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"

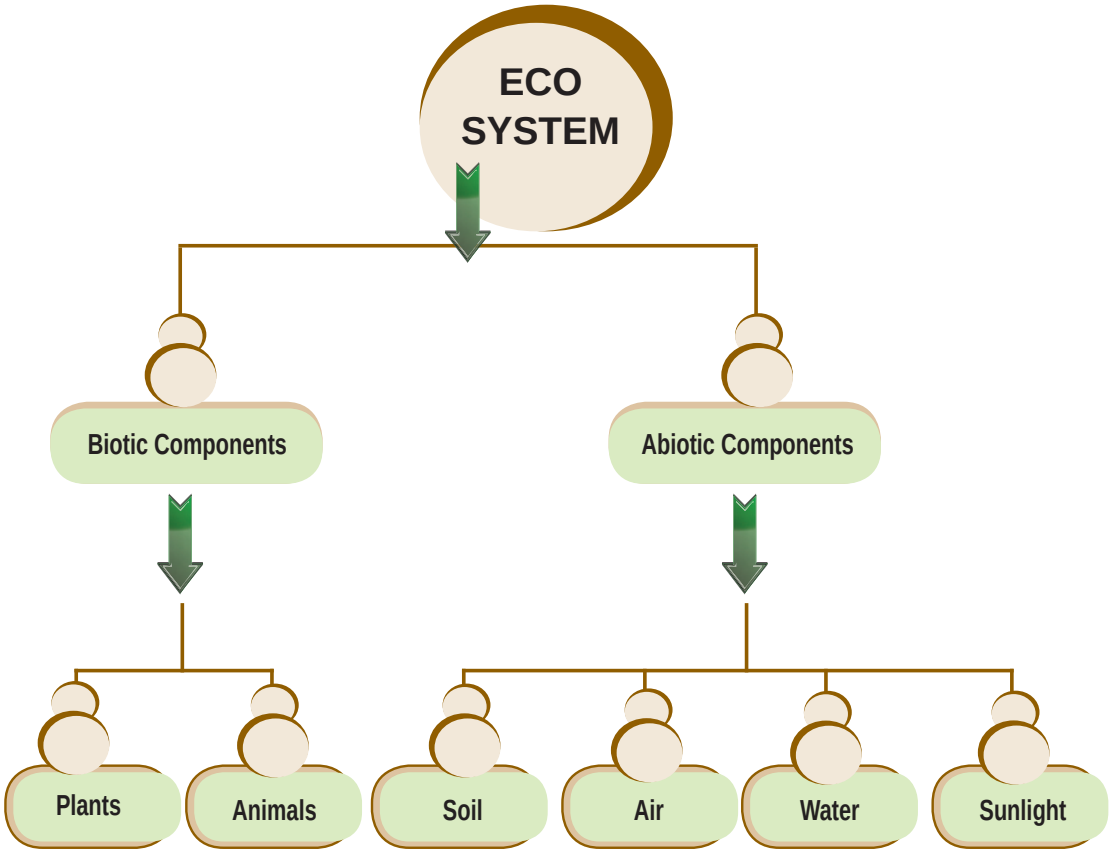
On 24th March, 2010, wild elephants entered Kumudepalli village, in Krishnagiri District.They were driven into the Sanamavu Forest near Hosur on that day. Three male wild elephants strayed into human habitation near Hosur on Tuesday.

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**

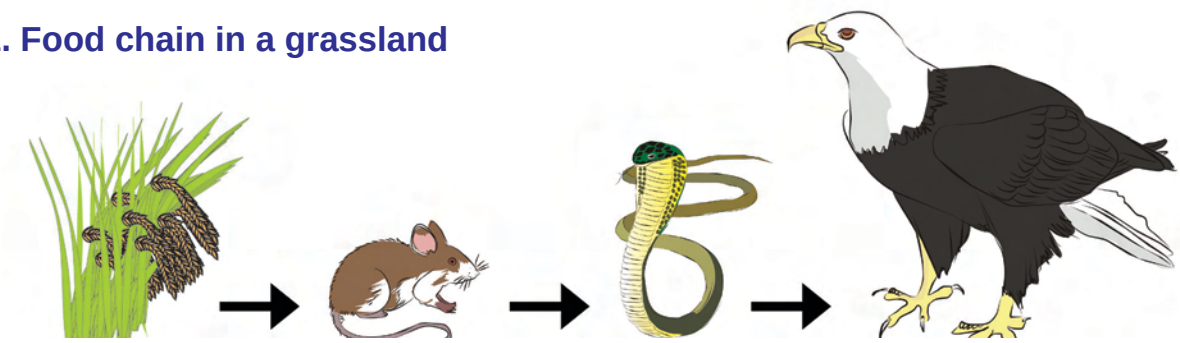
- I observe the picture.
- I recognise three biotic and two abiotic components in it.
- I write the names of three birds.

1. _____
2. _____
3. _____

1.2. FOOD CHAIN

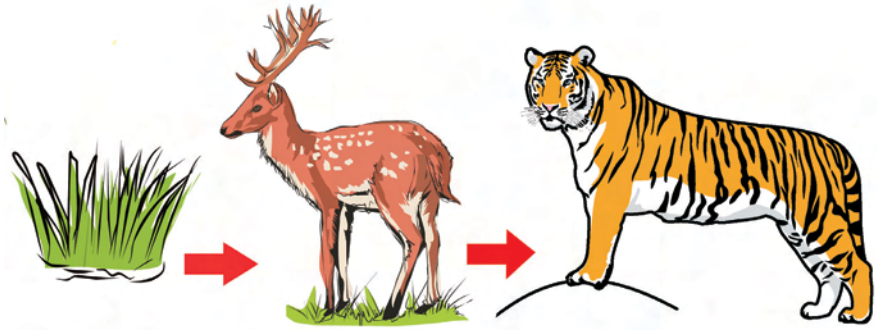
The sun is the ultimate source of energy to all living things. Green plants capture solar energy and convert carbon-dioxide and water into food by photosynthesis. This food energy is transferred to the primary consumer when they eat plants. Then the primary consumer is eaten by the secondary consumer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



Paddy (Producer) → Mouse (Herbivore) → Snake (Carnivore) → Eagle (Top Carnivore)

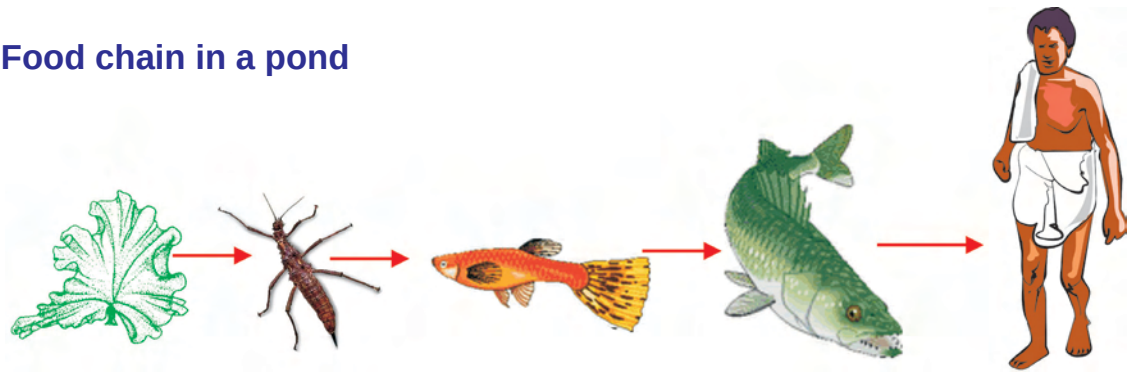
2. Food chain in a forest



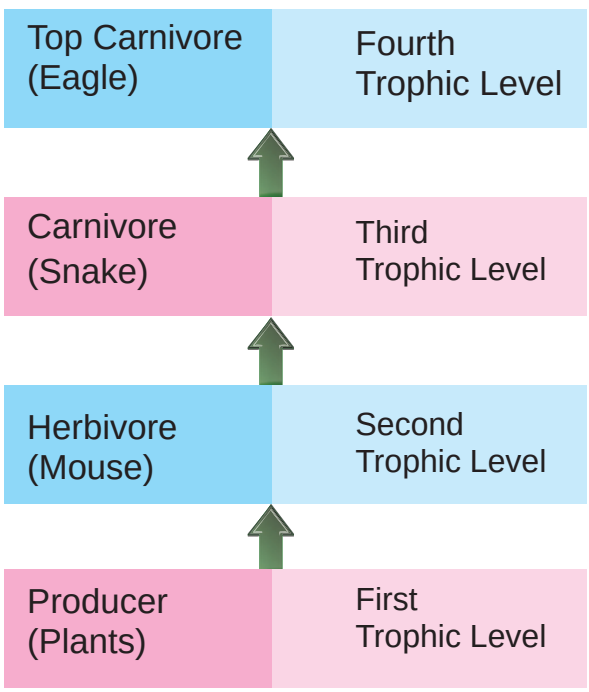
Grass → Deer → Tiger

(Producer) (Herbivore) (Carnivore)

3. Food chain in a pond



Phytoplankton → Insect → Small fish → Large fish → Man



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 levelis occupied by the large carnivores.

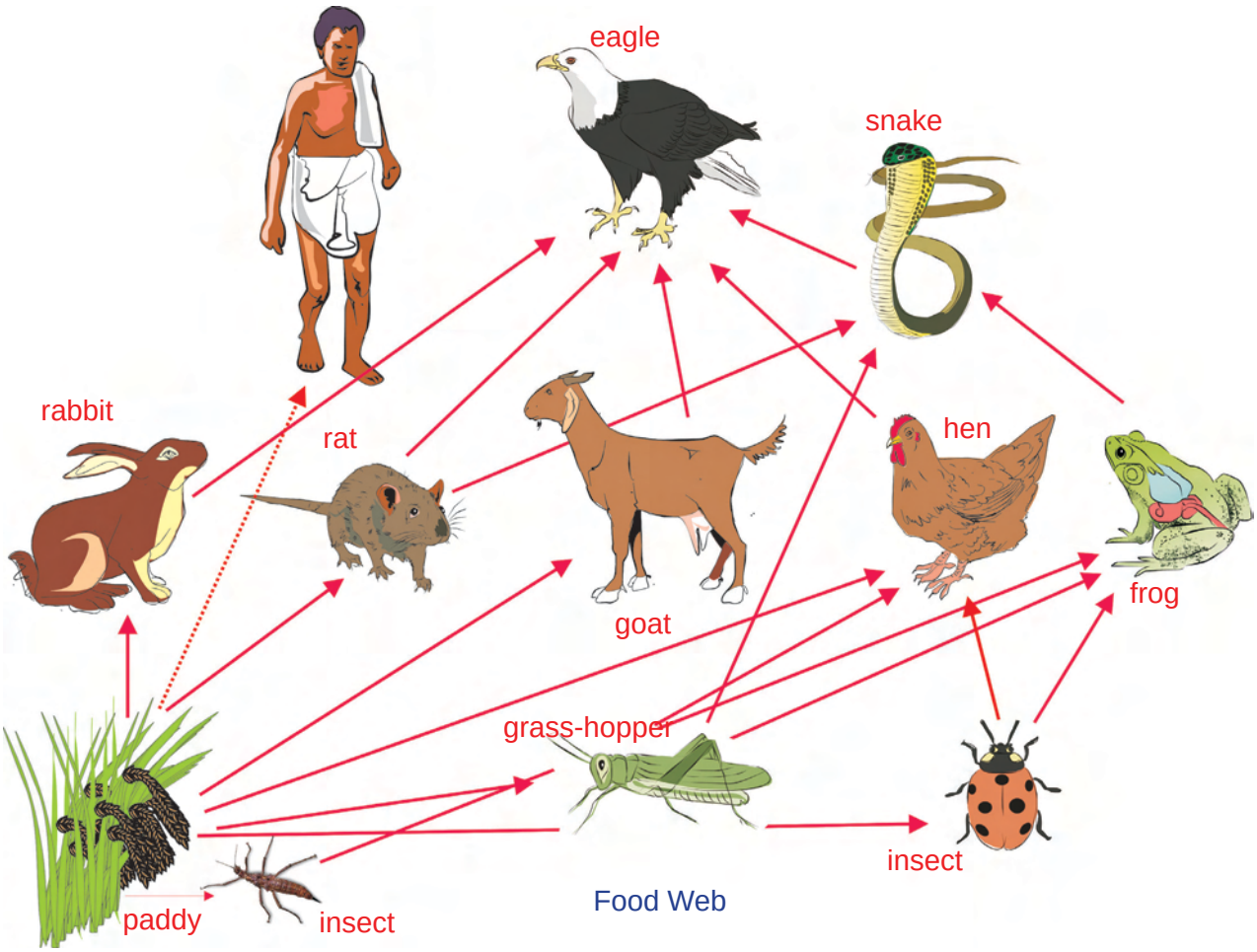
MORE TO KNOW

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.



Food Web

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

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

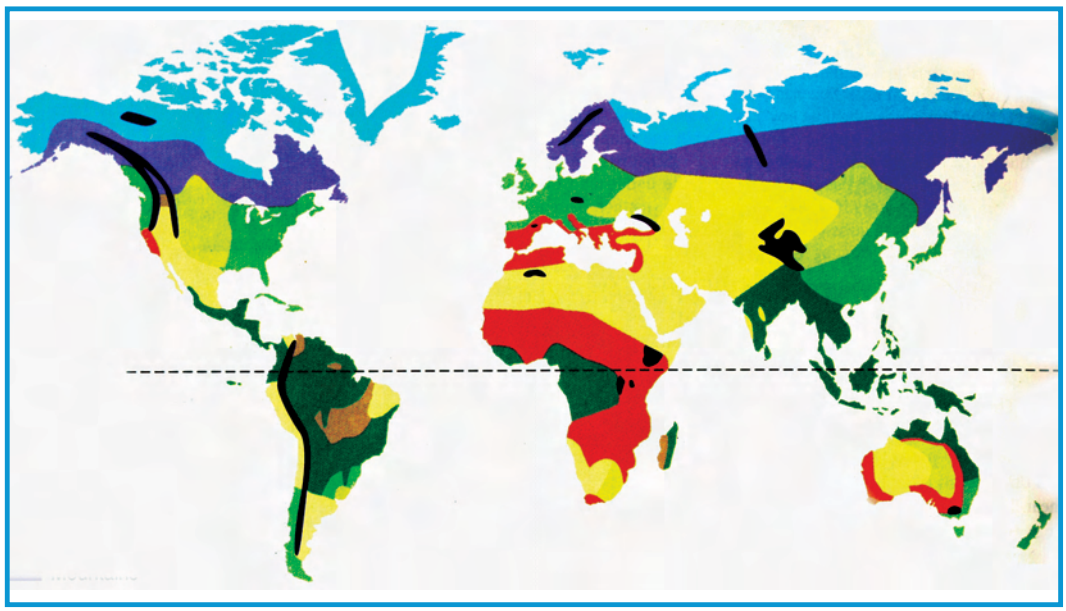
1.4. FLOW OF ENERGY

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.

Fig. 1.1. Tropical Rain Forest

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

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^{o}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.

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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:-

a) Forest is an area with high density of _____ (trees / grass)

b) _____ is an example of a natural ecosystem. (Paddy field / Desert)

c) The third trophic level in a food chain comprises of _____

(herbivore / carnivore)

d) A network of interlinked food chain is called a _____

(food web / food cycle)

e) 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	Herbivore	Plants
Carnivore	Second Trophic level	Producers
Snake	Mouse	First Trophic level

a) Suggest the common idea derived from these boxes.

b) Analyse the data given above and make a food chain.

4. Differentiate between the following:-

a) Consumers and decomposers

b) Food chain and food web

5. Discuss the effects of deforestation on the following:

a) Wild animals

b) Environment

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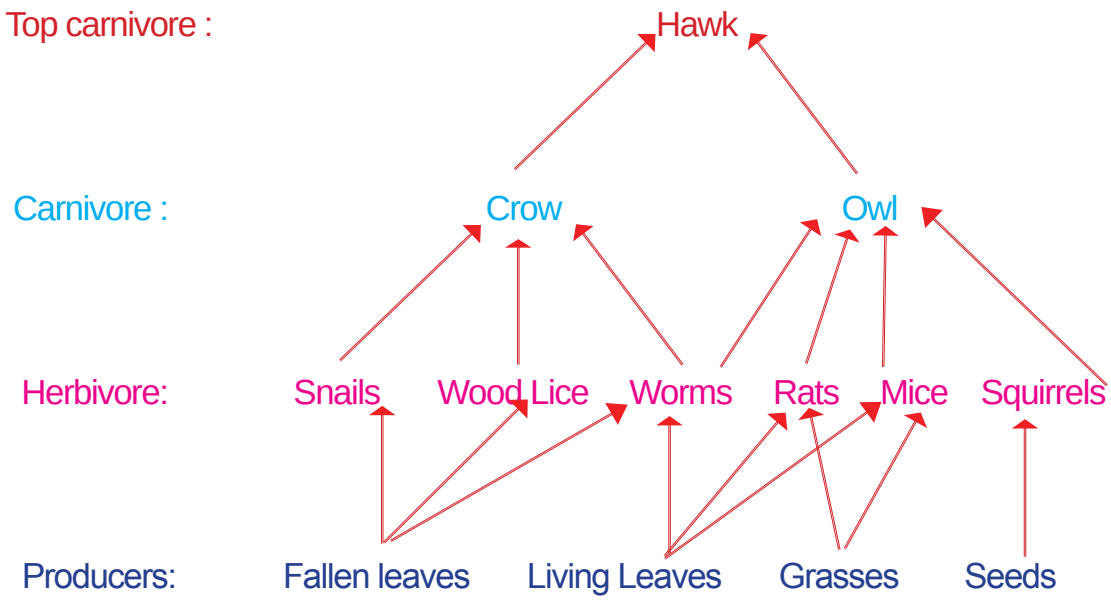
6. Food web in a forest is given below:



a) From the diagram identify the following :

i) a Carnivore

ii) a Herbivore

iii) 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

Webliography

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.

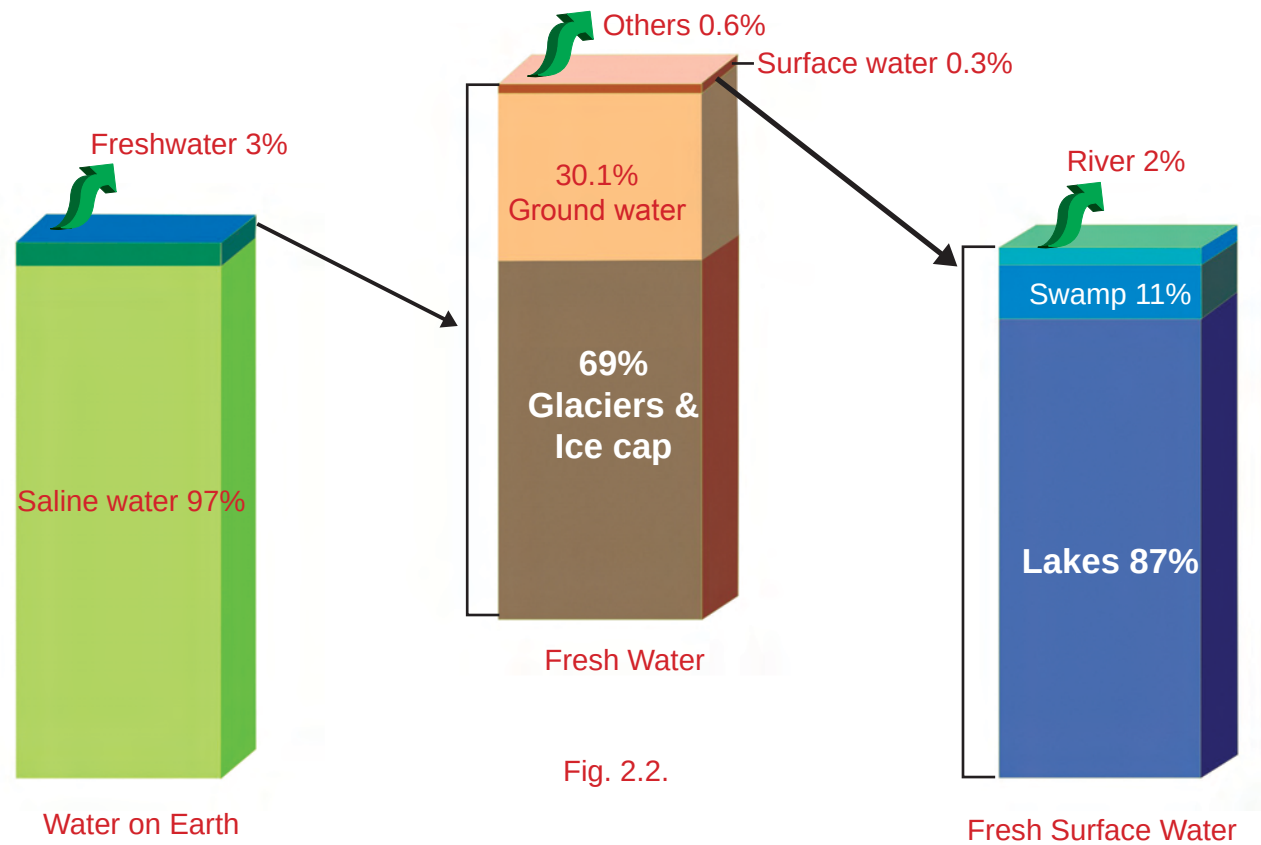


Fig. 2.2.

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.

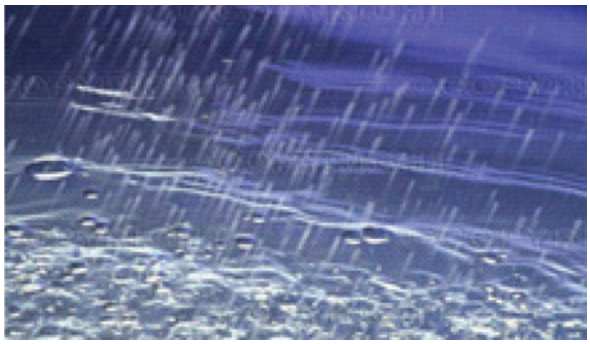


Fig. 2.3. Rain Water

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

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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.

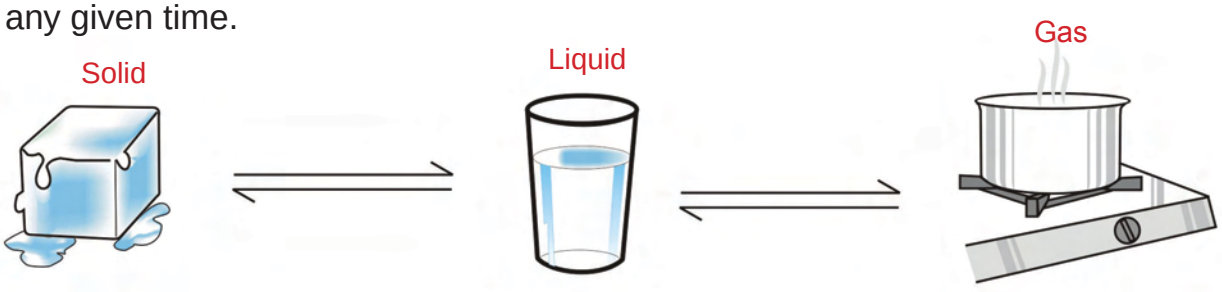


Fig. 2.5. (a) Water freezes to ice at 0^0C

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

Fig. 2.5. (c) Water changes to steam at 100^0C

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.

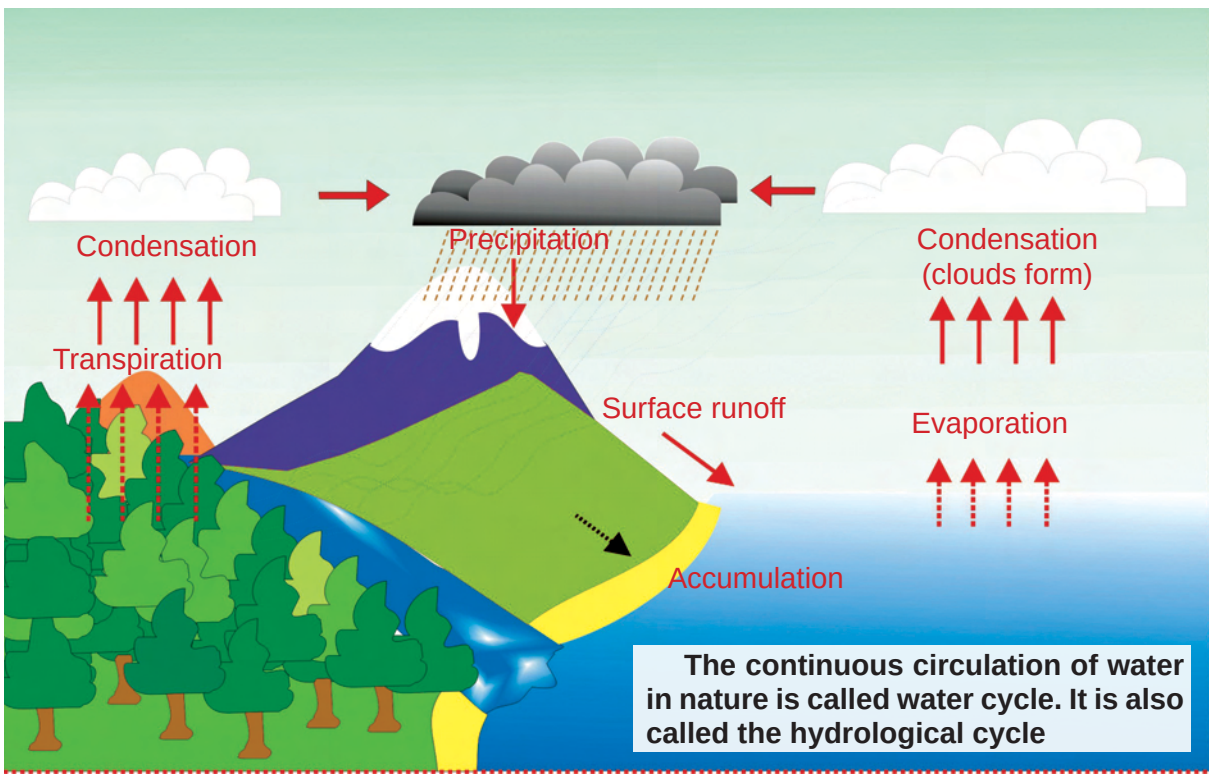


Fig. 2.6. Water cycle

2.4. GROUND WATER

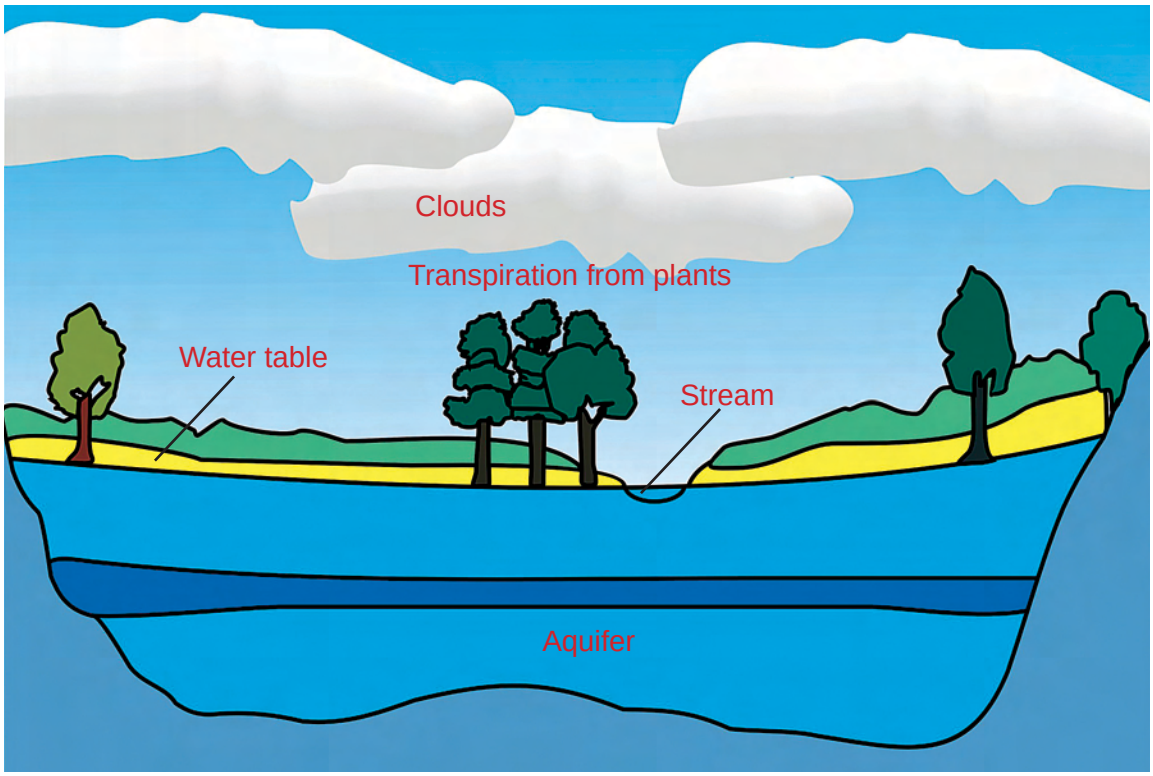


Fig. 2.7. Underground Water or Aquifer

- 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**.

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”.

- 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.

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 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.

Fig.2.8. Deforestation

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.

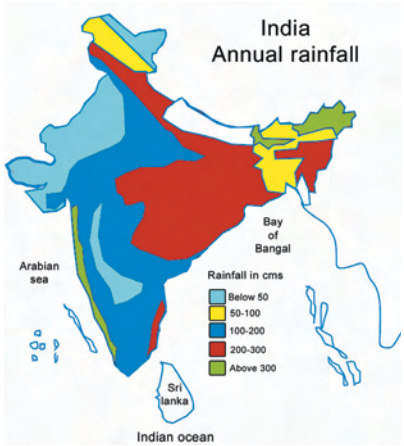
MORE TO KNOW

- 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 discus 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.

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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.

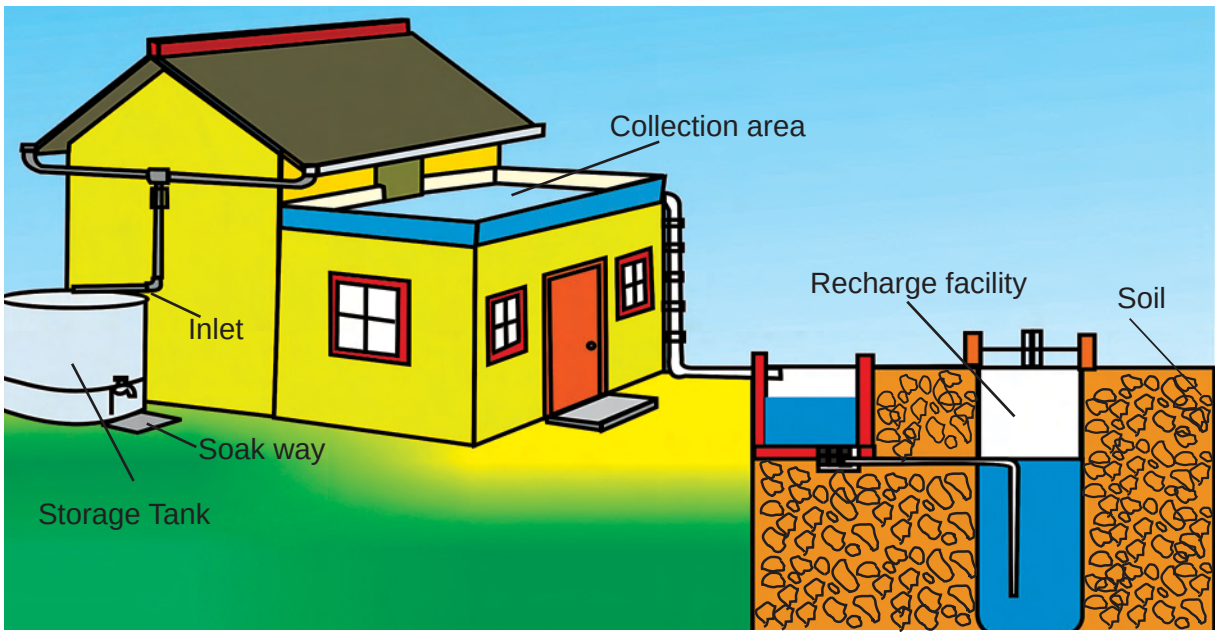


Fig. 2.10. Rainwater harvesting

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 Nemmeli 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.

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.

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.

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 .

SCIENCE

EVALUATION

1. Pick out the correct answer.

   a. Water exists in abundance on the planet ---------- (Earth/ Mars).

   b. ---------- are a huge store of water. (Oceans / Ponds)

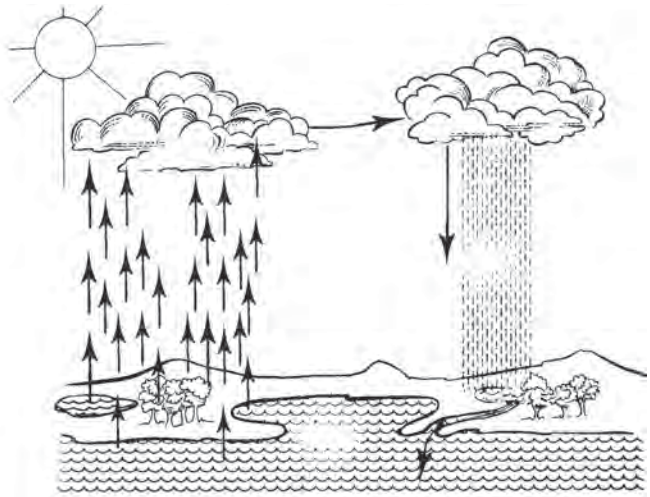
   c. ---------- is the gaseous form of water. (Rain / Water vapour)

   d. 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

   i) benefits human

   ii) 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) _____

SCIENCE

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) _____

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2. **Environmental Science** - Tata McGraw Hill, New Delhi.

Webliography

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. Accidently 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 substances 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 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.

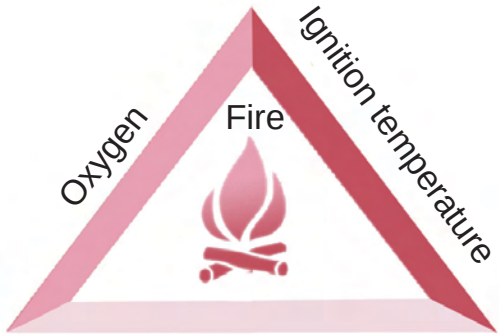
Case 2

- 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.

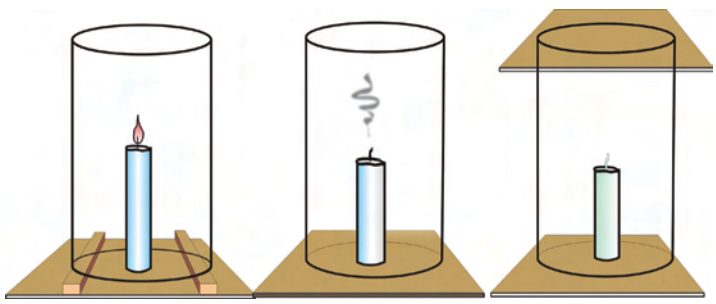


Fig 3.3
Air is essential for burning

SCIENCE

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.

Carbohydrates + Oxygen ⟶ Carbon dioxide + water + heat energy

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.

Carbon + Oxygen ⟶ carbon monoxide

SCIENCE

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.

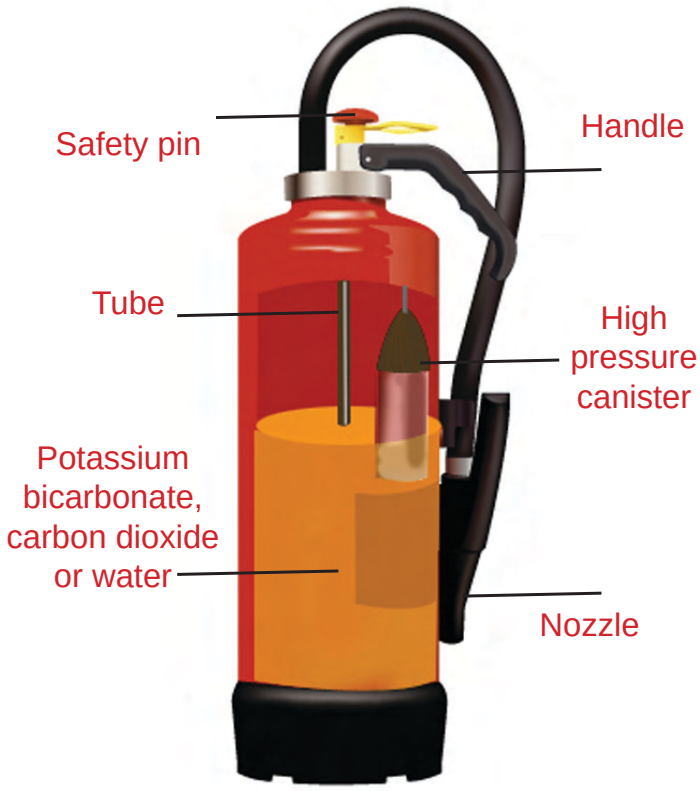


Fig 3.8. Fire Extinguishers

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.

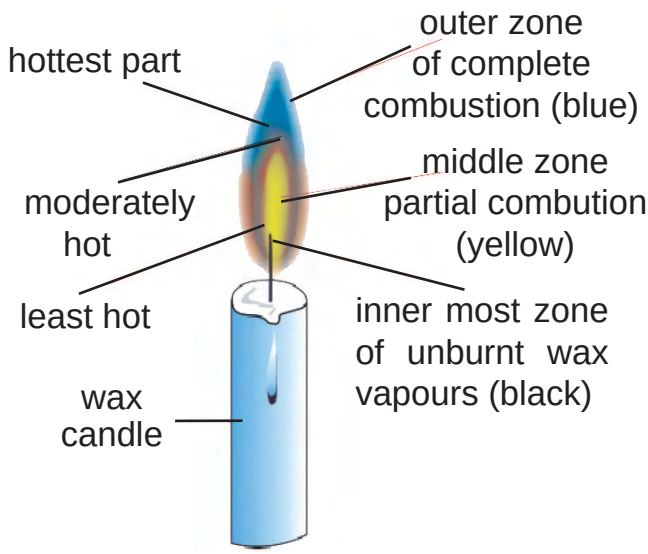


Fig 3.9. Structure of candle flame

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 carbondioxide and water vapour.

Hydrocarbon + Oxygen ⟶ Carbondioxide (blue flame) + Water (vapour)

SCIENCE

MORE TO KNOW

Incase of emergency we should call...

108 - Free Ambulance Service

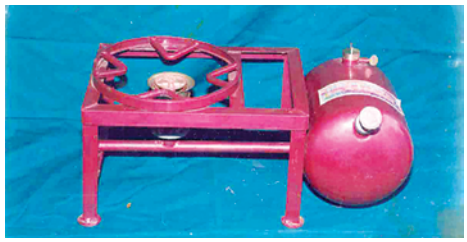
101 - Fire Service

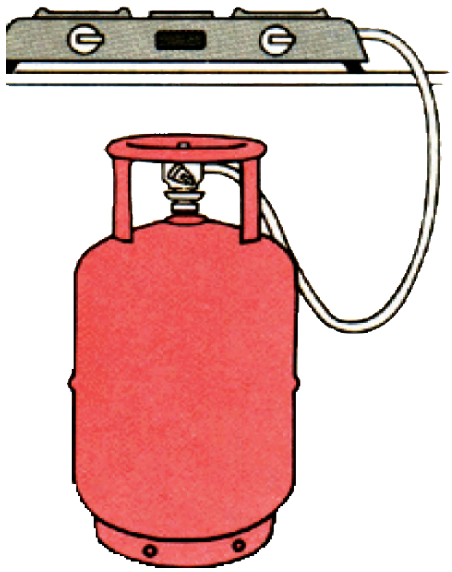
3.4. EFFICIENCY OF FUELS

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 ⟶ 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.

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

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.

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

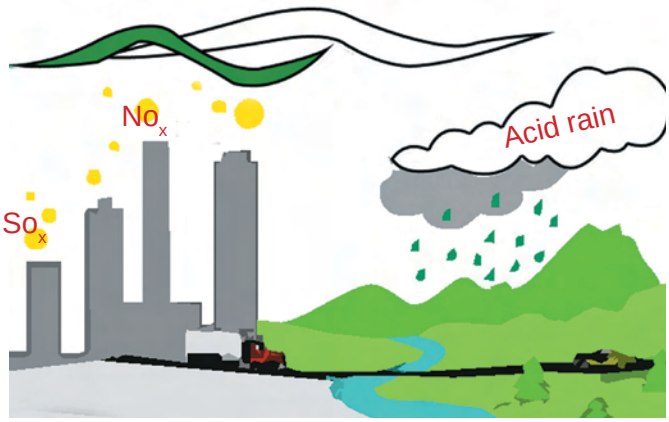


Fig 3.12. Acid Rain Formation

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.

SCIENCE

GLOBAL WARM(N)ING

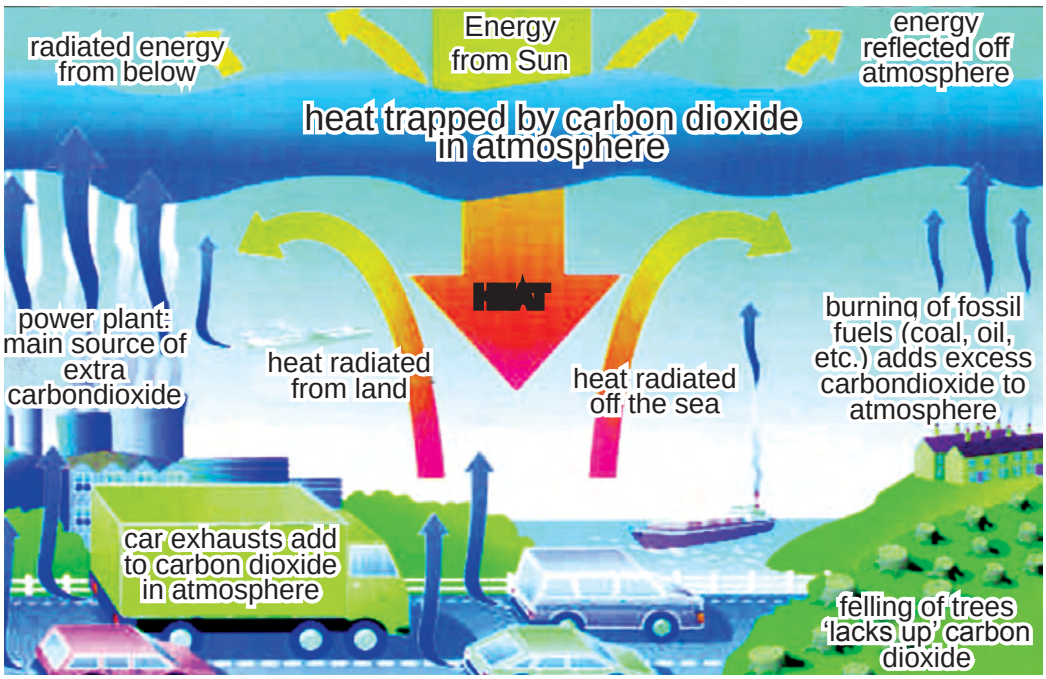


Fig 3.13. Global warming

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

a. During combustion light is evolved along with

i. heat ii. flame iii. air iv. none of these

b. Substances that catch fire easily are

i. inflammable ii. non-combustible iii. heavy iv. light

c. L.P.G is a mixture of

i. methane and propane ii. propane and butane

iii. butane and methane iv none of these

d. Rusting of iron is an example of _____combustion

i. slow ii. rapid iii. spontaneous iv. incomplete

e. _____is a good supporter of combustion.

i. oxygen ii. carbon di oxide iii. nitrogen iv. hydrogen

f. Petrol is a

i. solid fuel ii. highly inflammable substance

iii. non combustible substance iv. less inflammable substance

II. Fill in the blanks:

a) The lowest temperature at which fuel catches fire is called _____

(body temperature / ignition temperature)

b) _____ is used to extinguish oil fire. (Water / Foamite)

c) 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)

a. In a rapid combustion, substances catch fire without application of heat.

b. All types of fire can be extinguished by water.

c. Non –luminous zone is the hottest part of a flame.

d. 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.

a. Water is not used to control fire involving electrical equipments.

b. Gaseous fuels are considered superior to solid fuels.

c. Large piece of wood takes a longer time to start burning than wood shavings.

d.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.

1) a pan of hot oil catches fire

2) a cotton pillow catches fire

3) a wooden door is on fire

4) 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

a. Are biofuels a better alternative to fossil fuels ?

b. Carbon dioxide is necessary for photosynthesis but it causes global warming.

PROJECT

1) 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?

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Webliography

http://www.einstrumentsgroup.com

http://www.en.wikipedia.org/wiki/combsustion

http://www.chem.csustan.edu./consumer/fuels

Places of scientific importance for visit:

1. Murugappa Chettiyar Research Centre, Tharamani, Chennai
2. A Fire and Rescue Station

4.1. HEAT

Dip a steel spoon into a pan of boiling water. What do we notice? After a few minutes the steel spoon becomes too hot to hold. What happened? The boiling water has transferred its heat energy to the spoon. When we touch ice, we feel cold. Here, the heat energy is transferred from our body to the ice.

So the energy which can be transferred from a hotter body to a colder body and which produces a sensation of hotness or coldness is called heat.

4.1.1. SOURCES OF HEAT:

1. The Sun

The sun gives us light. Does it also give us heat?

1. Place a metal piece in sun light. Touch the metal piece after a few minutes. Do we feel any change ? Yes, it has become hot.
2. On standing under the sun for some time, touch your head. Does it feel hot?
3. Will we be able to walk bare-footed on a sunny day in the afternoon? It may be uncomfortable because the ground is hot.

So we understand that the sun gives out heat besides light.

Fig 4.1. Sun

Fig 4.2. Coal fire

2. Combustion

Burning of coal, kerosene etc., produces heat.

These are called **fossil fuels** since they are made from the remains of plants and animals that died millions of years ago and were buried deep inside the earth.

MORE TO KNOW

The sun gives us 3.8×10^{26} joule of heat energy per second. This energy is produced by nuclear fusion.

The sun is the prime source of heat energy without which life would be impossible on the earth. The enormous amount of heat from the sun can be used as an alternate source of energy. Solar energy is now being used in solar cookers, solar heaters and for providing electricity in small villages in the rural areas.

joule is the unit used to measure energy.

3. Friction

The weather becomes very cold in winter. If we rub our hands together, they become warm. The faster we rub, the hotter they become. Rubbing two things together produces heat due to friction.

The ancient man used friction to produce a spark. Sometimes he rubbed two flint stones to make a fire.

Fig 4.3. Producing spark

Fig 4.4. Forest fire

4. Electric current

When electric current flows through a conductor heat energy is produced. The water heater, iron box, electric kettle etc. work on this principle.

Fig 4.5. Electric kettle

4.1.2. HOT AND COLD OBJECTS

Heat energy is not visible but can be felt.

ACTIVITY 4.1 **I DO**

I need: Three large bowls, ice cold water, hot water, tap water

1. I take three large bowls. I fill one with ice cold water, the other with hot water and the third with tap water.
2. I dip one hand in ice cold water and the other in hot water for a few minutes.
3. Then I take out my hands and plunge both into the bowl containing tap water.
4. I find that the tap water feels hot to my hand that was in cold water while the same tap water feels cold to my hand that was in hot water.
5. I infer that sense of touch cannot tell accurately the amount of heat energy possessed by a body.

4.1.3. HEAT AND TEMPERATURE

Heat energy is not visible but can be felt. To measure the heat energy we use the physical quantity, namely temperature. Temperature measures the degree of hotness or coldness of a body.

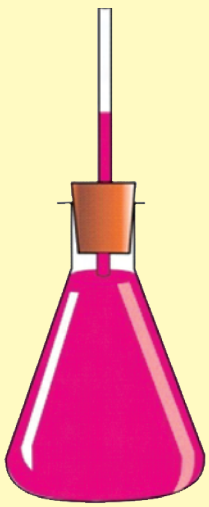
Thermometer

Since the sensation of hotness or coldness is relative, we use thermometers to measure the temperature. On what basis is a thermometer constructed?

ACTIVITY 4.2 **I DO**

I need: A glass bottle, a one hole cork, ink, narrow glass tube of suitable size.

1. I put some ink into a glass bottle and fill it with water.
2. I close the bottle tightly with a one holed cork and insert the narrow glass tube into the hole.



3. I keep the bottle in a pan of boiling water and note that the coloured water in the glass tube rises up.
4. I understand that the water gets heated and expands to rise up in the glass tube.
5. I realize that the rise in the level is the measure of the temperature.
6. Now I cool the bottle. I note that the water level in the glass tube goes down.

I infer that

liquids expand on heating and contract on cooling.

This principle is used in the construction of thermometer.

Almost all television channels end their news telecast with a mention of the maximum and minimum temperatures recorded in major cities for the day. In some channels the term Celsius is used, while in some other channels the term Fahrenheit is used. What is the difference? Both Celsius and Fahrenheit are valid terms used in the measurement of temperature.

Thermometers have two different scales to measure temperature.

a) Centigrade or Celsius scale.

b) Fahrenheit scale.

MORE TO KNOW

Kelvin scale

- The SI unit of temperature is kelvin(K)
- Kelvin scale is also known as absolute scale of temperature
- On this scale 0 kelvin = - 273^0C
- 0 K(kelvin) is also known as absolute zero

Thermometers have two fixed points based on which graduations are marked.

These are called the upper fixed point and the lower fixed point. The distance between these two fixed points is divided into an equal number of degrees.

The lower fixed point is the **melting point of pure ice**.

The upper fixed point is the **boiling point of water**.

TEMPERATURE SCALES	UPPER FIXED POINT	LOWER FIXED POINT	NUMBER OF DIVISIONS
CELSIUS	100^0 C	0^0 C	100
FAHRENHEIT	212^0 F	32^0 F	180

To convert Celsius into Fahrenheit we use the relation

$$\frac{C}{100} = \frac{(F-32)}{180}$$

'C' : Reading shown by the Celsius thermometer.

'F' : Reading shown by the Fahrenheit thermometer.

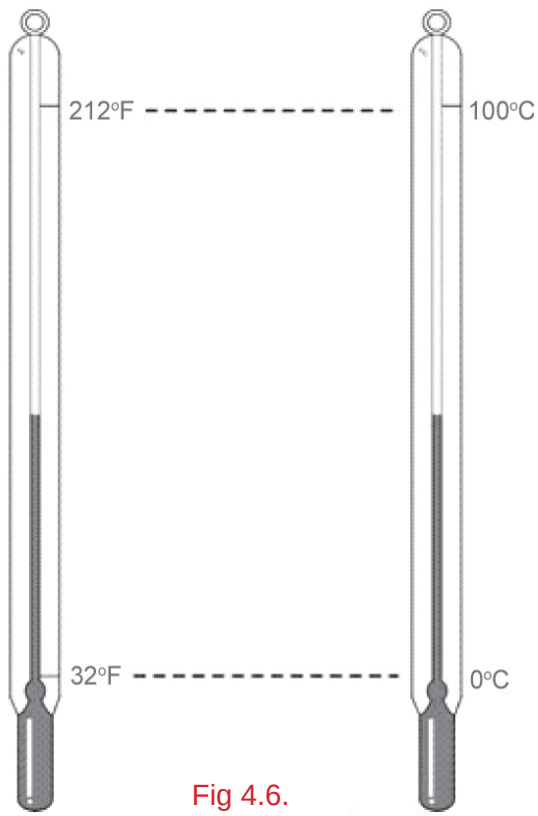


Fig 4.6.

Fahrenheit scale Celsius scale

To Think

Why mercury and alcohal are used as thermometric liquids?

Most thermometers use mercury because

1. it is opaque and shiny.
2. does not stick to glass.
3. it is a good conductor of heat.
4. it shows large expansion for small temperature changes.
5. it expands uniformly.

In some thermometers ALCOHOL is used.

SCIENCE

SCIENCE

4.1.4. MEASURING TEMPERATURE

Laboratory Thermometer

The laboratory thermometer consists of a thick walled glass tube enclosing a fine uniform bore capillary tube. There is a cylindrical bulb at one end. The bulb and a part of the stem are filled with mercury. The top end is sealed after removing air. The graduations are marked from -10^0 C to 110^0 C

When the bulb is immersed in hot water, the mercury in the bulb expands and rises up in the capillary tube. The level of mercury in the tube gives the measure of temperature of the hot water.

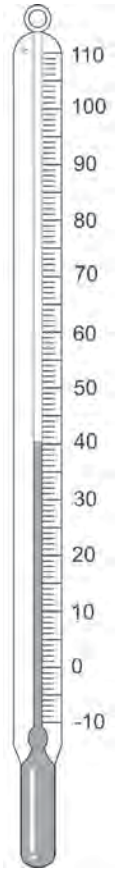


Fig 4.7

Clinical Thermometer

When we are sick, we visit a doctor. The first thing the doctor does is to record the body temperature. He would do so with the help of a clinical thermometer. Shall we learn about the construction of a clinical thermometer?


Fig 4.8

It consists of a thick walled glass tube marked in degrees enclosing a capillary tube of fine bore. There is a cylindrical bulb at one end. Air is removed from the tube and the other end is sealed. The bulb and a part of the stem are filled with mercury. There is a constriction just above the bulb which prevents mercury from flowing back into the bulb. The reading of the mercury level gives the body temperature of the patient. The thermometer is marked from 35^0 C to 42^0 C. The normal body temperature is 36.9^{0}C (98.4^{0}F). This is indicated by an arrow mark in the thermometer. It is used only to measure the temperature of the human body.

Clinical thermometers are available with Fahrenheit markings. They are also available with both Celsius and Fahrenheit markings.

MORE TO KNOW

The digital thermo meter in use now a days is an electronic device containing no glass or mercury. It is unbreakable and safe to use.

It beeps one minute after it has been kept under the arm or inserted into the mouth of the patient.

The temperature can be read from the numerical display.

4.2. LIGHT

Fig 4.9.

Look at the picture of the city taken at night. Can you imagine how the city would look if all the lights were turned off? Would you be able to see anything?

Can we see objects when there is no light? We cannot see any object when there is no light.

Light and darkness:

Light is a form of energy that gives us the sense of vision. The absence of light causes darkness. To see objects, our eye should receive light from them.

4.2.1. REFLECTION

When light falls on a transparent material like clear glass it passes through it. However, when it falls on opaque objects like table, chair, etc. some of it bounces back.

This bouncing back of light from a surface is called reflection.

The story of the Dog and the Bone

One day a dog with a bone in its mouth was crossing a bridge. Suddenly it looked down into the water and saw another dog carrying a big bone in its mouth. The greedy dog wanted the second bone also.

Thinking that it would frighten the other dog and get another bone, it barked loudly. Alas! The bone fell into the water and the greedy dog lost its own bone.

What do you think the dog saw in the water?

The dog thought that there was another dog, but what it saw was its own image reflected in the water.

Fig 4.10.

Taj Mahal

Candle

Let us observe the pictures given.

We see an exact replica of the object known as its image.

What causes the formation of an image?

Reflection of light produces the image.

Swan

4.2.2. MIRROR

What is a mirror ?

A mirror is used by us every day for looking at our own image while combing our hair or washing our face. We can see our image in a mirror; but not in a plane glass sheet or in a piece of wood or a stone. Why?

This is because most of the light falling on a mirror is reflected, but other objects do not reflect as much light.

A mirror is a shiny surface which reflects almost all the light falling on it.

Most mirrors are made of glass. A mirror that is flat is called a plane mirror.

ACTIVITY 4.3 **WE DO**

We need: A piece of glass, a mirror, a white sheet of paper.

1. We hold each object so that sunlight falls on it and the reflected light is projected on a wall.
2. We find that the mirror reflects the maximum amount of light and the paper reflects the minimum amount of light.

We infer that, different objects reflect different amounts of light

Let us investigate the nature of an image formed by a plane mirror.

ACTIVITY 4.4 — WE OBSERVE

We need: A mirror, a candle

1. Keep a candle in front of the plane mirror.
2. Observe the image of the candle in the mirror.
3. Place a screen behind the mirror.
4. Can we get this image on the screen?

   No, we cannot get the image.

   Such an image which we can see only inside the mirror and cannot be got on a screen is called a virtual image.

A virtual image is always erect.

The image formed by a plane mirror is always virtual and erect.

ACTIVITY 4.5 — WE OBSERVE

We need: A mirror

1. Let us stand in front of a mirror and observe our image. Is it big or small?
2. Gradually let us move away from the mirror. What happens to the size of the image?
3. Does it change?
4. The size of the image remains unchanged.

We infer that the size of the image formed by a plane mirror is always equal to the size of the object.

MORE TO KNOW

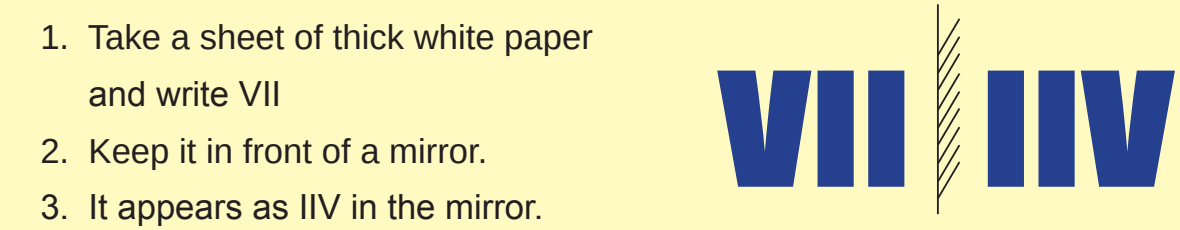
- Mirrors have a thin layer of silver coating at the back with the coating of red or orange paint. The paint covers the silvering and prevents it from being rubbed.
- When you look into a mirror, light arriving at your eyes is coming from the silvered surface. This gives the impression that the image is somewhere behind the mirror.

SCIENCE

ACTIVITY 4.6 WE OBSERVE

We need: A mirror, a sheet of thick wihite paper

1. Take a sheet of thick white paper and write VII
2. Keep it in front of a mirror.
3. It appears as IIV in the mirror.



4. There is a side to side inversion.
5. Now stand in front of the mirror and touch your nose with your right hand. What do you see in the mirror?
6. The image appears in the mirror as if the nose is being touched with the left hand.

We will find that in the mirror right appears as left and left appears as right. This property is known as **lateral inversion.**

7. Does the image appear upside down? No! the image is erect.

The image formed by a plane mirror is always laterally inverted.

Have you ever noticed strange letters in front of an ambulance?

Actually it is nothing but the word AMBULANCE written such that drivers in vehicles ahead can read the word properly in their rear view mirrors.

Fig 4.11. Ambulance

Self Check

(i) KEEP QUIET

(ii) PLEASE SIT DOWN

1. What do these mirror messages say?
2. Write your own mirror messages.

MORE TO KNOW

To see the full size image of an object, the mirror should be at least half the height of the object.

ACTIVITY 4.7 **WE OBSERVE**

We need: A strip of plane mirror, a graph sheet, an eraser

1. Place a strip of plane mirror on a line on the graph sheet.
2. The image of the graph sheet is seen inside the mirror.
3. Place an eraser or sharpener at the boundary of the second line.
4. Note the position of the image inside the mirror.
5. Repeat by placing the eraser at different positions and observe the position of the image every time.
6. Is there any relation between distance of the image from the mirror and that of the object in front of it?

The image is formed at the same distance as far behind the mirror as the object is in front of it.

SCIENCE

4.3. SPHERICAL MIRRORS

Kannan and Kamala were waiting for their dinner. Kannan lifted up his new steel plate and saw his image in it. He told Kamala, “I can see my image due to reflection formed on the plate. We learnt this in our class today”.

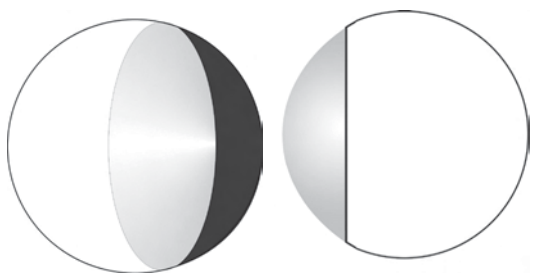
Kamala took up a new steel spoon and said “Look Kannan. I can also see my image. This spoon also acts as a mirror”.

So mirrors need not necessarily be plane. Curved surfaces can also act as mirrors.

Look at your reflection in a polished steel spoon. Do both surfaces of the spoon give the same kind of image?

Some mirrors have a plane reflecting surface, some others have a bulged reflecting surface and yet some more have a hollow reflecting surface.

The mirror with the bulged reflecting surface is called a convex mirror and the mirror with a hollow reflecting surface is called a concave mirror. These are known as curved mirrors.



Concave mirror Convex mirror

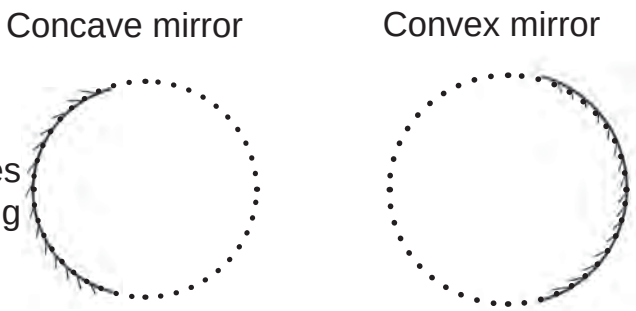
Fig 4.12.

Representation of mirrors in diagrams

Fig 4.13.

Self check

Let us complete the spheres with curved mirrors b & c forming a part of the sphere.



SCIENCE

Any curved surface is a part of a sphere. Hence convex and concave mirrors are referred to as spherical mirrors.

Self Check

Let us take a rubber ball and cut a portion of the ball with a knife. The inner surface of the cut portion is concave while the outer surface is convex.

Are you now convinced that concave and convex mirrors are a part of the sphere? What happens when light falls on spherical mirrors?

Concave mirror makes the light meet at a point after reflection (converges) and convex mirror diverges the light.

ACTIVITY 4.8 WE OBSERVE

We need: A concave mirror, a sheet of white paper

1. Hold a concave mirror facing the sun and try to focus the light reflected by the mirror on a the sheet of paper.
2. Adjust the paper till you get a sharp bright spot on it.
3. The bright spot is, in fact, the image of the sun.

The image formed on the paper or screen is called a real image.

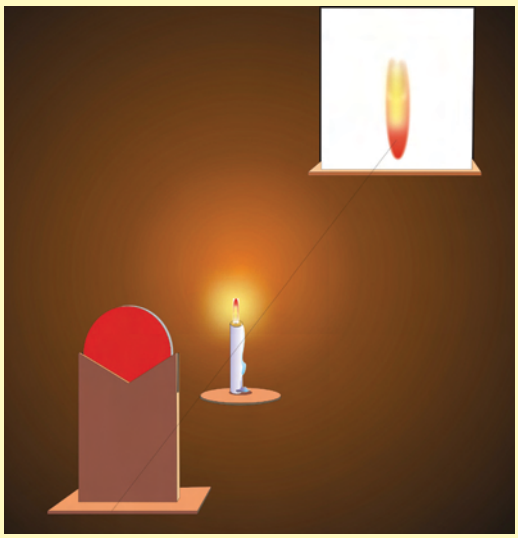
MORE TO KNOW

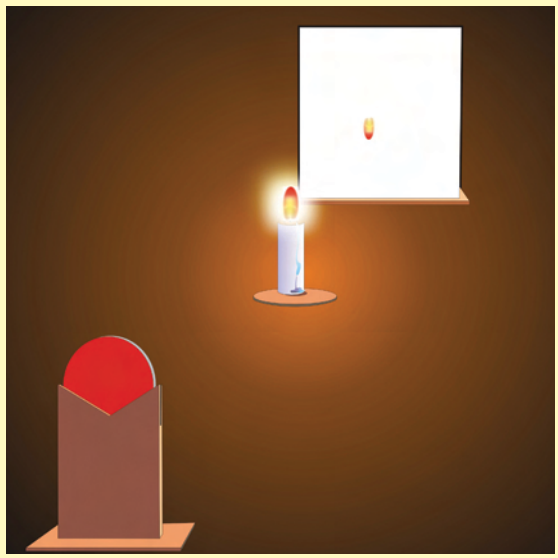
Mirrors are used in light houses. They reflect light a long way to help ships at sea.

ACTIVITY 4.9 WE OBSERVE

We need: A concave mirror, a candle, a mirror stand, a screen

1. Fix the concave mirror on a stand and place it on the table. Paste a piece of white paper on a cardboard of size 15cm X 20cm. This will act as a screen.
2. Keep a lighted candle on the table at a distance of 50 cm from the mirror. Move the screen till a sharp image is obtained.
3. Is the image real or virtual? Is it bigger, smaller or of the same size as the flame?





4. Now move the candle towards the mirror and place it at different distances from the mirror. In each case try to obtain the image on the screen.
5. Record your observations.

We see that the image formed by a concave mirror on the screen is a real and inverted . It may be smaller or larger or of the same size as the object.

When the object is placed very close to the concave mirror, an erect and enlarged virtual image is formed inside the mirror.

ACTIVITY 4.10 WE OBSERVE

We need: A convex mirror, a candle, a mirror stand, a screen

- Fix the convex mirror on a stand and place it on the table. Keep a lighted candle in front of the mirror. Try to get an image on the screen.
- It is not possible to get an image on the screen. The convex mirror diverges the light. Therefore a virtual image, smaller than the object is seen inside the mirror.

What do we understand?

Convex mirrors form only virtual images that are diminished in size.

SCIENCE

Uses of spherical mirrors:

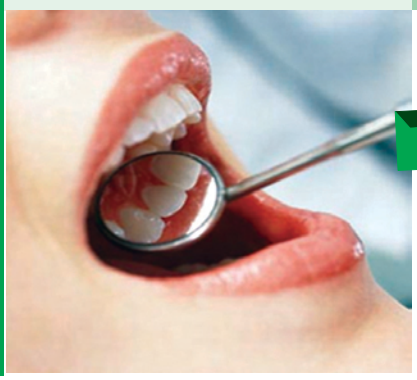
Used as reflectors in car headlamps, torches, searchlights and telescopes.

Used as shaving mirrors

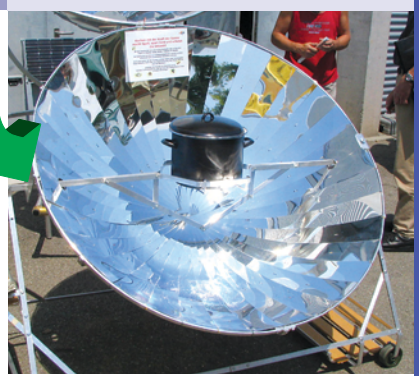
CONCAVE MIRROR

CONCAVE MIRROR

Used by dentists and ENT doctors to focus light on parts to be examined.



Used in solar cookers to converge the sunlight on the food to be cooked .



CONVEX MIRROR

Used as rear view mirrors in automobiles since its field of view is wide.

Used to watch over a large area.

4.4. SUN LIGHT – WHITE OR COLOURED?

Fig 4.14.

Have you seen the rainbow in the sky? The rainbow is seen as a large arc in the sky with many colours, in the opposite direction of the sun, when it rains.

The rainbow is a spectacular demonstration of white light as a combination of many colours.

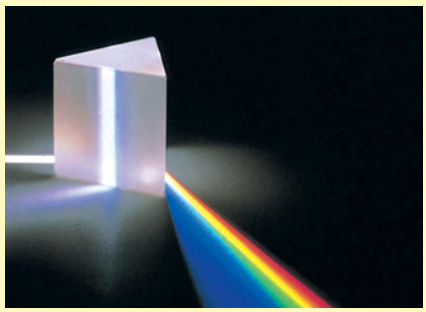
Rainbows occur when sunlight from behind the observer falls on water droplets. So, we infer that sunlight consists of many colours.

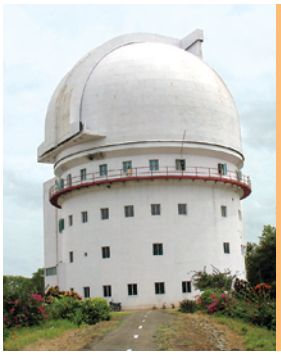
ACTIVITY 4.11 **WE OBSERVE**

We need: A glass prism, a mirror

1. Take a glass prism and with the help of a mirror reflect a beam of sunlight on one face of the prism.
2. The light coming out of the other face is made to fall on a white screen or wall.

We see colours similar to those of the rainbow. This proves that sunlight consists of many colours.





Interesting Fact:

Kavalur Observatory located in Javadu Hills (Vellore Dist) in Tamil Nadu has one of the largest reflector telescopes in Asia.

How many colours are present?

When observed carefully, there are seven colours, though it may not be easy to distinguish all of them.

The colours are Violet, Indigo, Blue, Green, Yellow, Orange and Red represented as **VIBGYOR.**

What is dispersion?

You have observed that white light is made up of seven colours. It is possible to split it into its constituent colours. The splitting up of white light into its seven constituent colours is called dispersion.

This band of colours is called a spectrum.

Can these colours be mixed to give white light?

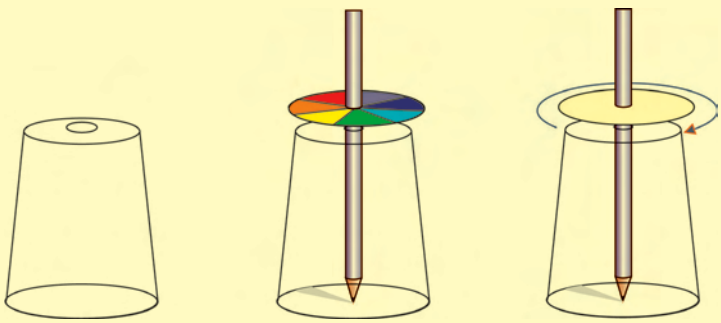
Yes, this can be done with the help of a Newton's disc.

Newton's disc is a circular disc with segments painted in the seven colours of the spectrum. The disc is supported on a stand. It is provided with a handle to rotate the disc.

When the disc is rotated fast, the colours disappear and the disc appears almost white.

Fig 4.15. Newton's disc

ACTIVITY 4.12 **I DO**



I need: A white cardboard, colours or paints, knitting needle or sharp pencil, a plastic tumbler

To make a Newton's disc:

1. I cut out a disc from white cardboard.
2. I divide the disc into seven equal sections using a protractor.
3. I paint or colour each section with any one of the seven colours of the spectrum.
4. I make a hole at the centre of the disc. I push a long pencil or a long knitting needle through it and the plastic tumbler.
5. I spin the disc as fast as I can.When the disc spins very quickly the colours merge. I see only the white colour. From this I understand that white light consists of seven colours.

EVALUATION

I Choose and write the correct answer

1. 100 degree on the celsius scale is equal to 180 degree on the fahrenheit scale. Then 1 degree celsius is equal to

   a) (F-32) x 100/180 b) (F-32) x 180/100

   c) (F+32)x 100/180 d) (F+32) x 180/100

2. On the Fahrenheit scale the number of divisions between the upper and lower fixed points is

   a) 212 b) 180 c)100 d) 32

3. Ajay stands 1 m in front of a mirror. He moves 50 cm forward towards the mirror . The distance between Ajay and his image is

   a) 50 cm b) 2m c) 3m d)1m

4. To see your face in a mirror inside a dark room you should shine light from a torch on to

   a) the mirror b) your face

   c) the nearest wall d) the ceiling of the room

5. Which of these will form both real and virtual images?

   a) plane mirror b) concave mirror c) convex mirror d) all the above

II. Fill in the blanks:

1. _____ is a measure of the heat energy possessed by a body. (Temperature/ Pressure)
2. The tyre of a moving vehicle becomes hot due to _____ (friction/combustion)
3. On a thermometric scale, the boiling point of water is taken as the _____ (upper fixed point / lower fixed point)
4. In a cinema, the image on the screen is a _____ (real image / virtual image)
5. Bouncing back of light from a surface is called _____ (reflection / refraction)

III. Match the following

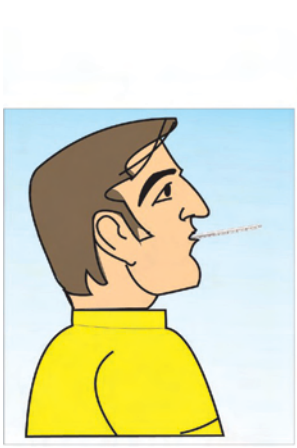
1. Sun	a) combustion
2. Burning of paper	b) measures temperature
3. Thermometer	c) dispersion of light
4. Convex mirror	d) source of heat and light
5. Spectrum	e) diverges light

IV Suggest a reason for the following:

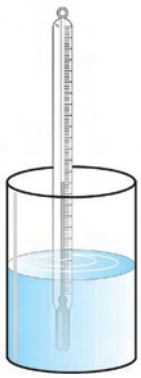
1. A shooting star is visible as it streaks across the night sky.
2. A clinical thermometer has a constriction.
3. We cannot use an ordinary laboratory thermometer to measure the temperature of a liquid which is at 400^0 c.
4. Concave mirror forms a real image while a convex mirror does not.

V.

Arun at the doctor's clinic



Muthu in the laboratory



Observe the pictures given above. One of them is correct and the other is wrong. Explain why the picture is wrong.

VI. Vijay wanted to help his mother who is a doctor to sterilize her instruments. So he washed her clinical thermometer in boiling water. Unfortunately it broke. What was his mistake?

VII. Write five English letters that appear the same even after lateral inversion. (Example: H)

VIII. Identify the nature of the mirrors by observing the images formed by them.

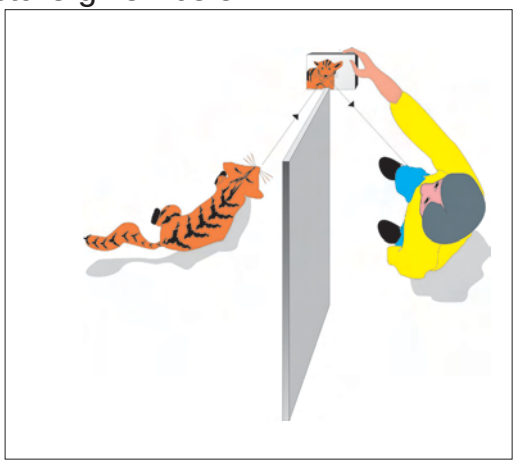
(a) ----------

(b) ----------

(c) ----------

IX. You are given samples of different kinds of mirrors. Suggest a simple method to identify them.

X. Observe the picture given below:



What is your inference?

PROJECT

1. Hold a concave mirror towards a distant object. Adjust the position of the concave mirror till a clear and well defined image is obtained on the wall or on a screen. Measure the distance from the concave mirror and the wall or screen. Repeat for different objects and record your observations.

Object	Distance

This distance is called the **'focal length of the mirror'.**

2. Take water in a metal container. Keep the bulb of the thermometer inside the water for two minutes at 10 am and measure the temperature. Keep the container in the sunlight for 30 minutes and again measure the temperature. Repeat at 12 noon and 2 pm. Record your observations.

Time	Temperature inside the class room (^{0}c)	Temperature after keeping in sunlight (^{0}c)
10 am		
12 noon		
2 pm		

FURTHER REFERENCE

Books

1. Young Scientist Vol-4 - World Book. Inc

Webliography

http://www.arvindgupta.toys.com

http://www.dmoz.org/kidandteens/schooltime/science.com

'I can, I did'

Student's Activity Record

Subject :

Sl. No.	Date	Lesson No.	Topic of the Lesson	Activities	Remarks