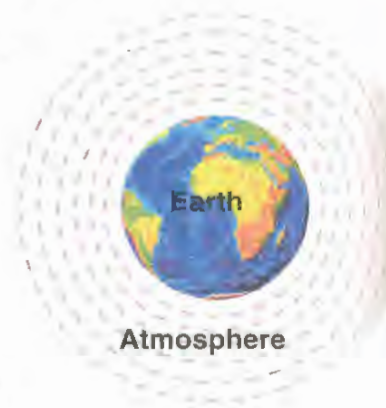


CHAPTER - 20

AIR : ITS USES AND POLLUTION

The earth is surrounded by an envelope of air, called the atmosphere. It extends up to a few hundred kilometres above the earth.

Air is a mixture of gases like nitrogen, oxygen, carbon dioxide, argon, hydrogen, helium, neon, etc. All living things use oxygen in the air for breathing. Without air, life would be impossible on the earth.



The atmosphere is most dense at sea level

The density of atmospheric air decreases with altitude (height).

Air Exerts Pressure

Air is a matter and, therefore, has weight. Air exerts pressure because it has weight. Several kilometres high column of air above us, exerts a tremendous pressure on us. We do not feel this pressure because it acts equally in all directions. We can prove that air exerts pressure by the following activities.

ACTIVITY

Take a glass tumbler and fill it completely with water. Cover the tumbler with a thick cardboard with your right hand. Hold the tumbler with the other hand and carefully turn the tumbler upside down.

What do you see ?

Does the cardboard fall down ?

Does water go out ?



You will see that cardboard does not fall down.

It is because that air exerts an upward pressure on the cardboard and so the cardboard and water do not fall.

Thus, from the above activity, it is clear that air exerts pressure.

Activity

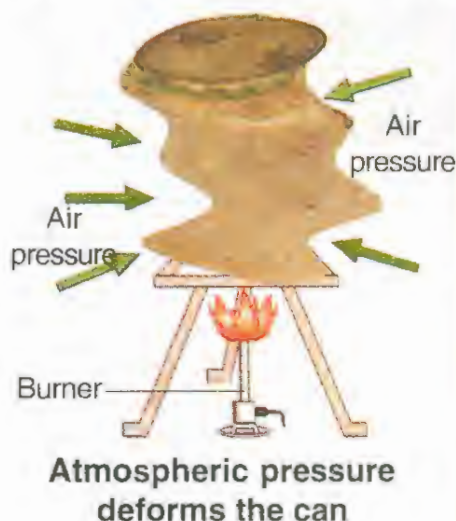
Take a narrow tin can. Put some water in it. Heat the water till it starts boiling.

Let the water boil for a while. After that close the mouth of the can tightly. Allow the can to cool.



What do you find after some time ?

You will find that the sides of the can crumble. The water vapour produced by the boiling water drives away the air contained in the can. When the can is allowed to cool, the vapour condenses to water and a partial vacuum is created inside the can. Now the pressure of the outside air acts on the can and crumbles it.



The above activity shows that for seeing the effect of air pressure, we have only to remove air from a container.

Air Occupies space and has weight

To show that air occupies space and has weight, let us perform the following activity:

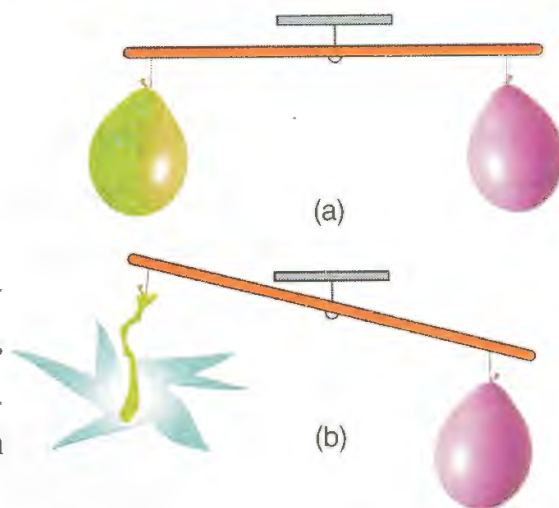
ACTIVITY

Take a thin straight stick, two balloons of the same size, a string and a pin. Tie the string to the middle of the stick. Fill both the balloons with air so that both of

them are equal in size. Tie the mouths of the two balloons with strings of the same size. Hang the balloons one on each side of the stick as shown in fig. (A). Hold up the string at the centre.

The stick remains horizontal and the balloons are balanced. Now prick one of the balloons with the pin and allow air to escape. This end will go up and the other end will come down as shown in fig. (B).

The balloon filled with air is heavier than the balloon which has no air. This shows that air occupies space and has weight.



The uses of Air

The properties of air like 1. air occupies space, 2. air has weight and 3. air exerts pressure help us to perform some of our day-to-day activities.

1. Air can expand certain bodies

Since air occupies space and exerts pressure, it is therefore used to inflate (expand) things like balloons, air pillows and mattresses.



Balloons and pillows are elastic in nature. When air is filled in them, the pressure of air expands their bodies.

Air can be used to inflate a football bladder or a cycle tube. The football will bounce well because of the pressure of the air inside the bladder.

Air is also used to inflate tubes of cycle, car, bus



and lorry tyres.

Due to the air pressure on the inner walls of the tyre-tube, the bicycle and the other vehicles run smoothly on the road.

2. Air pressure can move liquids

Air pressure is used to draw liquids up in straw, an injection syringe, a medical dropper, an ink-filler, a fountain pen, and the common lift pump.

We use a straw to draw cold drink from a bottle. One end of the straw is kept in the drink and is sucked through the other end. Owing to this, some air is removed from the straw tube and the air pressure inside it is reduced. Now the outside pressure acting on the surface of the drink forces it up into the straw and then into the mouth.



Atmospheric pressure helps in sipping drink



Atmospheric pressure presses liquid medicine into the syringe

An injection syringe works with air pressure. The doctor introduces the syringe into the liquid medicine and pushes the piston down pushing the air out. Then he pulls the piston up. The outside air exerts pressure on the surface of the medicine and forces the liquid into the syringe.

Atmospheric pressure presses the liquid into the medicine dropper. The open end of the dropper is dipped into the liquid medicine and the rubber bulb is pressed. The air from the tube of the dropper is forced out and the air pressure



Atmospheric pressure presses liquid into the dropper (filler)

inside it reduced. The outside air pressure presses the liquid medicine into the tube of the dropper. The liquid contained in the dropper can now be emptied.

The fountain pen also works on the same

principle. The medicine dropper can also be used as ink-filler.

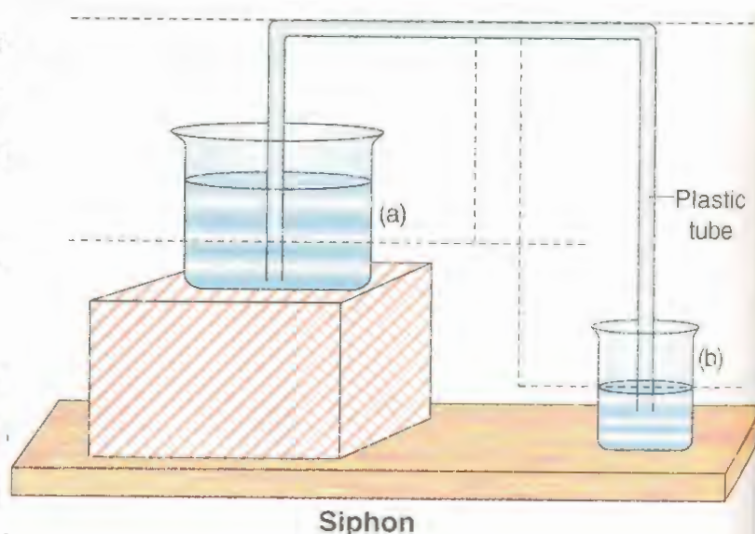
The common lift pump works on the same principle as a syringe and it helps to draw water up.

There are two valves in a lift pump which open only upward and prevent water from going down.

If you are asked to transfer the kerosene oil from a big container into a beaker. How will you do it ?

Take a plastic tube and fill it completely with the kerosene. As shown in the siphon figure, let one end of the rubber tube be dipped in the kerosene and the other end be kept in the beaker. Kerosene will flow speedily and get collected in the beaker.

In this way, the kerosene from the container can be emptied into different beaker. Care should be taken to see that the level of kerosene in the container is higher than that in the beaker. The higher the level of the container from which the liquid is transferred, the faster will be the flow of liquid. There should not be any air leakage in the siphon tube.

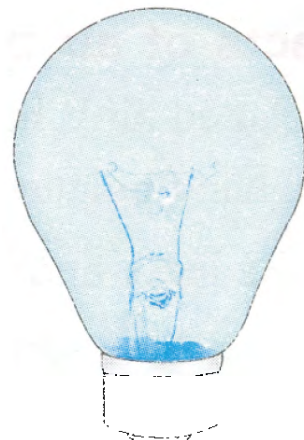


A siphon is a simple arrangement usually made of glass, or plastic, or rubber tube which provides an easy transfer of liquid from a higher level to a lower level.

A siphon is, generally, used if the container is too heavy to be lifted, if the container is fixed to a part of a machine or if the container contains a liquid sediment.

3. Various constituents of air

- * **Nitrogen** : It is the main constituent of air. It is required for the normal growth and development of plants. It is an inactive gas, so it serves to dilute the highly active gas, oxygen. Now-a-days, fertilizers are prepared from the nitrogen of air. Fertilizers increase crop yield.
- * **Oxygen** : It is the active constituent of air. All living things depend on oxygen for respiration. No life can exist on earth without oxygen. It is also essential for burning.
- * **Carbon dioxide** : It is present in air in very small amount. In the presence of sunlight, green plants prepare their food by using this gas.
- * **Water vapour** : Water vapour in air is the cause of the dew, clouds, rain, snow and hail.
- * **Rare gases** : Helium, neon, argon, krypton and xenon are known as 'rare gases' of air. They are very inactive. Helium is used for filling balloons. Argon and krypton are used for filling electric bulbs. Neon is used inside the brightly coloured advertising lights (neon signs).



**Krypton and Argon
user of the Bulb.**

Air Pollution

Air is most important for our existence. It is essential for respiration of both animals and plants. Therefore, air has to be, as far as possible, pure. When poisonous gases and harmful substances mix with the air and make it impure, the air is said to be polluted.

Air gets polluted by smoke, dust and coke emitted by running automobiles and chimneys of factories.

Some common air pollutants which pollute the air are gases like carbon monoxide, carbon dioxide, dust, sulphur dioxide, etc.

Sources of Air Pollution

Various sources of air pollution are :

Burning coal, wood, kerosene, petrol, diesel, etc.

Exhaust gases from automobiles.

Smoke from factories.

Smoke Dirt and dust raised by heavy traffic.

Dirt and dust from certain mines.

Decaying animal and plant matter in garbage.



Effect of air pollution

Polluted air is harmful and injurious to human health. Some of the harmful effects of inhaling polluted air are:

- *Redness and irritation of eyes.
- * Chocking sensation in the throat.
- * Difficulty in breathing, bronchitis.
- * Cough.
- * Sneezing.



Do you know that Tokyo is the most polluted city of the world and Delhi is the most polluted city of India ? Other most polluted cities of India are Kolkata, Mumbai and Kanpur.

Control of air pollution

The pollution of air can be controlled by the following ways:

1. By using smokeless sources of energy, like solar energy, wind energy etc.
2. By installing very tall chimneys in the factories.
3. By growing more trees.

New Words

- Expand** : Cause something to become greater in size.
- Garbage** : Waste material, especially domestic waste, agricultural waste.
- Inactive gas**: One of the constituents of air that dilutes the highly active gas, oxygen.
- Matter** : A physical substance in general. Substance, material or thing of a specified kind.
- Pollution** : Unfit condition of air, water or land resulting by addition of pollutants.
- Pollutants** : Substances which pollute the air, water or land.
- Pressure** : Force, or weight of something pressing continuously on, or against, something that it touches.
- Siphon** : Pipe, tube, etc., in the form of an upside-down, used for making a liquid flow; for example, from one container to another, using atmospheric pressure.
- Vacuum** : The space that is completely empty of all matter, or gases.
- Weight** : Degree of heaviness of a thing, especially as measured on a balance.

RECAP

- ✍ Air has weight and exerts pressure.
- ✍ Air pressure can move liquids.
- ✍ Air ink-fillers, common lift pumps and siphon operate by using air pressure.
- ✍ Air can expand certain bodies.
- ✍ Air contains many gases useful to man.
- ✍ Living being breathe in oxygen. Oxygen is needed for combustion.

- ✍ Nitrogen is needed for the manufacture of fertilizers.
- ✍ Carbon dioxide is needed for the plants to prepare their food.
- ✍ Air gets polluted by smoke, dust and coke.
- ✍ Polluted air is harmful to human health.

Think and Answer

I. Fill in the blanks. Choose the right words from the box:

harmful air exerts pressure nitrogen space
oxygen mixture no weight

1. Air has _____ shape of its own.
2. Air is a _____ of gases.
3. The major constituents of air are _____ and _____.
4. Air occupies _____ and has _____.
5. Pichkari works on the principle that _____.
6. Polluted air is _____ to health.

II. Give scientific reasons:

1. Air exerts pressure but we do not feel it.
2. Air is a mixture of gases but to us it appears to be a single gas.
3. Air has no shape of its own.

III. State whether True or False for each statement:

1. Air is a mixture of gases. []
2. Air does not occupy space. []
3. Air exerts pressure. []
4. Air takes the shape of the container. []
5. Carbon dioxide is needed for green plants to prepare their food. []
6. Polluted air is suitable for breathing. []

IV. Tick (✓) the correct answers :

1. Air consists of :

- | | |
|-------------------------|--------------------------|
| (a) oxygen only | (b) Nitrogen only |
| (c) Carbon dioxide only | (d) all the above gases. |

2. Fertilizers are prepared from :

- | | |
|--------------|-----------------|
| (a) nitrogen | (b) oxygen |
| (c) carbon | (d) rare gases. |

3. A gas used in brightly coloured lights is:

- | | |
|-----------|-------------|
| (a) argon | (b) krypton |
| (c) neon | (d) helium |

4. The gas used in filling balloons is :

- | | |
|--------------|--------------------|
| (a) oxygen | (b) helium |
| (c) nitrogen | (d) carbon dioxide |

5. Pollution of air is due to :

- (a) carbon dioxide given out by human beings and animals.
- (b) smoke given out by automobiles, factories, etc.
- (c) cutting of the green plants.
- (d) growing less trees and plants.

V. Answer the following questions :

1. Mention two properties of air pressure ?
2. Describe an experiment to prove that air has weight ?
3. Describe an experiment to prove that air exerts pressure ?
4. State the names of five rare gases in the air ?
5. Cite some examples which are based on the principle that air exerts pressure?
6. How does medicine dropper work ?
7. Name the gadgets in daily use which make use of air pressure?

8. Give an experiment to show how air pressure helps to push down or lift the liquid up in the straw.
9. How do you feel the air around you?
10. State the uses of nitrogen and oxygen?
11. State the uses of carbon dioxide?
12. State two uses of siphon?
13. What is air pollution ?
14. What are the different causes of air pollution ?
15. List some ways to control air pollution.



DO AND LEARN

1. Bring a tumbler up to your mouth. Suck air out of the tumbler. See what happens. Why does it get stuck to your mouth ?
2. To find out whether the air that you breathe in is pure, carry out some activities at home:
 - (i) With the help of your parents clean the blades of a ceiling fan observe it after a week, especially in summers when it is in use.
 - (ii) Take a potted plant and wash its leaves with water. Keep the plant in the open. Observe it for 3-4 days.

