

SCIENCE

STANDARD SEVEN

Term III



Dear children, given above is a beautiful picture of a house with a garden in front. But you will be surprised to know that there are ten animals hidden in it. Shall we find them?

The picture shows a good relationship between plants and animals in a non-living environment.



1.1. ECO SYSTEM

“WILD ELEPHANTS STRAY INTO HUMAN HABITATION NEAR HOSUR”



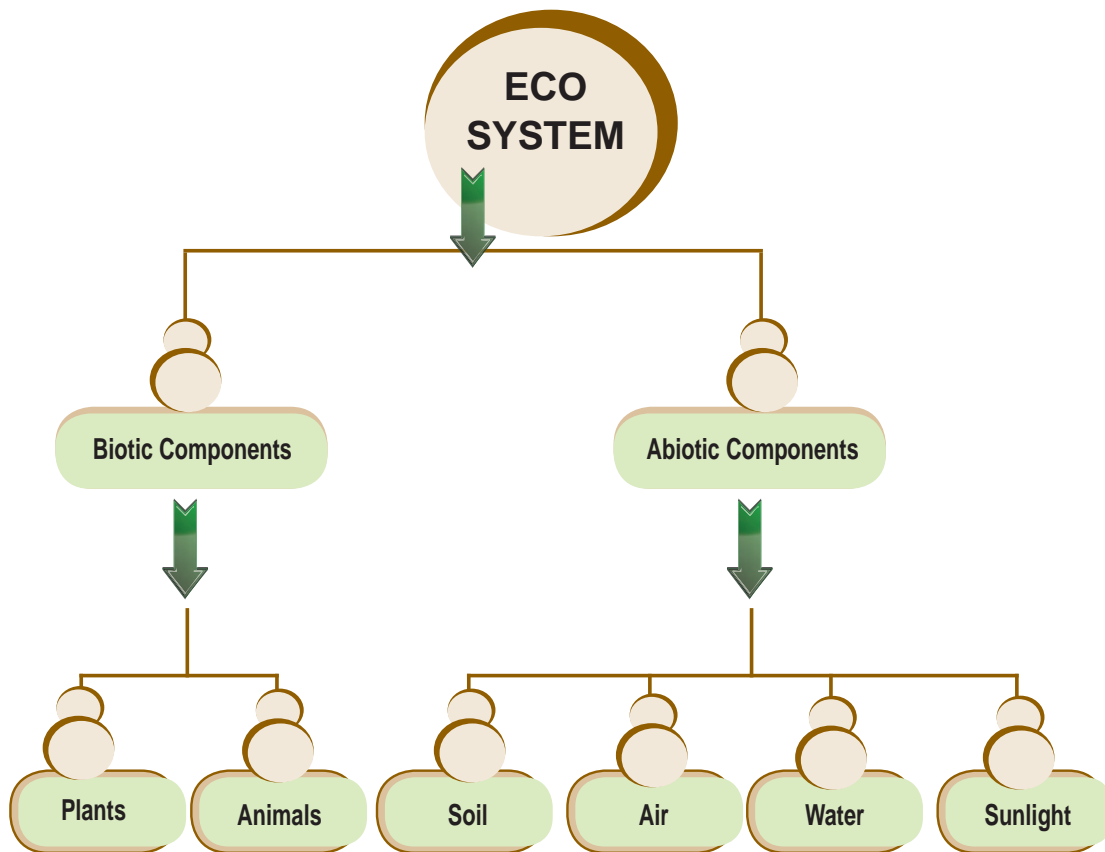
On 24th March, 2010, wild elephants entered Kumudepalli village, in Krishnagiri District. They were driven into the Sanamavu Forest near Hosur on that day. Three male wild elephants strayed into human habitation near Hosur on Tuesday.

According to the forest officials, the elephants aged between fifteen and twenty strayed into Kumudepalli village in the morning. On information, the officials led by District Forest Officer V.Ganesan, Assistant Conservator of Forest K.Rajendran and Hosur Ranger R.Madheswaran drove the pachyderms to the nearby Sanamavu Reserve Forests with the help of the villagers by bursting crackers.

Wild elephants entering into the human habitations have become an order of the day for the past three to five months. They did not harm anybody during the operation. Of the three elephants one is sub male elephant with the age of fifteen. And the other two are about twenty, an official said.

The above information is a newspaper report. Why have these elephants come out of the forest? move into the areas where people live.

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



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

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

Components of Eco-system

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

Biotic Components

The living components are broadly classified into three categories.

1. **Producers:** They are green

plants that prepare their own food by the process of photosynthesis.

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

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

Abiotic Components

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



ACTIVITY - 1.1

I DO

- ☛ I observe the picture.
- ☛ I recognise three biotic and two abiotic components in it.
- ☛ I write the names of three birds.

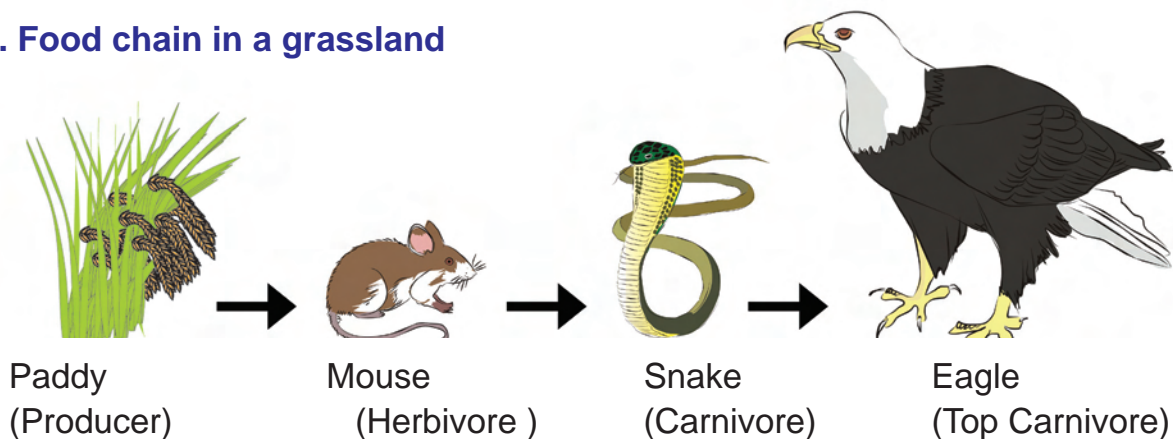


1. _____
2. _____
3. _____

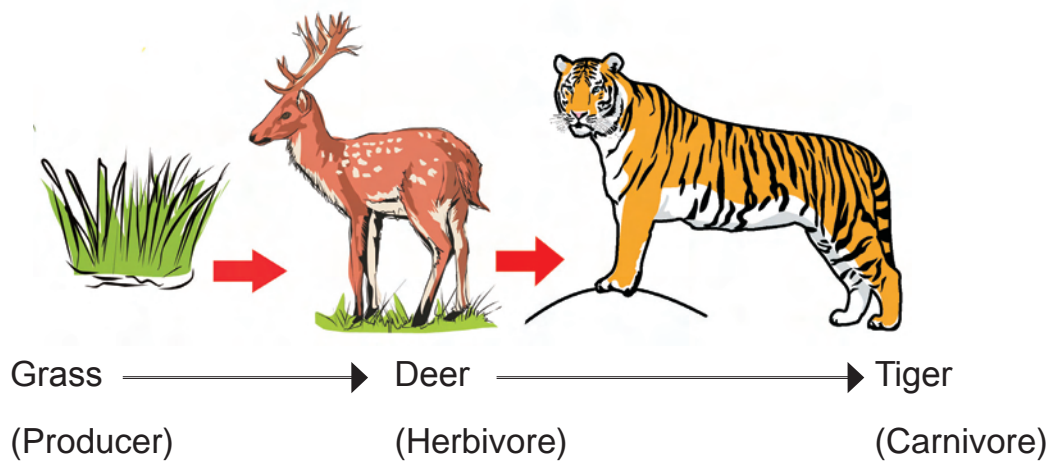
1.2. FOOD CHAIN

The sun is the ultimate source of energy to all living things. Green plants capture solar energy and convert carbon-dioxide and water into food by photosynthesis. This food energy is transferred to the primary consumer when they eat plants. Then the primary consumer is eaten by the secondary consumer which in turn is eaten by a tertiary consumer. So, in a given ecosystem, there is a process of organisms eating some others or being eaten by some other organisms. The path of energy transfer from one organism to another in a single direction is called a food chain.

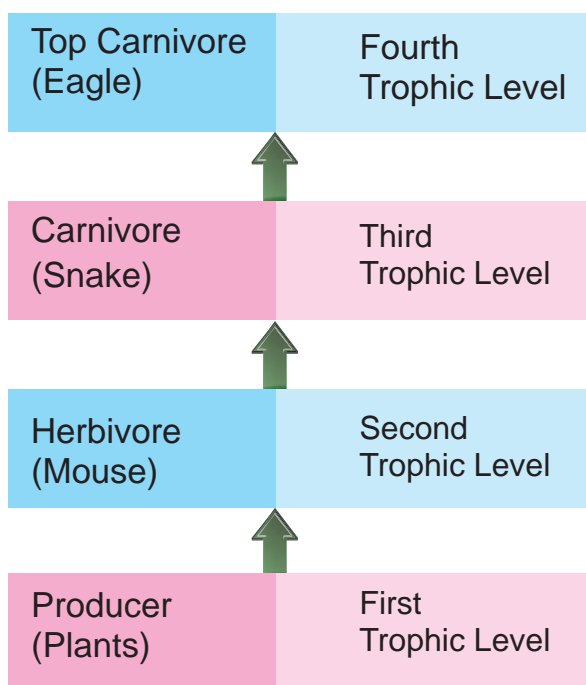
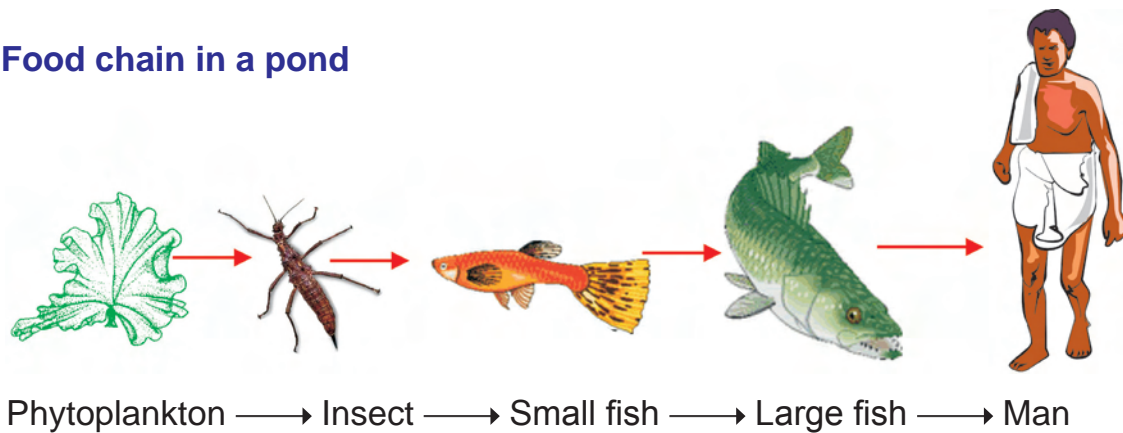
1. Food chain in a grassland



2. Food chain in a forest



3. Food chain in a pond



In a food chain, each group of organisms occupies a particular position. The position of organisms in a food chain is called **trophic level**.

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

MORE TO KNOW

If one link in a food chain is broken it would result in the extinction of a species.

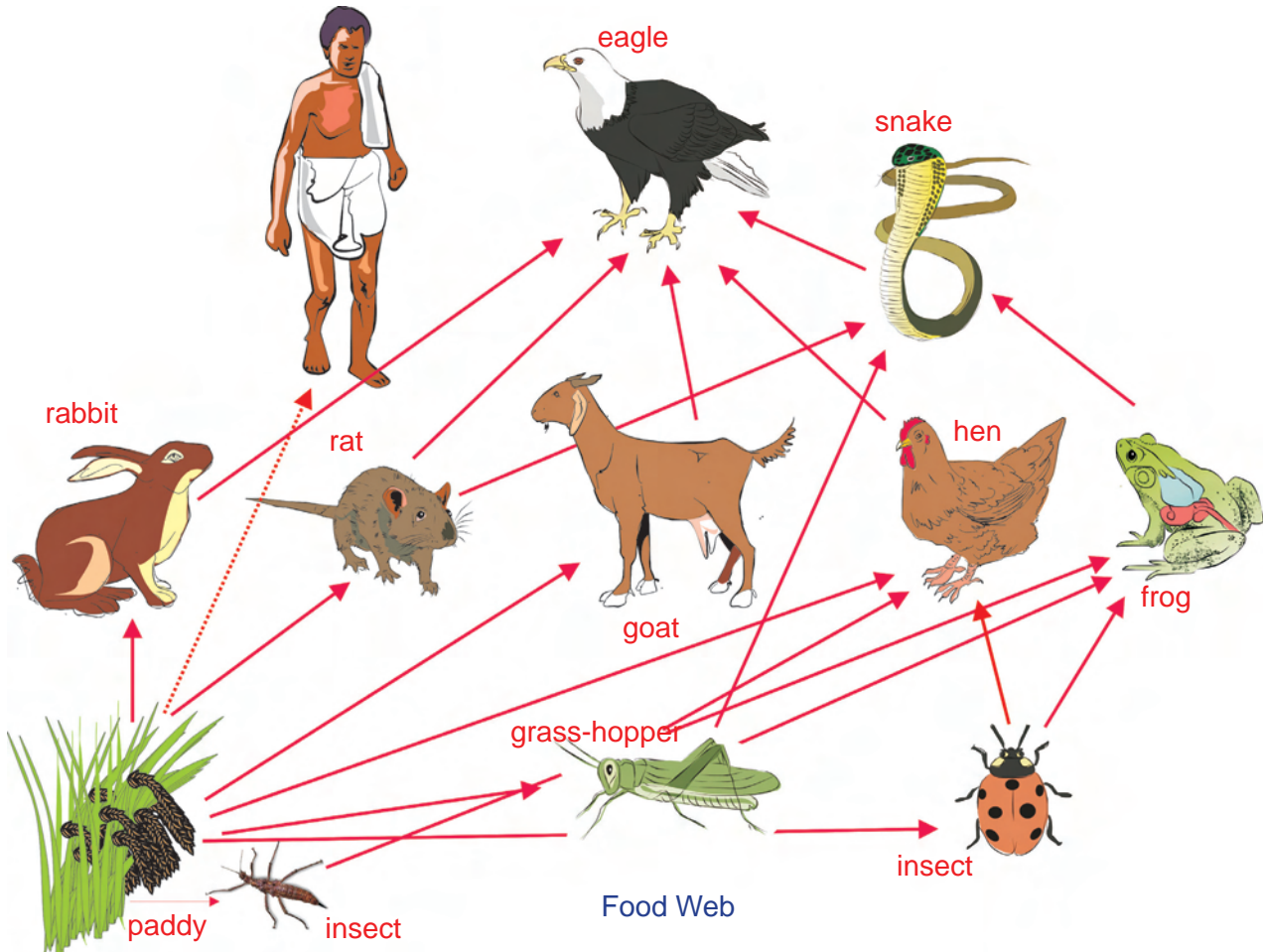


1.3. FOOD WEB

ACTIVITY 1.2

I DO

- I find which trophic level I belong to when I eat vegetables or meat.
- With dotted lines I show few more food chain links to man.



SCIENCE

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

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

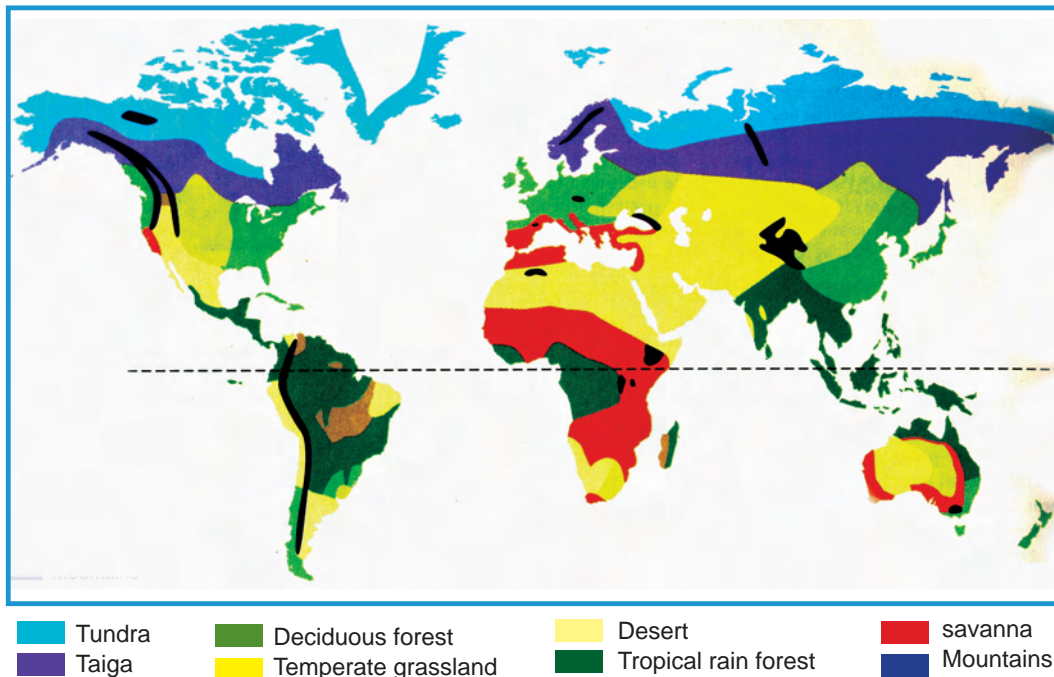
1.4. FLOW OF ENERGY

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

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

1.5. BIOME

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



THE DIFFERENT BIOMES

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

1.5.1. TYPES OF FORESTS

1) Tropical Rain Forest: They are found in South America, Africa and Indo Malaysia region near the equator. The weather is warm (20°C-25°C). Rainfall is plentiful, 190 cm per year. In India, they



Fig. 1.1. Tropical Rain Forest

ACTIVITY 1.3

WE DO

Divide the class into groups of four or five students each. Each group has to select any Biome and discuss its climate, flora and fauna found there.



are found in Andaman and Nicobar Islands, Western ghats, Assam and West Bengal.

2) Savannah: They are found South Africa, Western Australia, North West India and Eastern Pakistan. They love a dry weather alternating with wet weather. The rainfall is about 25cm per year. Frequent fires occur during the dry season. In India, grassy plains are found in the Nilgiris, Khasi hills and Naga hills.

3) Deserts: They are found Africa, Arizona in America and Mexican desert in Mexico. The days are hot and nights are cold. The annual rainfall is less than 25 cm. In India, it is found in Rajasthan (The Thar Desert).



Fig. 1.2. Desert

4) Temperate Grassland: It is found in North and South America and parts of Europe. The annual rainfall is 25cm to 100 cm. They have two very severe dry seasons. They have windy hot summers and cold winters. In India, It is found in Uttar Pradesh.

5) Deciduous Forests: They are found in North America, Eastern Asia and Europe. They receive 75 to 100 cm of rainfall. The climate is moderate with mild winters. In India, it is found

in Punjab, Tamil Nadu, Uttar Pradesh, Bihar, Odisha and Madhya Pradesh.

6) Taiga: It is found Canada, Europe and Russia. They are also called Boreal Forests. The climate is of a short cool summer and a long winter with abundant snowfall. The annual rainfall is 20cm to 60 cm. Most of it is covered with snow and ice. It is found in Himachal Pradesh, Punjab and Kashmir in India.

7) Tundra: It is found south of the ice covered poles in the Northern hemisphere. Though it receives 25 cm of rainfall, it has permanently frozen soil. The climate is extremely cold and windy. The temperature is less than 10°C. In India, it is found in the Himalayas.

1.5.2. IMPORTANCE OF FORESTS

1. Forests are the sources for the formation of rivers.
2. They increase the rainfall.
3. They prevent soil erosion and floods.
4. They become habitats to animals.
5. They maintain the oxygen and carbon dioxide balance in nature.

Forests are considered as God's first temples. They play an important role in our day-to-day life.

MORE TO KNOW

Vanamahotsav is an annual Indian tree planting festival celebrated in the month of July. It is to create an enthusiasm in the minds of people to conserve forests.

1.5.3. DIFFERENT FLORA AND FAUNA

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

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

ACTIVITY - 1.4

I DO

I match the product with its use.

1.	Timber	Pencil
2.	Shelter	Neem
3.	Music	Wood
4.	Tool	Coffee
5.	Medicine	Veena
6.	Drink	Palm Leaves

ACTIVITY - 1.5

I DO

Prepare a poster or logo or slogan or a notice related to deforestation.



EVALUATION

1. Pick out the correct answer:-

- Forest is an area with high density of _____ (trees / grass)
- _____ is an example of a natural ecosystem. (Paddy field / Desert)
- The third trophic level in a food chain comprises of _____
(herbivore / carnivore)
- A network of interlinked food chain is called a _____
(food web / food cycle)
- The festival of "Vanamahotsav" is celebrated in the month of _____.
(June / July)

2. Rearrange the following words to form a food chain.

- (a) snake, mouse, paddy, eagle, grasshopper.

_____ > _____ > _____ > _____ > _____

- (b) man, big fish, phytoplankton, small fish, insects.

-----> -----> -----> -----> -----

3.

Third Trophic level Carnivore Snake	Herbivore Second Trophic level Mouse	Plants Producers First Trophic level
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- Suggest the common idea derived from these boxes.
- Analyse the data given above and make a food chain.

4. Differentiate between the following:-

- Consumers and decomposers
- Food chain and food web

5. Discuss the effects of deforestation on the following:

- Wild animals
- Environment

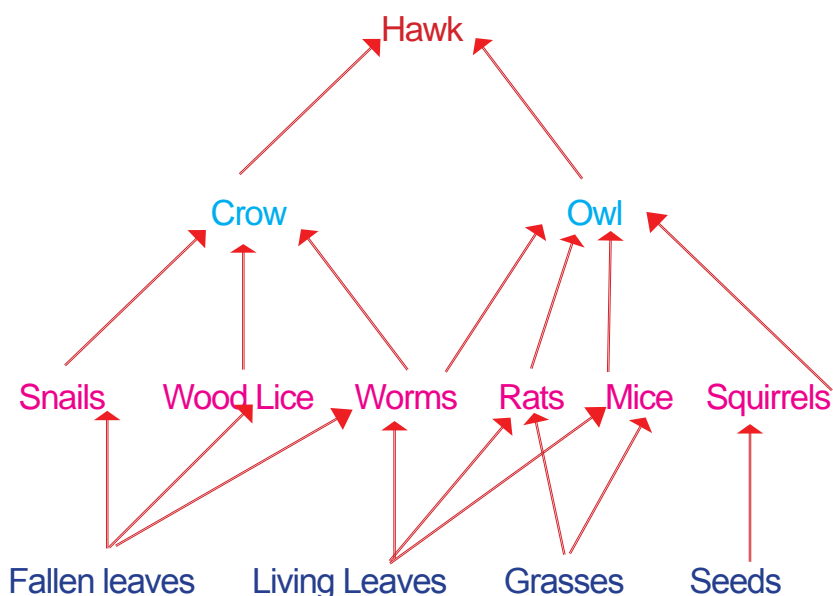
6. Food web in a forest is given below:

Top carnivore :

Carnivore :

Herbivore:

Producers:



a) From the diagram identify the following :

- a Carnivore
- a Herbivore
- a Producer

b) Select four organisms from the food web and draw as many food chain as possible.

7. Match the following types of forests with their unique characteristic features.

Rain forest, Savannah, Desert, Grassland, Taiga, Tundra.

S.No.	Characteristic feature	Types of Forest
a.	Frequent forest fire	_____
b.	Windy weather	_____
c.	Snow and ice	_____
d.	Hot days and cold nights	_____
e.	Ice covered frozen soil	_____
f.	Plentiful rainfall	_____



8. Given below are a list of animals. Match it with the biome where they are found.

- | | | |
|---------------|---|----------------------|
| a) Snake | - | Savannah |
| b) Cheetah | - | Tundra |
| c) Camel | - | Tropical Rain Forest |
| d) Antelope | - | Taiga |
| e) Black bear | - | Desert |
| f) Grey wolf | - | Deciduous forest |
| g) Penguin | - | Grassland |

FURTHER REFERENCE

Books

Ecology - Shukla and Chandel, S.Chand & Company, New Delhi

Environmental Science (9th edition) - Enger and Smith, McGraw Hill, New York

Websites

www.national_geographic.com

www.mongabay.com

Places of scientific importance for visit

1. Coral reefs in Mandapam, Ramanathapuram District
2. Mangrove forest in Pitchavaram, Cuddalore District



Fig. 2.1. Mettur dam

Valli, Inba and Selva have gone on a picnic to Mettur dam. Valli is surprised to see so much of water available on our planet Earth. She wonders why we still experience shortage of water. Selva tells them that 70% of our Earth is made of water but only 3% of it is fresh water. Hence only a fraction of it is fit for human consumption.

Children, shall we find out why we celebrate March 22 every year as World Water Day.

It is to arouse an awareness



2.1 AVAILABILITY OF WATER

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

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

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

MORE TO KNOW

IMPORTANT DAYS

- World Wetland Day - Feb 2
- World Forest Day - March 21
- Earth Day - April 22
- World Environment Day- June 5
- Natural Resources Day - October 5
- Nature Conservation Day - Nov 25

ACTIVITY 2.1

I DO

I collect clippings from newspapers and magazines on the news items, articles and pictures related to water shortage. I paste them in my scrapbook. I show and share the information with my teachers and friends.

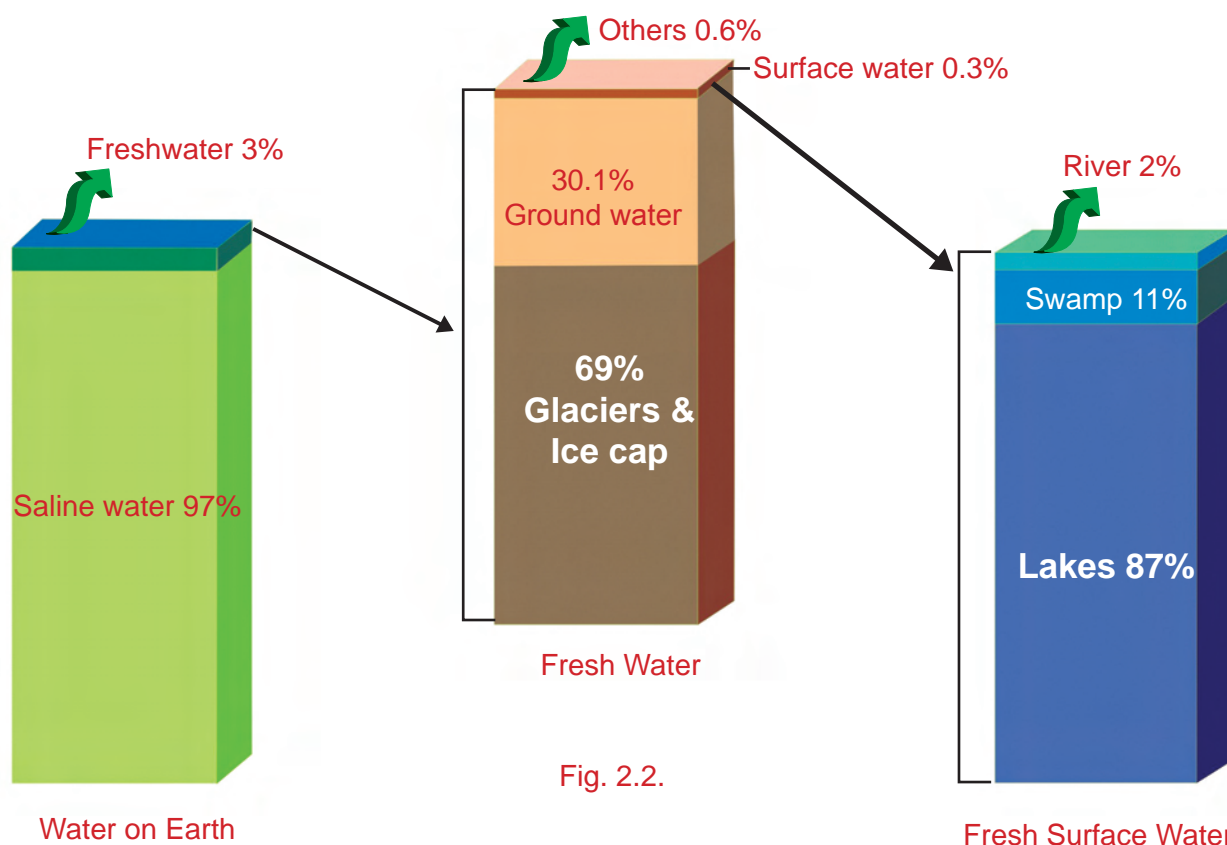


Fig. 2.2.



2.2. SOURCES OF WATER

1. Rain water

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

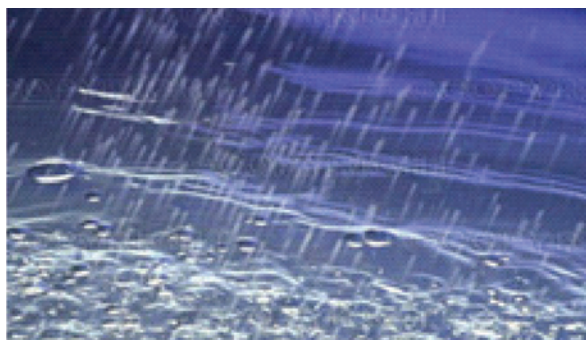


Fig. 2.3. Rain Water

2. Glaciers, ice and snow

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

3. River water

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

4. Sea and Ocean water

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

5. Lake and Pond water

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



Fig. 2.4. Glaciers

ACTIVITY 2.2

WE DO

Collect samples of rainwater, water from hailstones, river water, sea water and lake or pond water.

S.No.	Sample	Purity	Colour	Uses
1.				
2.				
3.				
4.				
5.				

2.3. FORMS OF WATER

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

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

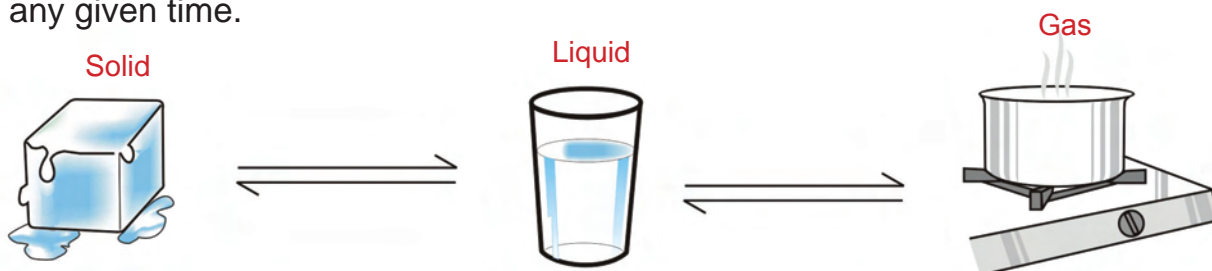


Fig. 2.5. (a) Water freezes to ice at 0°C

Fig. 2.5. (b) Water remains a liquid between 0°C and 100°C

Fig. 2.5. (c) Water changes to steam at 100°C

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

2. Liquid: Rain and dew are in the

form of water droplets. Also liquid water covers three quarters of the surface of the earth in the form of lakes, rivers and oceans.

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

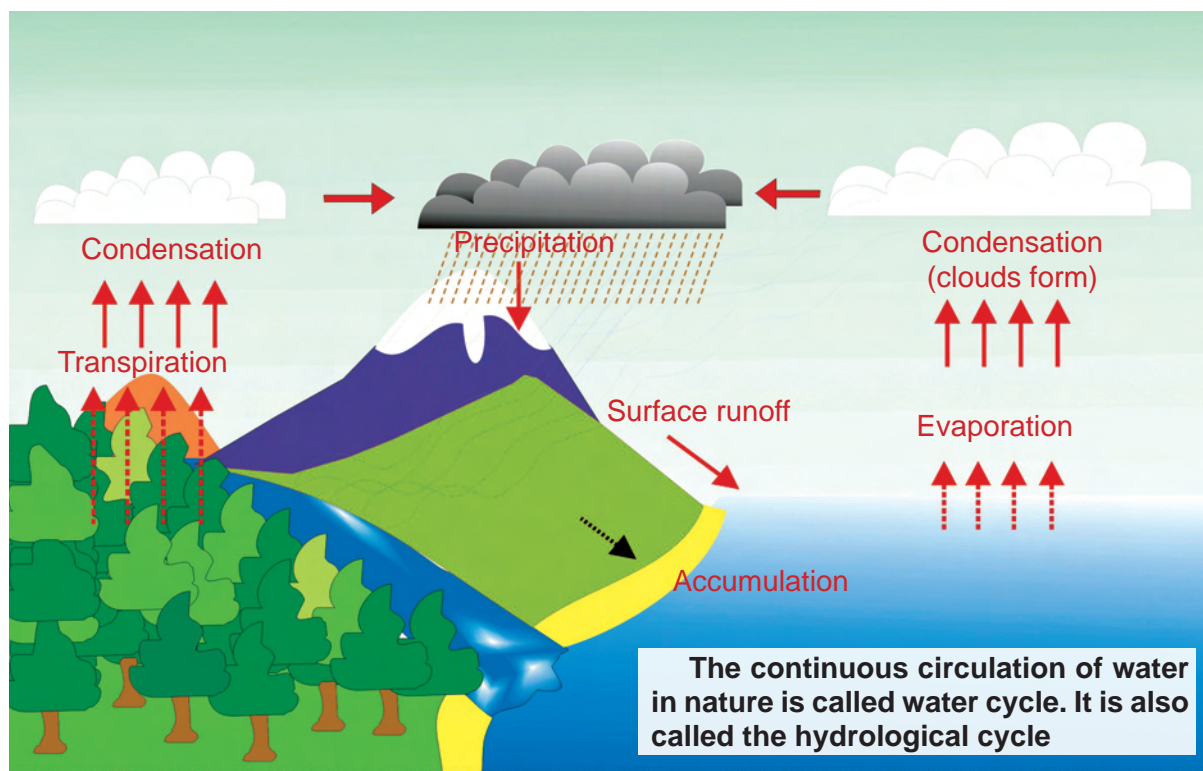


Fig. 2.6. Water cycle



2.4. GROUND WATER

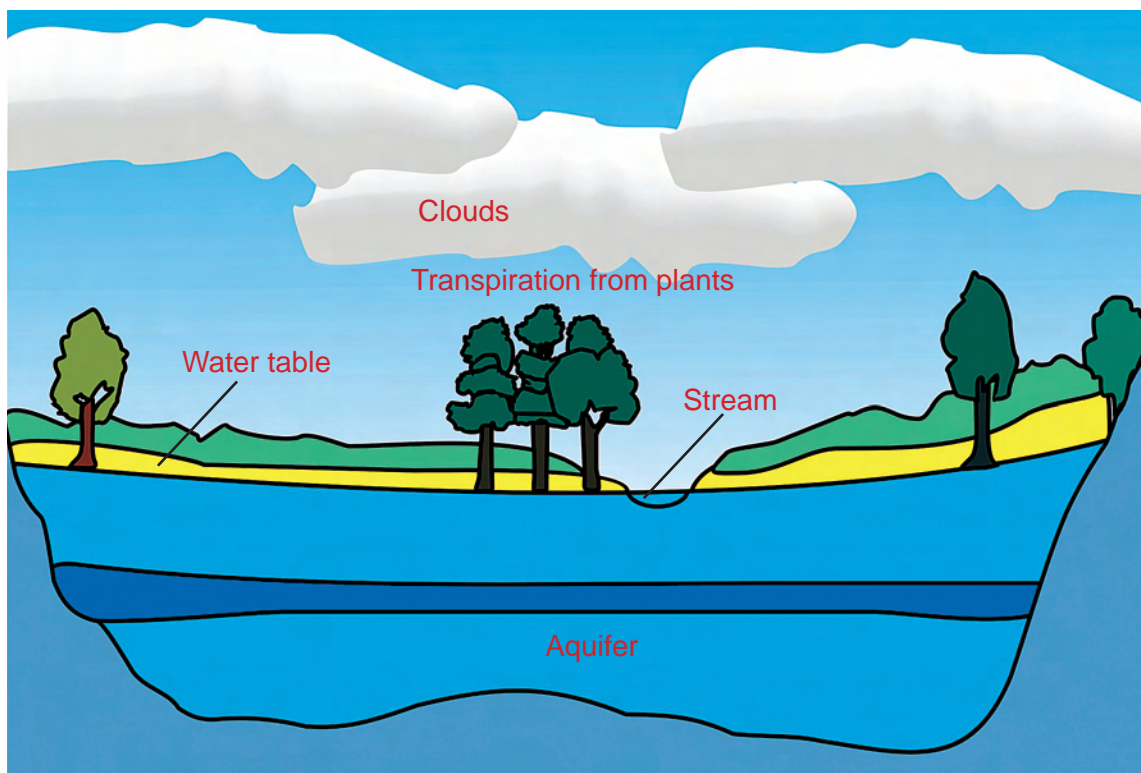


Fig. 2.7. Underground Water or Aquifer

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

MORE TO KNOW

A World Bank report says, "India is the largest user of groundwater in the world and its underground aquifers are being depleted at an alarming rate".

2.5. DEPLETION OF WATER

1. Natural forces

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

2. Human causes

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

3. Salt water intrusion

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

4. Commercialization of water resources

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

5. Sand grabbing from rivers

Some rivers are deeply affected by sand grabbing. **eg. Palar river**

2.6. DISTRIBUTION OF WATER

Water availability in India depends greatly on the seasonal monsoons. The monsoons bring heavy rains over most of the country between June and September. Except Tamil Nadu, which receives over half of its rain in October and November. India has places of dry condition of deserts. (Thar desert) and places with rainforest climate (North Eastern States) too. In



Fig.2.8. Deforestation

general, the northern half of the country is subjected to extremes of rainfall. India has a large network of rivers too. The three major rivers the Indus, the Ganga and the Brahmaputra originate in the Himalayas and drain nearly two-thirds of the land area.

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

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

MORE TO KNOW

- India receives nearly 4 per cent of the global precipitation and ranks 133 in the world in terms of water availability per person per annum.
- The total renewable water resources of India is estimated at 1,897 sq km per annum.
- By 2025, it is predicted that large parts of India will join countries or regions having absolute water scarcity.

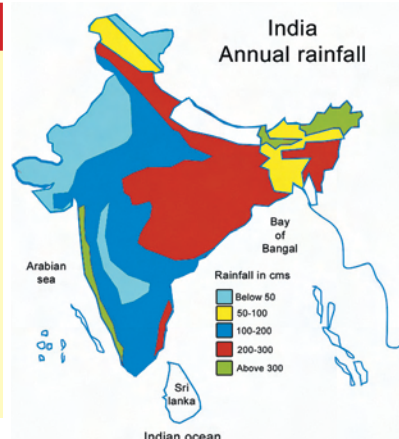


ACTIVITY 2.3

WE DO

Given here is the rainfall map of India. It gives the average annual rainfall in different regions of our country.

1. We locate on the map the place we live in.
2. Are we blessed with sufficient rainfall?
3. We discuss about the necessary steps to be taken to increase the rate of rain fall.



2.7. SCARCITY OF WATER

Scarcity of water is defined as a situation where there is insufficient water to satisfy normal requirements.

Though water is a renewable resource, we, the humans, are using it at a faster rate than it is being replenished.

Factors contributing to the depletion of water table.

- Growing population has resulted in a growing demand for houses, offices, shops, roads etc. As a result, open areas like parks and playgrounds are used for construction of buildings. This reduces the seepage of water into the ground.
- Growing population has also resulted in an increase in the number of industries. Water is used in almost every stage of production of things that we use.
- As we already know India is an agricultural country and farmers have to depend on rains for irrigating their fields. However, erratic monsoons result in excess use of groundwater thereby decreasing the underground water.

- Uncontrolled use of bore well technology for extracting groundwater.
- Pollution of freshwater resources. This is due to the flow of untreated sewage from homes, toxic chemicals from industries and of pesticides and insecticides used by farmers into water bodies
- No effective measures for water conservation.

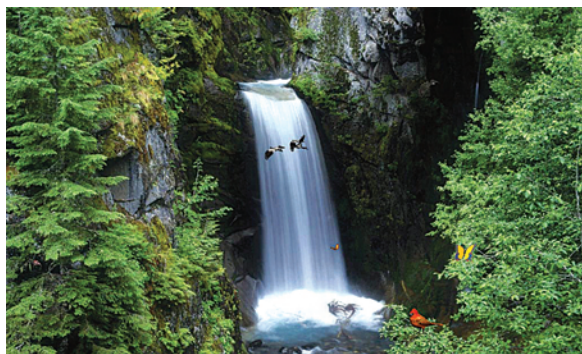


Fig. 2.9. Water is vital for the survival of all organisms on earth

MORE TO KNOW

A design of a toilet in which human excreta are treated by earthworms has been tested in India. It has been found to be a novel technique. Toilets that required little water is safe for processing of human waste. The conversion of toilet waste is very simple and hygienic. The human excreta are completely converted to vermicakes – a resource much needed for soil.

2.8 WATER MANAGEMENT - RAIN WATER HARVESTING

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

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

Rain water harvesting techniques

There are two main techniques of rain water harvesting.

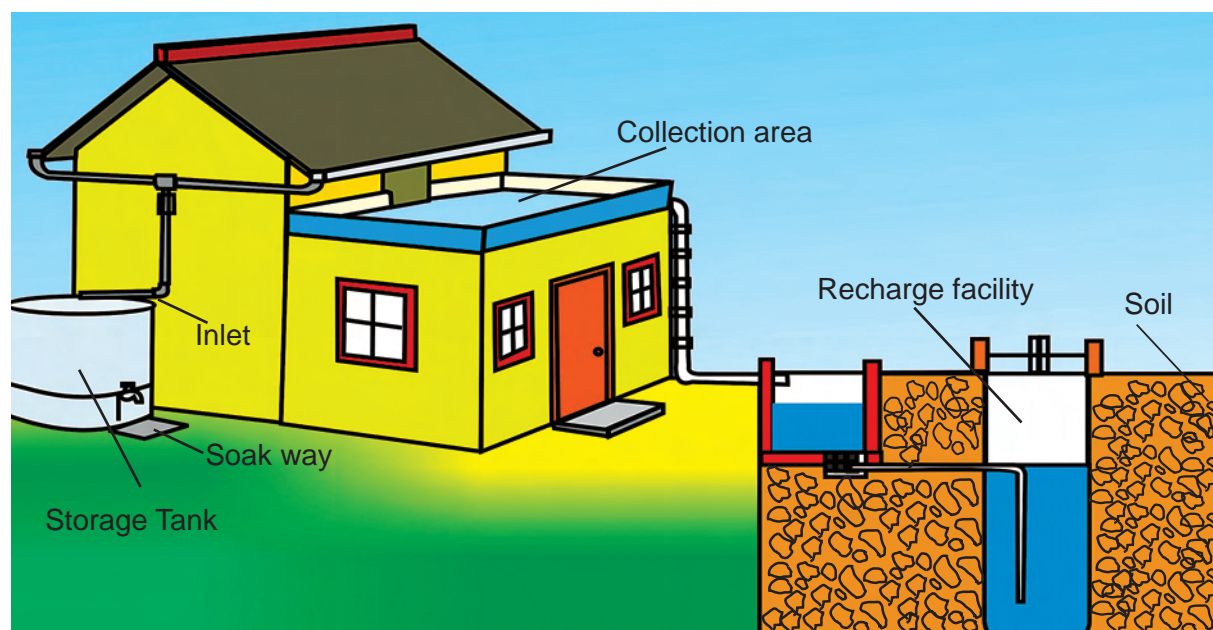


Fig. 2.10. Rainwater harvesting

1. Storage of rainwater on the surface for future use.
 2. Recharging the ground water.
- ☛ Surface water is inadequate to meet our demand and we have to depend on ground water.
 - ☛ Due to rapid urbanization, infiltration of rain water into the sub-soil has decreased drastically and recharging of ground water has diminished.

Advantages of rainwater harvesting

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

**ACTIVITY 2.4****WE DO**

Let us discuss the ways in which we can conserve water under the following headings:

1. Save a drop today. Keep drought away
2. Rain drops - life giving drops.
3. _____

2.9. SCIENCE TODAY**2.9.1. DRINKING ICE BERG WATER**

Fig. 2.11.
Melting of glacier



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

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

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

2.9.2. DESALINATION OF SEA WATER

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

The most common desalination processes are :

1. Distillation 2. Reverse Osmosis

1. Distillation

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

2. Reverse Osmosis

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

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

The Minjur Desalination Plant

It is the largest desalination plant in India. It is located in Kattupalli village near Minjur, about 35km north of Chennai. The plant is established on a 60 acre site at a cost of Rs.600 crore. It consists of 8,600 Sea Water Reverse Osmosis (RO) membranes to convert sea water into potable water. The RO technology of the plant produces 100 mld (million-litres-a-day) of freshwater from 273 million litres of sea water. The Minjur Desalination Plant supplies 100 mld of fresh water to the Chennai Metro Water Corporation at the rate

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

The Nemmeli desalination plant

The State Government has decided to alleviate the freshwater problems by the desalination of sea water. Besides the Minjur plant, the Chennai Metropolitan Water Supply and Sewage Board (CMWSSB) is also constructing a Desalination Plant at Nemmeli at a total cost of Rs.908.28 crore. The plant has a capacity to convert 100 million litres per day as



Fig. 2.12. The Desalination Plant at Minjur, Thiruvallur Dt.,

MORE TO KNOW

Water obtained through distillation is called distilled water. This water is normally pure enough for use in school science lab and medical laboratories.



potable water from sea water. Water from the Nimmeli plant would be carried over 40 km to the city, to be supplied to its residents.

2.9.3. SWEET WATER ON EARTH

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



Fig. 2.13. Teethal Beach (Gujarat)

Geologists at the Indian Institute of Technology in Mumbai offered the explanation that water turning sweet is a natural phenomenon. Continuous rainfall over the preceding few days had caused a large pool of fresh water to accrue in an underground rock formation near to the coast. Then this water discharged into the sea as a large “plume”, as fractures in the rocks widened. Because of the differences in density, the discharged fresh water floated on top of the salt water of the sea and spread along the coast. In course of time, the two would mix to become normal sea water once more.

MORE TO KNOW



All oceans and seas have salty water. The saltiest of all is the Dead sea. It is called “dead” because the high salinity prevents any fish or other visible aquatic organisms to live in its water. Imagine 300 grams of salt in one litre of water. Interestingly, even if a person does not know how to swim, he would not drown in this sea. He would only float in it.

ACTIVITY 2.5

I DO

I calculate the amount of water I use daily.

ACTIVITY	AMOUNT OF WATER USED IN LITRES
Drinking	
Cooking	
Bathing	
Washing	

Water is a resource . Water is essential for the hygienic well being of all human beings. So water must be used optimally .

EVALUATION

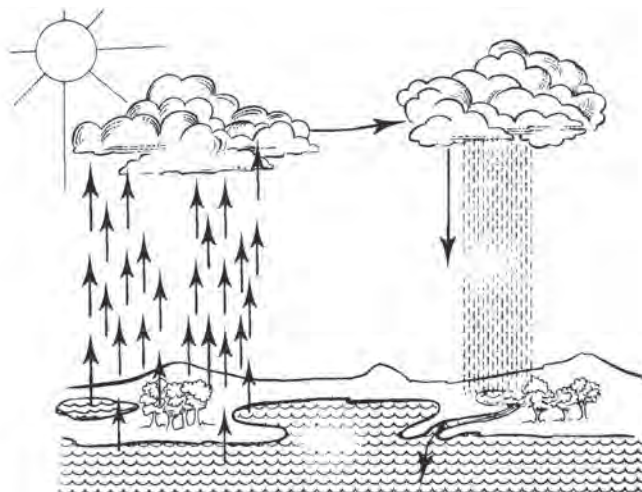
1. Pick out the correct answer.

- Water exists in abundance on the planet ----- (Earth/ Mars).
- are a huge store of water. (Oceans / Ponds)
- is the gaseous form of water. (Rain / Water vapour)
- Desalination is an artificial process by which ----- is converted to fresh water. (sea water / river water)

2. Given below are some sources of water. Arrange the jumbled words in the right order and fill in the blanks

INAR RAIN OWNS RRVIE _____
 ASE . AKEL NOPD _____

3. The diagram of a water cycle is given. Use the following words in the right place; sea, cloud, evaporation, rain



4. Why is supply of water essential to humans?

5. a) Why has urbanisation occurred ? List the ways in which urbanisation

- benefits human
- harmful to wild life.

b) Suggest one way in which the effects of urbanisation can be reduced.

6. Advise class leaders on water conservation in your school. You can give them the following instructions;

- | | |
|-----------------------------------|----------|
| a) Close the water tap after use. | e) _____ |
| b) _____ | f) _____ |
| c) _____ | g) _____ |
| d) _____ | h) _____ |



7. All of us use water every day. Fill in the table according to your observation:-

S.No.		IN SCHOOL	AT HOME
1.	Source of water		
2.	Number of taps		
3.	Taps that leak		
4.	Water wasted by leakage every day in litres		

8. Visit the following places to observe rain water harvesting and state why rainwater harvesting is essential in these places.

- i) Temple
- ii) School building
- iii) Government office
- iv) House

9. The State Government of Tamil Nadu has taken up a venture to convert sea water into potable water. Name the two desalination plants setup in connection with this idea

- a) _____
- b) _____

FURTHER REFERENCE

Books

- 1. **Framework of Science** - Paddy Gannon, Oxford University Press, New Delhi
- 2. **Environmental Science** - Tata McGraw Hill, New Delhi.

Websites

www.rainwaterharvesting.org
<http://www.worldwaterday.org>

Places of scientific importance for visit:

- 1. The Desalination Plant, Minjur, Thiruvallur District
- 2. The Desalination Plant, Nemmeli, Kanchipuram District
- 3. Sathanur Dam, Thiruvannamalai District



In the Stone Age, people never knew the use of fire. They ate raw food. Accidentally they discovered that by rubbing two stones together, they could produce fire. Later they used fire for cooking, getting light and for safeguarding their lives from animals. Fire is obtained by the rapid oxidation of a substance in the chemical process of combustion, releasing heat, light and various other products.



Fig 3.1 (a)



Fig 3.1 (b)

3.1. COMBUSTION AND ITS TYPES

Combustion is the burning of substances in air or oxygen to release heat and light. The substance that undergoes combustion is called **fuel**.

ACTIVITY 3.1

WE DO

Aim : To know about the various substances that are used as fuel.

We use various kinds of fuel for various purposes at home, in industries and for running automobiles. Let us name a few fuels.

- 1.
- 2.
- 3.

There are many substances that can burn. They can be classified depending on their state as solid, liquid and gas. Cowung, coal and firewood are solid fuels. Kerosene and petrol are liquid fuels. LPG, coal gas, natural gas and bio-gas are gaseous fuels. You have learnt that magnesium burns to form magnesium

oxide and produces heat and light. You can perform a similar activity with a piece of charcoal. What do you observe? You will find that coal burns in air producing carbon dioxide, heat and light. This process is an example of combustion. The substances that undergoes combustion are called **combustible substances**.

ACTIVITY 3.2

WE OBSERVE

Aim: To differentiate combustible and non-combustible substances

We need: straw, wood, iron, nail, kerosene, a piece of stone, charcoal, match sticks, glass, burner, tongs

Procedure:

- ☛ Light the burner
- ☛ Using tongs, hold a piece of straw over the flame.
- ☛ What happens to the straw? Record the observation in the table given below
- ☛ Repeat the above procedure with other substances and record your observation in the table.
- ☛ If combustion takes place, mark the substance as combustible, otherwise, mark it as non-combustible.

Table 3.1

Tick the appropriate column

Substance	Combustible	Non-Combustible
Straw		
Wood		
Iron nail		
Kerosene		
Stone piece		
Charcoal		
Matchsticks		
Glass		

From the above activity, we infer that substances like paper, straw, wood, matchsticks, etc. are combustible substances. Substances like stone, glass, iron nails, etc. do not burn on being exposed to flame. Such substances are called **non-combustible** substances.

Let us investigate the conditions under which combustion takes place.



Fig.3.2 combustible & non-combustible things



ACTIVITY 3.3

WE OBSERVE

Aim: To show air is necessary for combustion

We need: chimney, candle, match box, wooden blocks, glass plate

Procedure:

(Caution: Be careful while handling the candle)

- Fix a lighted candle on a table.

Case 1

- Place a glass chimney over the candle and rest it on a few wooden blocks in such a way that air can enter the chimney.
- Observe what happens to the flame.

Case 2

- Now, remove the wooden blocks and let the chimney rest on the table.
- Again observe the flame.

Case 3

- Finally, place a glass plate over the chimney.
- Watch the flame again.
- What happens in the three cases?
- Does the flame flicker off?
- Does it flicker and give smoke?
- Does it burn unaffected?
- Can you infer anything about the role played by air in the process of burning?

Condition necessary
for combustion



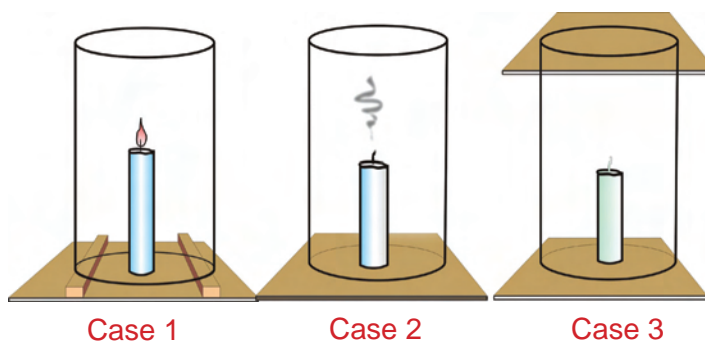
TO THINK

You might have heard that when the clothes of a person catch fire, the person is covered with a blanket to extinguish the fire. Can you guess why?



The candle burns freely in case 1 when air can enter the chimney from the bottom. In case 2, when air does not enter the chimney from the bottom, the flame flickers and produces smoke. In case 3 the flame finally goes off, because the air is not available. Therefore you can easily understand that air is necessary for combustion.

Fig 3.3
Air is essential
for burning



Ignition temperature

When a sparkler is lighted with a burning candle, it does not burn immediately. It takes some time and only when it attains a particular temperature, it starts burning.

A fuel has to be heated to a certain minimum temperature before it can catch fire. This temperature is different for different fuels. Some substances catch fire immediately, while some take a longer time. The lowest temperature at which a fuel catches fire is called its **ignition temperature**.

ACTIVITY 3.4 WE OBSERVE

Aim: To understand the importance of ignition temperature.

We need: paper cup, water, burner

Procedure:

1. Place a paper cup containing water on a flame.
2. The water will become hot, but the cup will not burn.
3. This is because the water takes away the heat from the cup and does not allow it to reach its ignition temperature.



Fig 3.4. Heating water in a paper cup

Now, we can easily understand why fire is extinguished by water, and a log of wood takes a longer time to start burning than wood shavings, when heated in a flame.

When water is poured over a burning substance, it absorbs heat from the substance. As a result the temperature of the substance falls below the ignition temperature, and it stops burning.

A log of wood has a huge mass. So, when we heat it with a flame, the heat received by the log is dissipated through its bulk mass. And the log takes a long time to attain its ignition temperature. On the other hand, wood shavings, having a smaller mass, attain the ignition temperature more readily. So, a large piece of wood takes a longer time to start burning than wood shavings.

Types of combustion

Combustion can be of different types. It can be spontaneous, rapid, slow and incomplete.

Spontaneous combustion

Some combustion reactions take place without the application of heat energy. When white phosphorus is exposed to air at room temperature, it catches fire immediately; even without being lit by a match stick. This type of combustion reaction that occurs without the help of any external heat source is called **spontaneous combustion**.



Rapid combustion

Bring a burning match stick or gas lighter near a gas stove in the kitchen with the help of your parents. Turn on the knob of the stove. What do you observe? The gas burns rapidly. Such combustion is known as **rapid combustion**. Bursting of fire crackers, burning of camphor, magnesium ribbon in air, gas in a burner and kerosene in a stove are good examples of rapid combustion.



Fig 3.5. Burning of Magnesium ribbon

Slow combustion

Combustion that takes place at a very slow rate is called **slow combustion**. During this type of combustion low heat and light are produced. Food oxidized in our body to release energy is an example of slow combustion.



Incomplete combustion

Combustion takes place in the presence of oxygen. If the supply of oxygen is insufficient, then combustion will be incomplete. This is called **incomplete combustion**. Carbon forms carbon monoxide when it undergoes incomplete combustion.



MORE TO KNOW

Rusting of iron is another good example of slow combustion. During rusting, iron is oxidised and energy is released, but the process is very slow. So we cannot see how it happens.



Fig 3.6. Rusting of iron

3.2. FIRE CONTROL

Heat energy in the form of fire plays an important role in our daily life. Unfortunately, fire has an enormous destructive quality, if it is not controlled properly. We read in the newspaper about the destruction by fire leading to loss of life and property. Thus, it is important to know not only the methods of controlling fire, but also the different means of putting out the fire when they get out of control.



Fig 3.7-Fire Control

Fire can be controlled and extinguished by

1. removing any combustible substances near the region of fire;
2. cutting off the supply of air by using sand or blanket;
3. bringing down the ignition temperature by using water;

Usually sand and water are thrown on burning substances to extinguish fire. Sand reduces the supply of air and cools it. **Water should not be used for oil fire.** Oil being lighter, floats, spreads and causes severe damage. So, oil fire should be extinguished by using substances like foamite. Fire that is caused by electrical appliances or installations, can be put out by using solid carbon dioxide or carbon tetrachloride. Water should not be used as there is a risk of getting an electric shock.

Fire Extinguishers

All of us are familiar with fire extinguishers, the red painted steel containers kept in factories, hospitals, schools, theatres, business places, etc. In the event of a fire breaking out, fire extinguishers can be used to put out the fire.

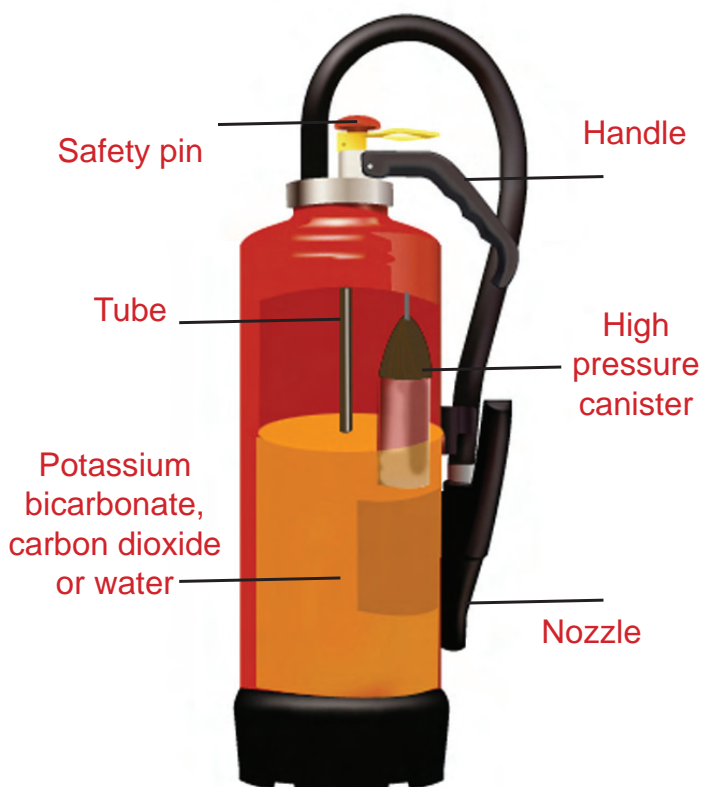


Fig 3.8. Fire Extinguishers



3.3. FLAME AND ITS STRUCTURE

Observe an LPG flame. Did you observe the colour of the flame? What is the colour of a candle flame? Recall your experience of burning a magnesium ribbon. If you have not done the experiment so far, try burning the substances given in the table below.

Is flame formed on burning the following substances? Record your observations.

Table 3.2 (Tick the appropriate column)

Sl.no	Substance	Forms flame	Does not form flame
1	candle		
2	magnesium		
3	camphor		
4	kerosene		
5	charcoal		

Parts of a candle flame

Zone of non-combustion:

This is the dark zone that lies around the wick. It contains unburnt gas particles. No combustion takes place here as no oxygen is available.

Zone of partial combustion:

In this zone, the hydrocarbons present in the oil gas from wax decompose into free carbon and hydrogen. The unburnt carbon particles impart a pale yellow colour to the flame. This is the luminous part of the flame.

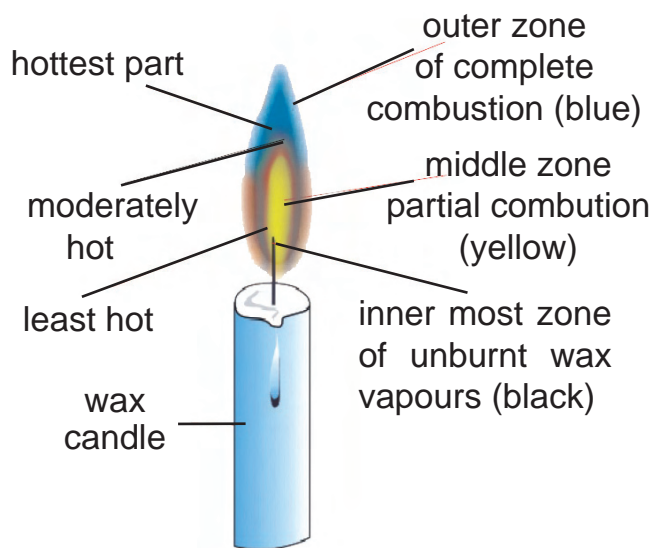
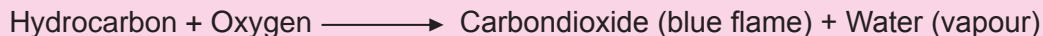


Fig 3.9. Structure of candle flame

Zone of complete combustion (blue) : This is the non-luminous thin zone of the flame. It is the outermost hottest region in the flame that is invisible. Here, carbon and hydrogen are completely oxidized to carbon dioxide and water vapour.



MORE TO KNOW

Incase of emergency we should call...

108 - Free Ambulance Service



101 - Fire Service

3.4. EFFICIENCY OF FUELS

Any substance that can be burnt or otherwise consumed to produce heat energy is called a fuel. Wood, natural gas, petrol, kerosene, diesel, coal, and LPG are commonly used as fuels.

We use fuels to run all forms of modern transportation like automobiles,

trains, buses, ships, and aeroplanes. Fuels are the important source of energy for many industries. Thermal power stations depend heavily on fuels for generating electricity. We also use fuels for domestic purposes, e.g. cooking.

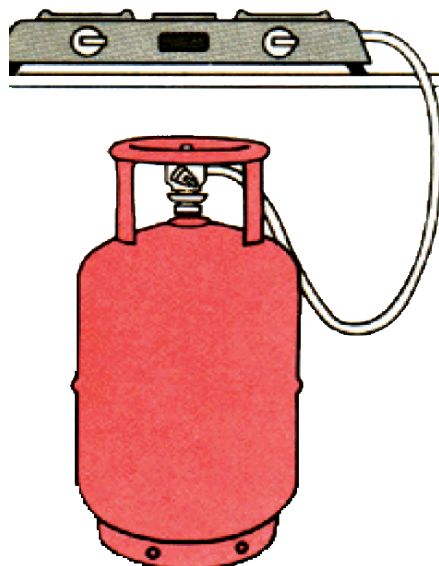


Fig 3.10. using different types of fuel



Characteristics of a good fuel:

We know that a large number of substances burn to produce heat energy. But not all of these substances can be used as fuel. The characteristics of a good fuel are as follows:

1. It should be cheap and readily available.
2. It should be easy to store, transport and handle.
3. It should not produce toxic fumes or smoke or other harmful products on combustion.
4. The amount of soot or ash left behind should be minimum.
5. It should have a high calorific value.
6. It should have a low ignition temperature.

Calorific Value

The main constituents of fuels are hydrocarbons. During combustion, these hydrocarbons get oxidized to form carbon dioxide and water. Heat is evolved in this process (exothermic process).

Hydrocarbon + Oxygen \longrightarrow
Carbon dioxide + Water + Heat energy

Fuel

The nature of the fuel can be determined by the amount of heat energy evolved. The higher the heat energy evolved, the better is the fuel.

The amount of heat energy liberated when 1 kg of the fuel is burnt completely in oxygen is called the **calorific value** of the fuel. The calorific values of some common fuels are given in Table 3.3.

Types of Fuels

There are three types of fuels. They are solid, liquid, and gaseous fuels.

Solid Fuels

Coal, wood, charcoal, coke, and paraffin wax are some commonly used solid fuels. The drawbacks of solid fuels are as follows:

1. They have a high ignition temperature.
2. They produce a large amount of residue (soot, ash) after combustion.
3. Their calorific value is low.

Table 3.3

Calorific value of some fuels

Fuel	Calorific value (Kcal/Kg)
Wood	4000
Coal	7000
Coke	8000
Kerosene	10,300
Petrol	11,500
Natural gas	8000-12,000
Water gas	3000-6000
Hydrogen	34,000
Methane	13,340
LPG	11,900

Liquid Fuels

Petrol, kerosene, and diesel are some commonly used liquid fuels which are obtained from petroleum (an oily mixture of hydrocarbons in its crude form). Ethyl alcohol is also a liquid fuel. Locomotives, buses, and lorries use diesel as fuel.

Gaseous Fuels

Gases such as methane, carbon monoxide and hydrogen are combustible. Natural gas, producer gas, coal gas, water gas, LPG (Liquefied Petroleum Gas), and biogas (gobar gas) are other examples of gaseous fuels. Gaseous fuels are preferred over solid and liquid fuels because of the following advantages:

- They have a low ignition temperature.
- They burn completely (complete combustion) and leave no residue (soot, ash, smoke).
- They are easy and safe to handle, transport, and store.
- They have a high calorific value.
- They are cheap.

Natural gas

Natural gas is obtained from petroleum wells. It contains a mixture of hydrocarbons (methane and ethane). It is one of the cheapest available gaseous fuels.

Producer gas, coal gas and water gas

Producer gas, coal gas, and water gas are important gaseous fuels used in industries. All these are obtained from coal or coke.

LPG (Liquefied Petroleum Gas)

It is the most widely used gaseous fuel for cooking. LPG is a mixture of propane (15%) and butane (85%) liquefied under pressure. It has a high calorific value. A small amount of ethyl mercaptan, an inert gas with a characteristic odour, is added to LPG to detect any leakage.

Biogas (Gobar gas)

Gobar gas contains a mixture of methane and ethane and is a very cheap form of gaseous fuel. Gobar gas is becoming increasingly popular in villages, where cattle can be maintained in large numbers. It is also comparatively less expensive.



Fig.3.11-Biogas (Gobar gas) plant



3.5. FUELS AND ENVIRONMENT

The increasing fuel consumption has harmful effects on the environment.

1. Carbon fuels like wood, coal and petroleum release unburnt carbon particles. These fine particles are dangerous pollutants causing respiratory diseases like asthma.

2. Incomplete combustion of these fuels gives carbon monoxide gas. It is a very poisonous gas. It is dangerous to burn coal in a closed room, because the carbon monoxide gas produced can kill persons sleeping in that room.

3. Combustion of most fuels releases carbon dioxide in the environment. Increased concentration of carbon dioxide in the air causes global warming.

4. Burning of coal and diesel releases sulphur dioxide. It is an extremely suffocating and corrosive gas. Moreover, petrol engines give off

Acid rain formation

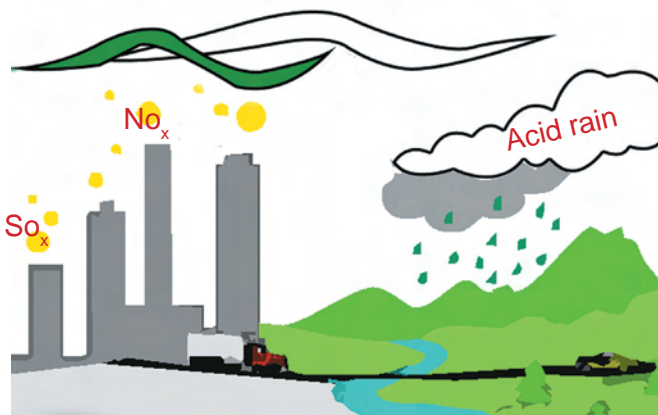


Fig 3.12. Acid Rain Formation

gaseous oxides of nitrogen. Oxides of sulphur and nitrogen dissolve in rain water and form acids. Such rain is called **Acid Rain**. It is very harmful for crops, buildings and soil.

The use of diesel and petrol as fuels in automobiles is being replaced by CNG (Compressed Natural Gas), because CNG produces harmful products in very small quantities. CNG is a cleaner fuel.

GLOBAL WARM(N)ING

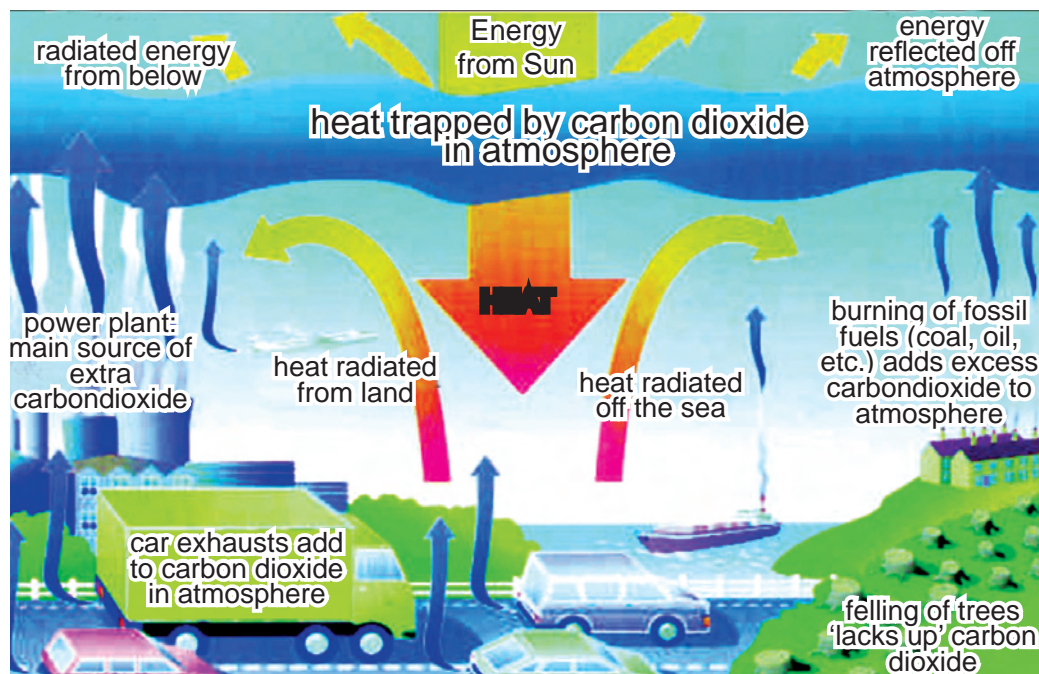


Fig 3.13. Global warming

It is the rise in temperature of the atmosphere of the earth. This results, in the melting of polar glaciers, which leads to a rise in the sea level, causing floods in the coastal areas. Low lying coastal areas may even be permanently submerged.

EVALUATION

I. Choose the correct answer

- During combustion light is evolved along with
 - heat
 - flame
 - air
 - none of these
- Substances that catch fire easily are
 - inflammable
 - non-combustible
 - heavy
 - light
- L.P.G is a mixture of
 - methane and propane
 - propane and butane
 - butane and methane
 - none of these
- Rusting of iron is an example of _____ combustion
 - slow
 - rapid
 - spontaneous
 - incomplete
- _____ is a good supporter of combustion.
 - oxygen
 - carbon di oxide
 - nitrogen
 - hydrogen
- Petrol is a
 - solid fuel
 - highly inflammable substance
 - non combustile substance
 - less inflammable substance

II. Fill in the blanks:

- The lowest temperature at which fuel catches fire is called _____
(body temperature / ignition temperature)
- _____ is used to extinguish oil fire. (Water / Foamite)
- The amount of heat energy liberated by completely burning 1 kg of fuel is called _____
(calorific value / flame value)

 III. Write True for the correct statement and False for the wrong statement.
 Also correct the wrong statement(s)

- In a rapid combustion, substances catch fire without application of heat.
- All types of fire can be extinguished by water.
- Non –luminous zone is the hottest part of a flame.
- A good fuel should have a low calorific value.

IV. Match the following:

- | | | |
|-----------------------------------|---|---------------------|
| 1) Oxides of Sulphur and Nitrogen | - | Luminous flame |
| 2) Biogas | - | Non- Luminous flame |
| 3) Ethyl alcohol | - | Acid rain |
| 4) Yellow colour flame | - | Gaseous fuel |
| 5) Blue colour flame | - | Liquid fuel |



V. Sharmila has the following substances. Help her to classify them into combustible and non-combustible.

dry leaves, petrol, rubber tube, chalk, paper

VI. Oil fire should be controlled by using foamite. Water should not be used to control oil fire. Could you explain why this is so?

VII. Give reasons.

- Water is not used to control fire involving electrical equipments.
- Gaseous fuels are considered superior to solid fuels.
- Large piece of wood takes a longer time to start burning than wood shavings.
- Kerosene burns more readily than wood.

VIII. Magesh and Keerthivasan were doing an experiment in which water was to be heated in a beaker. Magesh placed the beaker close to the wick in the yellow region of the flame. Keerthivasan placed the beaker on the outer most blue region of the flame. Which beaker would get heated faster?

IX. How would you put out the fire in each of the following cases? Justify the method chosen.

- a pan of hot oil catches fire
- a cotton pillow catches fire
- a wooden door is on fire
- an electric fire

X. Classify the following into solid, liquid, and gaseous fuels.

petrol, coal, wood, oil, natural gas, LPG, coke, water gas, charcoal, kerosene

Solid fuel	Liquid fuel	Gaseous fuel

XI. Compare the characteristics of the following fuels and choose the best fuel on the basis of the responses to the following questions.

i) Coal ii) Kerosene iii) LPG

- How much heat energy does it give out ?(Use table 3.3)
- Does it cause pollution ?
- Is it easily available ?
- Is it easy and safe to store and transport ?
- How much does it cost ?

XII. Debate on the following topics

- Are biofuels a better alternative to fossil fuels ?
- Carbon dioxide is necessary for photosynthesis but it causes global warming.

PROJECT

- Survey 5 houses in your area. Find the number of households using LPG, kerosene, electricity, wood, biogas and cattle dung as fuel. Then tick (✓) the appropriate column in the table below.

Name of the resident :

Door No. :

Characteristics of the fuels used		Types of fuels					
		LPG	Kerosene	Electricity	Wood	Biogas	Cattle dung
Smoke produced	High						
	Moderate						
	Low						
Residue formed	High						
	Moderate						
	Low						
Time taken to cook food	Long						
	Moderate						
	Less						
Cost of the fuel	Costly						
	Moderate						
	Less						

Based on your observations and data provided by the households.

which of these fuels would you choose for use in your house ? Why?

FURTHER REFERENCE

Books

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- Framework of Science – Paddy Gennom, Oxford University Press, New Delhi

Websites

<http://www.einstrumentsgroup.com><http://www.en.wikipedia.org/wiki/combsustion><http://www.chem.csustan.edu./consumer/fuels>

Places of scientific importance for visit:

- Murugappa Chettiyar Research Centre, Tharamani, Chennai
- A Fire and Rescue Station