes for preservation of endangered species.
- ❖ Constitute Central Zoo Authority and recognition of zoos.
- ❖ Restrict, regulate or prohibit trade in wild animals and products obtained from them.

Jim Corbett National Park was the first to be established in 1936 in Uttarakhand, India.

- ❖ There are 15 biosphere reserves in India.
- ❖ The Nilgiris is a biosphere reserve in Tamil Nadu.

Organisations Involved in Conservation of Wildlife

i. Indian Board for Wild Life (IBWL)
ii. World Wildlife Fund (WWF) for Nature
iii. World Conservation Union (WCN)
iv. International Union for Conservation of Nature and Natural resources (IUCN)
v. Convention of International Trade in Endangered Species (CITES)
vi. Bombay Natural History Society
vii. Wild life Preservation Society of India, Dehradun

Rathika Ramasamy, a native of Venkatachalapuram village, Theni District in Tamil Nadu was the first Indian woman to strike an International reputation as wildlife photographer. Her passion is towards bird photography. A photobook on wildlife titled "The best of wildlife moments" was published in November 2014.

Wildlife Conservation Initiatives In India.

- ❖ Project Tiger and Project Elephant has been launched in 1973 and 1992 respectively
- ❖ Crocodile Conservation Project was launched in 1976.
- ❖ Sea Turtle Conservation Project was launched in 1999.

- ❖ Indian Rhino Vision 2020 is to conserve at least 3000 greater one-horned rhinos in Assam, India by 2020.

Soil Erosion

The top layers of soil contain humus and mineral salts, which are vital for the growth of plants. Removal of upper layer of soil by wind and water is called soil erosion. Soil erosion causes a significant loss of humus, nutrients and decrease the fertility of soil.

Agents of Soil Erosion

Agents of soil erosion are high velocity of wind, air currents, flowing water, landslide, human activities (deforestation, farming and mining) and overgrazing by cattle.

Management of Soil Erosion

- ❖ Retain vegetation cover, so that soil is not exposed.
- ❖ Cattle grazing should be controlled.
- ❖ Crop rotation and soil management improve soil organic matter.
- ❖ Runoff water should be stored in the catchment.
- ❖ Reforestation, terracing and contour ploughing.
- ❖ Wind speed can be controlled by planting trees in form of a shelter belt.

Renewable and Non-Renewable Energy Resources

Energy is an important input for development. The expansion of possible energy resources has been directly related with the pace of agricultural and industrial development in every part of the world. Energy resources can be classified as non-renewable and renewable.

Non-renewable (Exhaustible) energy resources

Energy obtained from sources that cannot renew themselves over a short period of time is known as non-renewable energy. These are available in limited amount in nature. They include coal, petroleum, natural gas and nuclear power. These conventional energy resources account for 90% of the world's production of commercial energy and nuclear power account for 10%.

Renewable (Inexhaustible) energy resources

These energy resources are available in unlimited amount in nature and they can be renewed over a short period of time, inexpensive and can be harvested continuously. These comprise the vast potential of non-conventional energy resources which

include biofuel, biomass energy, geothermal energy, water energy (hydroelectric energy and tidal energy), solar energy, wave energy and wind energy.

Fossil Fuels

Fossil fuels are found inside the earth's crust and are energy rich substances formed by natural process, such as anaerobic decomposition of buried dead organisms, over millions of years. As the accumulating sediment layers produce heat and pressure, the remains of the organisms are gradually transformed into hydrocarbons. e.g. petroleum, coal and natural gas.

Coal and Petroleum

Coal and Petroleum are natural resources. They are called fossil fuels as they are formed from the degradation of biomass buried deep under the earth millions of years ago.

India is the third largest consumer of crude oil in the world, after the United States and China.

Coal is used for generation of electricity at Thermal power plants. Petroleum also known as crude oil is processed in oil refineries to produce petrol and diesel which are used to run automobiles, trucks, trains, ships and airplanes etc. Kerosene and LPG (Liquefied Petroleum Gas) obtained from petroleum is used as domestic fuel for cooking food.

The coal and petroleum reserves can get exhausted if we continue using them at a rapid rate. The formation of these fossil fuels is a very slow process and takes very long period of time for renewal.

Steps to Conserve Coal and Petroleum Resources

It is necessary to conserve or save coal and petroleum resources for the future use, which can be done by reducing their consumption.

i. If electricity is saved, it will in turn reduce the use of coal
ii. Using bicycle for covering short distances instead of using cars, scooters or motor cycles
iii. Using pressure cooker can reduce the consumption of kerosene and LPG while cooking food. Solar cooker and solar heaters can be used wherever possible

iv. Motor vehicles should be designed with fuel efficient engines to increase efficiency and also reduce air pollution

The Taj Mahal is one of the seven wonders of the world and is located in Agra, Uttarpradesh. It is built with white marble. The Mathura oil refinery owned by Indian Oil Corporation present around this area produce sulphur and nitrogen oxides. The white marble became yellow due to air pollution. The Government of India has set up emission standards around the monument to protect it from the damage.

Non-Conventional (Alternative) Energy Resources

The energy crisis has shown that for sustainable development in energy sector we must conserve the non-renewable conventional resources from its rapid depletion and replace them by non-polluting, renewable sources which are environmentally clean.

Efforts are made to develop new sources of energy which is called non-conventional sources of energy. It would provide greater initiative to local people who could assess their needs and resources and plan a strategy that could be useful to them.

Solar Energy

Solar energy is the energy obtained from the sun. The sun gives out vast amount of light and heat. It is only a little less than half (47 %) of solar energy which falls on the atmosphere reaches the earth's surface. If we could use just a small part of this energy it would fulfill all the country's need for power. Solar energy has advantages and also certain limitations.

Solar Energy Devices

The energy from the sun can be harnessed to provide power. The various devices used for harnessing sun's energy are called solar energy devices.

Solar Cells

Solar cells (Photovoltaic devices) is made up of silicon that converts sunlight directly into electricity. Solar cell produces electricity without polluting the environment. Since it uses no fuel other than sunlight, no harmful gases, no burning and no wastes are produced. Th ese can be installed in remote and in accessible areas (forests and hilly regions) where setting up of power plant is expensive.

Uses of Solar cells

i. It can be used for street lighting, traffic signals, water pumping, battery charging system etc.
ii. It is used in artificial satellites and space probes
iii. It provides radio and TV transmission to remote areas
iv. It is used in calculators, electronic toys and watches.

Solar Panel

Arrangement of many solar cells side by side connected to each other is called solar panel. Th e capacity to provide electric current is much increased in the solar panel. But the process of manufacture is very expensive.

Solar Cooker

It consists of an insulated metal box or wooden box which is painted from inside so as to absorb maximum solar radiations. A thick glass sheet forms the cover over the box.

The reflector is the plane mirror which is attached to the box. Th e food is cooked by energy radiated by the sun.

Solar thermal power plant

In solar thermal power plants, many solar panels are used to concentrate sun rays, to heat up water into steam. Th e steam is used to run the turbines to produce electricity.

A capacity of 100 litres solar heater can save upto 1500 units of electricity per year.

Advantages of Solar Energy

i. It is available in abundance in our country and is free of cost.
ii. It is a renewable source of energy.
iii. It can be used for generating electricity or heat.
iv. It does not cause pollution.

Biogas

Biogas is the mixture of methane (nearly 75 %), hydrogen sulphide, carbon dioxide and hydrogen. It is produced by the decomposition of animal wastes (cow dung) and plant wastes in the absence of oxygen. It is also commonly called as 'Gobar gas' since the starting material used is cow dung which means gobar in Hindi.

Uses of biogas

i. It is used as fuel for cooking
ii. It is used to run motors and pump sets.
iii. It is used to generate electricity.

Advantages of biogas

i. It burns without smoke and therefore causes less pollution.
ii. An excellent way to get rid of organic wastes like bio-waste and sewage material.
iii. Left over slurry is a good manure rich in nitrogen and phosphorus
iv. It is safe and convenient to use
v. It can reduce the amount of greenhouse gases emitted.

Shale gas

Shale refers to the soft finely stratified sedimentary rock that is formed from the compaction of small old rocks containing mud and minerals – such as quartz and calcite, trapped beneath earth's surface. These rocks contain fossil fuels like oil and gas in their pores.

The fuel is extracted by a technique called hydraulic fracturing (drilling or well boring of sedimentary rocks layers to reach productive reservoir layers).

Environmental concerns of shale gas

i. Shale drilling could affect ground water reserves, which can contaminate the drinking water resources and also affect the fertility of the soil.
ii. Million gallons of water is needed to break and release the shale gas, which in turn can affect the water table.

Shale gas exploration: Cambay (Gujarat), Assam-Arakan (North East), Gondwana (Central India), Krishna Godavari onshore (East Coast), Cauvery onshore and Indo-Gangetic basins.

Wind Energy

The kinetic energy possessed by the wind is due to its high speed, that can be converted into mechanical power by wind turbines. The wind energy can be used for (i) generating electricity (ii) Run water pumps, flour mills etc. (iii) Rotatory motion of windmill is used to draw water from wells.

- ❖ The world's largest and tallest wind turbine is situated in Hawaii.
- ❖ One wind turbine can produce electricity for 300 homes.

Windmill

Windmill is a machine that converts the energy of wind into rotational energy by broad blade attached to the rotating axis. When the blowing air strikes the blades of the windmill, it exerts force and causes the blades to rotate. The rotational movement of the blades operate the generator and the electricity is produced. The energy output from each windmill is coupled together to get electricity on a commercial scale.

Advantages of Wind energy

i. Wind energy is free, eco-friendly, renewable source of energy.
ii. It does not cause pollution.
iii. Expenses on periodic maintenance is low when compared to the other power sources.

Water Energy

Earth's surface is covered with nearly 71% of water. Harnessing the energy from the flowing water can be used to produce electricity. The technique to harness the water energy is called Hydropower.

The electrical energy is derived from water flow, water falling from a height. Hilly areas are suitable for this purpose where there is continuous flow of water in large amounts falling from high slopes. It does not cause environmental pollution or waste generation.

Hydropower plants converts the kinetic energy of flowing water into electricity. This is called hydroelectricity.

Tidal Energy

Tidal energy is the energy obtained from the movement of water due to ocean tides. Tides are the rise and fall of sea levels caused by the combined effects of the gravitational forces exerted on the oceans of the earth.

A tidal stream is a fast flowing body of water created by tides. Turbines are placed in tidal streams. When the tides hit the turbine, the turbine rotates and converts the tidal energy into electric energy.

Advantages of tidal energy

i. Tidal energy does not produce any pollution.
ii. It does not use any fuel and does not produce any waste.
iii. Tides are predictable, so tidal energy can be produced at any time.
iv. Water is denser than air and therefore can generate electricity at lower speeds than wind turbines.

Rainwater Harvesting

Rainwater harvesting is a technique of collecting and storing rainwater for future use. It is a traditional method of storing rain water in underground tanks, ponds, lakes, check dams and used in future.

The main purpose of rainwater harvesting is to make the rainwater percolate under the ground so as to recharge 'groundwater level'.

Methods of rainwater harvesting

i. **Roof top rainwater harvesting**: Roof-tops are excellent rain catchers. The rain water that falls on the roof of the houses, apartments, commercial buildings etc. is collected and stored in the surface tank and can be used for domestic purpose.

ii. **Recharge pit**: In this method, the rainwater is first collected from the roof tops or open spaces and is directed into the percolation pits through pipes for filtration. After filtration the rainwater enters the recharge pits or ground wells.

People living in rural areas adopt a variety of water collecting methods to capture and store as rain water. Some of the methods used are

i. **Digging of tanks or lakes (Eris):** It is one of the traditional water harvesting system in Tamil Nadu. Eris are constructed in such a way that if the water in one eri overflows, it automatically gets diverted to the eri of the next village, as these eris are interconnected.

ii. **Ooranis**: These are small ponds to collect rainwater. The water is used for various domestic purposes (drinking, washing and bathing). These ponds cater the nearby villages.

Advantages of rainwater harvesting

Rainwater harvesting helps to

i. Overcome the rapid depletion of groundwater levels.
ii. To Meet the increase demand of water.
iii. Reduces flood and soil erosion
iv. Water stored in ground is not contaminated by human and animal wastes and hence can be used for drinking purpose.

Kallanai Dam, also known as Grand Anicut, is the fourth oldest dam in the world, constructed by King Karikala Chola of the Chola Dynasty in the 2nd century A.D.(CE). It still serves the people of Tamilnadu. The dam is located on the River Kaveri, approximately 20 km from the city of Tiruchirapalli.

Electrical Energy Management

Electricity or electric power is produced by generators. The generators are operated by the turbines attached to it. The turbines are rotated by steam, moving water or wind power to produce electricity.

Conservation of electrical energy

The following measures can be taken even at home and school to save electricity

i. Use energy efficient appliances to save electricity like Compact Fluorescent Lamps (CFL), Light Emiting Diode (LED)bulbs and other electric equipments.
ii. Switch off the lights and fans, television and other electrical appliances when not in use.
iii. Switch of the mobile phone chargers when not in use.
iv. Maximise the use of solar radiation. Solar water heating system can be used instead of electric geysers.
v. Minimise the use of air conditioners.

E-Wastes and its Management

E-wastes are generally called as electronic wastes, which includes the spoiled, outdated, non-repairable electrical and electronic devices. These wastes contain toxic metals like lead, cadmium, chromium and mercury, though also contain iron, copper, silicon, aluminium and gold which can be recovered.

Neverthless, only 5 % of e-wastes produced are recycled.

Sources of e-wastes

Electronic devices: Computers, laptops, mobile phones, printers, monitors, televisions, DVD players, calculators, toys, sport equipments, etc.

Household electrical appliances: Refrigerators, washing machine, microwave oven, mixer, grinder, water heater, etc.

Accessories: Printing cartridges, batteries and chargers.

E-wastes include
Computer components -66%
Telecommunication components - 12 %
Electronic components -5 %
Biomedical components -7 %
Other components -6 %

Environmental impact of e-wastes

Disposal of any kind of electrical and electronic devices without knowledge can become the landfill and water pollutants.

Electronic equipments contain many hazardous heavy metals such as lead, cadmium that can cause severe soil and groundwater pollution.

E-waste dumping yards and the places nearby are polluted and cause severe health hazard.

Health Effects of E- Wastes

Lead: Damages central and peripheral nervous system; affect brain development in children

Chromium: Asthmatic bronchitis

Cadmium: Accumulates in kidney and liver; neural damage

Mercury: Chronic damage to brain and respiratory system

Plastics including Polyvinyl Chloride (PVC): Burning produces dioxin which can cause developmental and reproductive problems, damages the immuns system.

Sewage Management

Untreated sewage or wastewater generated from domestic and industrial process is the leading polluter of water sources in India. Sewage water results in agricultural contamination and environmental degradation.

Sources of Sewage/wastewater

- Domestic purpose or household activities
- Dye and textile industries
- Leather industries
- Sugar and breweries industries
- Paper and pulp industries

The conventional wastewater treatment methods involve the following steps (a) Pre-screening (b) Aeration (c) Sludge Management and (d) Water Reuse.

Pre-screening: Wastewater generated from domestic and industrial activities is screened to remove soil and solid particulates.

Aeration: Screened wastewater is then pumped to an aeration tank. Here the microbial contaminants are removed by the biological degradation that occurs in the presence of air.

Sedimentation process: In this process, the solid particles in suspension form are allowed to settle. The particles that settle out from the suspension is known as sludge.

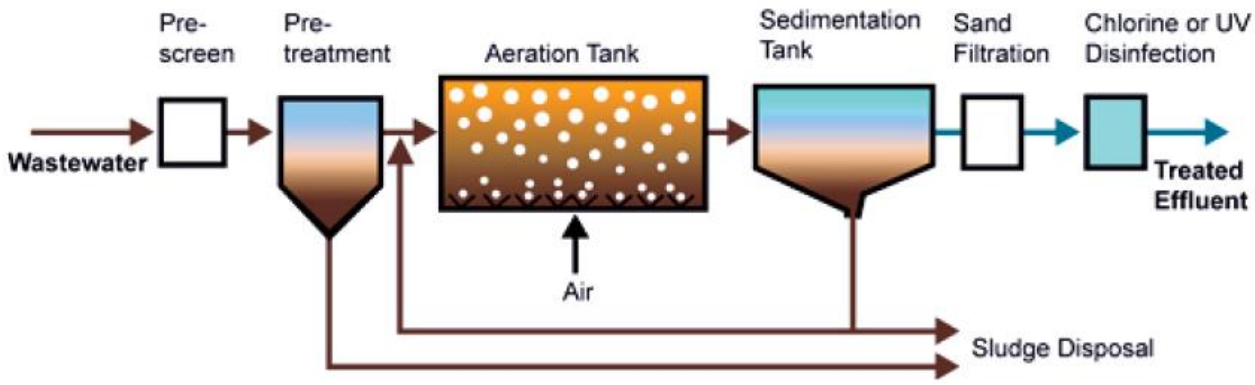
Sludge removal: The sludge generated by the degradation process is transferred periodically from the tank for safe disposal.

Disinfection: Chlorination and ultraviolet (UV) radiation of treated water is required to remove any microorganism contamination.

Water recycling: The water will then be supplied for domestic or industrial purposes.

Solid Waste Management

Solid wastes mainly include municipal wastes, hospital wastes, industrial wastes and e-wastes etc. The solid wastes are dumped in the soil which results in landscape pollution.



Conventional wastewater management

Solid-waste management involves the collection, treatment and proper disposing of solid material that is discarded from the household and industrial activities.

Methods of solid wastes disposal

i. **Segregation**: It is the separation of different type of waste materials like biodegradable and non biodegradable wastes.
ii. **Sanitary landfill**: Solid wastes are dumped into low lying areas. The layers are compacted by trucks to allow settlement. The waste materials get stabilised in about2-12 months. The organic matter undergoes decomposition
iii. **Incineration**: It is the burning of nonbiodegradable solid wastes (medical wastes) in properly constructed furnace at high temperature.
iv. **Composting**: Biodegradable matter of solid wastes is digested by microbial action or earthworms and converted into humus.

Recycling of wastes
Papers from old books, magazines and newspapers are recycled to produce papers in papermills.

Agricultural wastes like coconut shells, jute cotton stalk, bagasse of sugarcane can be used to make paper and hard board. Paddy husk can be used as livestock fodder.

Cow dung and other organic wastes can be used in go bar gas plant to provide biogas and manure for fields.

3R Approach

The 3R approach such as Reduce, Reuse and Recycle may be followed for effective waste management.

Points to Remember

- ❖ Conservation is a process which is concerned with the use, preservation and proper management of natural resources from destructive activities of human being.
- ❖ Conservation of natural resources contributes to the social and economic development of the country.
- ❖ Forests of a country constitute a major asset for the people of the country.
- ❖ National park is a reserved area for the conservation of entire wildlife including plants and animals.
- ❖ Sanctuary is a place reserved exclusively for the use of animals.
- ❖ Solar cell is a device that absorbs sunlight and converts it into electric energy.
- ❖ Solar water heater does not require electricity, they heat up water directly from sunlight.
- ❖ Biogas is produced by the anaerobic decomposition of cow dung.
- ❖ The technique of collecting and storing rain water for future purpose is known as rain water harvesting.
- ❖ Unwanted, non-working and outdated electronic products become e-waste