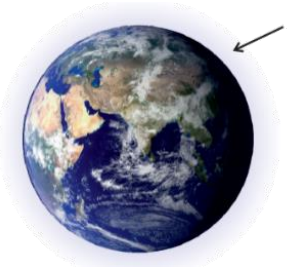
# 3 Air Around Us

"Life cannot be imagined without air, as air contains oxygen for respiration and carbon dioxide for photo-synthesis."

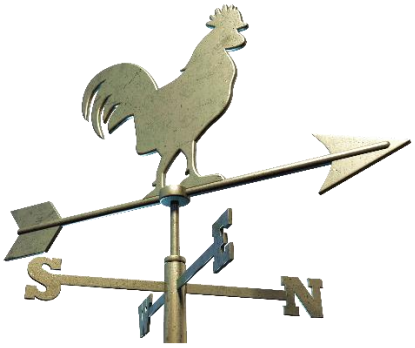
**Do You Remember ?**




- ★ Air is the invisible mixture of gases that surrounds Earth.
- ★ Air contain important substance, such as oxygen and nitrogen, that most species need to survive.
- ★ Sometimes, the word "atmosphere" is used instead of the word "air".

## 1. Introduction

Air is the natural mixture of gases that surrounds the earth. One of the reason that the Earth can sustain life is because of its atmosphere, which keeps air readily available for chemical reactions. A number of different gases, including oxygen, make up the Earth's atmosphere in a mixture that keeps plants, animals and people alive. In addition to sustaining life, air plays a role in many other important functions that are best performed when air quality is high.




A weather cock

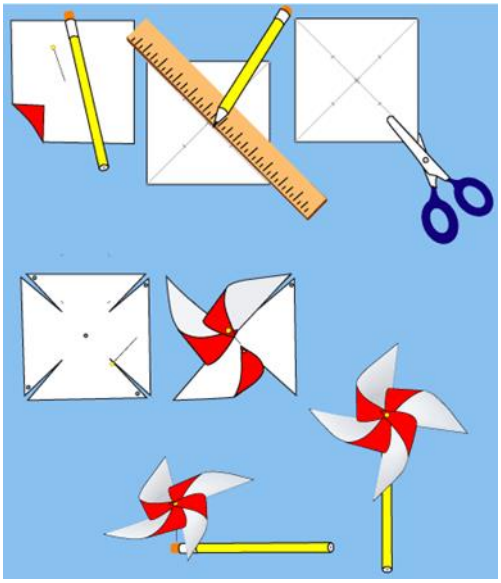
**Active Chemistry 1**

Let us make a firki of our own, following the instructions.

Hold the stick of the firki and place it in different directions in an open area.

Move it a little, back and forth. Observe, what happens.

Does the firki rotate? What makes a firki rotate – moving air, isn't it?



Making simple firkin

Thus, we can say that we cannot see air but we can feel the presence of air.

Have you seen a weather cock? It shows the direction in which the air is moving at that place.

A windvane (or weathercock) is an instrument which shows the direction of wind.

We all need air to survive. It contains oxygen and carbon dioxide, which are useful to plants and animals. Plants use carbon dioxide present in the air to make their own food by a process called photosynthesis.

**Quick Tips**

★ Matter is anything which has mass and occupies space.

★ Air is matter as it has mass, occupied space and exert pressure.

**Atmosphere**

A layer of air surrounding the earth and retained by the earth's gravity is called atmosphere.

## 2. Properties of air

**Important properties of air**

1. Air is a colourless gaseous substance.
2. It occupies space.
3. Air has weight and exerts pressure in all directions.

A barometer is used to measure atmospheric pressure.

**Air is called a mixture because**

1. Air is not a single substance.
2. It consists of many gases like nitrogen, oxygen, carbon dioxide and water vapour.
3. The constituents of air are not chemically combined.

In order to understand various properties of air, let us discuss the following activities.

**Active Chemistry 2**

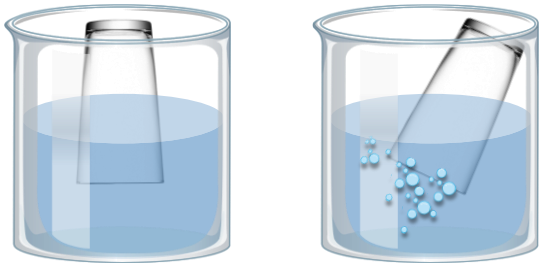
**Aim**

To show that air occupies space.

**Materials required**

(i) A glass trough half filled with water

(ii) A glass tumbler



Experiments with an empty bottle.

**Method**

(i) Take a glass tumbler and invert it, so as to ensure that anything in it falls down.

(ii) Now place the glass tumbler in the through of water. You will notice that the level of water inside and outside the glass tumbler is not the same. From this observation, conclusion can be drawn that there is something invisible within the glass tumbler.

(iii) Now tilt the glass tumbler. You will notice that bubbles rise up in the water. Why?

**Observation**

These bubbles are of air, which escape from the tilted glass tumbler.

To take the place of the air, the water rushes into the glass tumbler.

**Conclusions**

1. Air is colourless and transparent.
2. Air occupies space. As a matter of fact, it fills the whole space in the glass tumbler.


**Aim**

To show that air has mass.

**Materials required**

Balloons, twig of a broom, thread, needle.

Diagram A

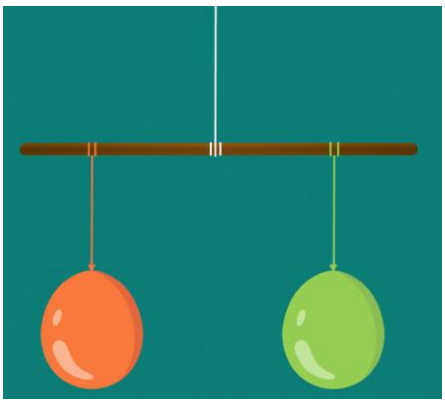
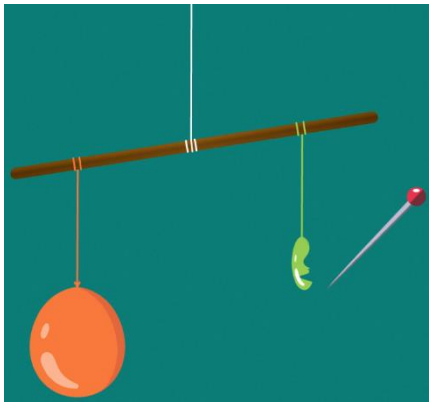


Diagram B



end of experiment

**Method**

1. Make a hole in the middle of a twig of broom.
2. From the middle point of the twig make two holes at an equal distance.
3. Introduce a thread from the middle hole of the twig and suspend it freely.
4. Tie balloons blown with air with equal volume.
5. The twig must be horizontal.
6. Make a tiny hole to the balloon on one side.

**Conclusion and observations:**

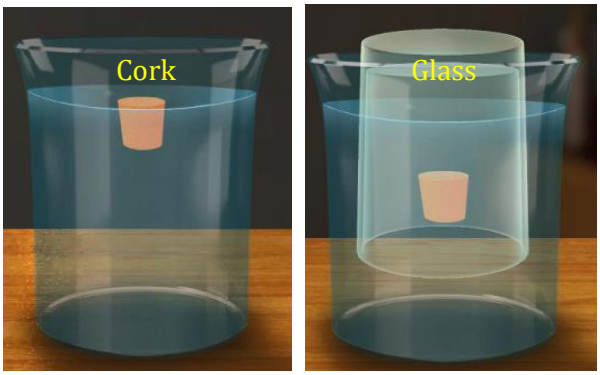
The air goes out and the twig with the punctured balloon comes down showing that the balloon which has air in it has more weight.

## Active Chemistry 4

**Aim**

To show that air exerts pressure.

**Materials required:** Cork, glass, water beaker.




Air exerts pressure

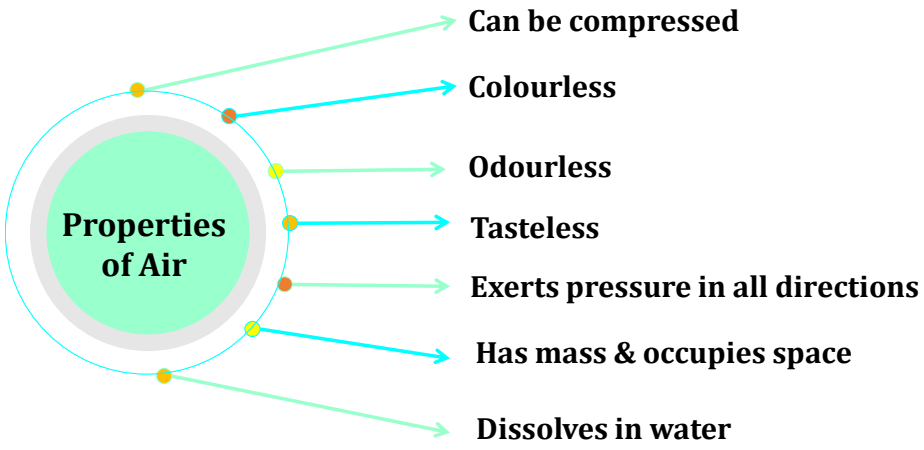
**Method**

1. A glass vessel is taken and is half filled with water.
2. A small piece of cork dropped on the water floats on it.
3. A glass is inverted on the floating cork and is pushed over the floating piece of cork.

**Conclusion & observation**

The air in the glass exerts pressure and pushes down the cork. This shows that air exerts pressure.

## Quick Tips



## Check your Concepts 1

**1.** Statement I : Air is a colourless gaseous substance.
Statement II : Air has weight and exerts pressure in all directions.
(1) Both statements I and II are correct.
(2) Both statements I and II are incorrect.
(3) Statement I is correct and statement II is incorrect.
(4) Statement I is incorrect and statement II is correct.

**2.** Air is
(1) Element (2) Mixture
(3) Compound (4) Gas

## Building Concepts 1

### How do we know the presence of air?

**Explanation**

Presence of air can be felt easily by increase in its speed. For example, if we sit in front of a moving table fan, we feel its presence. If we place a few pieces of paper in front of it, they are blown away.

## Check your Answers 1

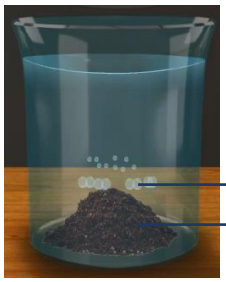
**1.** (1) **2.** (2)

**3. Presence of air**

We cannot see air, but we can feel when it moves and moving air is called wind.
Air is present everywhere around us. Its presence can be feel in many ways - when leaves of the trees rustle and the branches way in the wind or when the clothes hanging on a clothesline swing. This is because of the presence of air.

Presence of air can be felt easily by increase in its speed. For example, if we sit in front of a moving table fan with few pieces of paper, they blow away. It shows the presence of air.

## Active Chemistry 5



Soil has air in it

**Aim**

To show that soil contains dissolved oxygen.

**Materials required**

Soil sample, Beaker, Water

**Method**

(i) Take a lump of dry soil in a beaker or a glass. Add water to it and note what happens.

(ii) You will see bubbles coming out from soil.

**Observations**

(i) When the water is poured on the lump of soil, it displaces the air which is seen in the form of bubbles. The organisms that live inside the soil and the plant roots respire in this air.

(ii) A lot of burrows and holes are formed in the deep soil by the animals living in the soil. These burrows also make spaces available for air to move in and out of the soil.

(iii) When it rains heavily, water fills up all the spaces occupied by the air in the soil. In this situation, animals living in the soil have to come out for respiration, this will be the reason earthworms come out of the soil, only during heavy rains.

**Conclusion**

Soil contains dissolved oxygen.

## Active Chemistry 6

**Aim**

To prove that fresh water contains dissolved air.


Bubble formation in boiling water

**Materials required**

A glass beaker, a tripod stand, a wire gauze, a spirit lamp, fresh water

**Method**

Half fill the beaker with fresh water. Place the beaker on the wire gauze and tripod stand. Heat the beaker with a spirit lamp

**Observation**

In a few minutes, you will see the bubbles of air rising up in water. From where did these bubbles come?

**Conclusion**

The air (mostly oxygen) dissolves slowly in fresh water. When the water is warmed, the solubility of air decreases and hence it comes out of water in the form of bubbles.

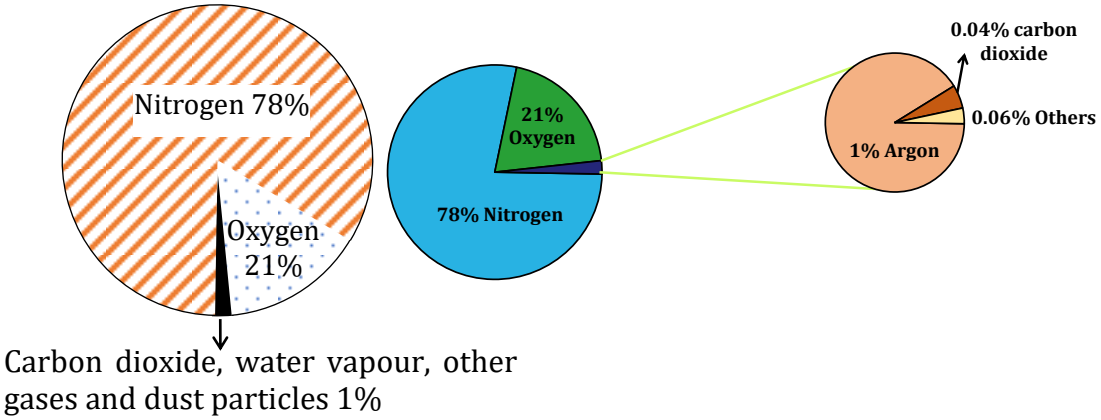
From the above activity, it is very clear that oxygen is dissolved in water. The water animals remove this oxygen with the help of their gills and use it for respiration.

The organisms living under soil also need oxygen for respiration.

## 4. Composition of air

Air is a mixture of many gases. The major component of air is nitrogen gas. Almost four-fifths of air is nitrogen gas. The second major component of air is oxygen gas. About one-fifth of air is oxygen gas. In addition to nitrogen and oxygen gases, air also contains small amounts of carbon dioxide gas, water vapour and some other gases (such as argon and helium etc.). The air may also contain some dust particles.

The composition of air is not always exactly the same. The composition of air changes slightly from place to place and season to season.




Composition of air

For example, the air over industrial cities usually have a higher amount of carbon dioxide in it than the air over open spaces. The air in coastal areas may have more water vapour than inland areas. The air also contains more water vapour in rainy season. Similarly, the amount of dust in the air is more in windy places than other areas.

**Quick Tips**

★ Composition of different gases in air is:

Nitrogen → 78%

Oxygen → 21%

Argon and other noble gases, water vapour and dust particle → 0.97%.

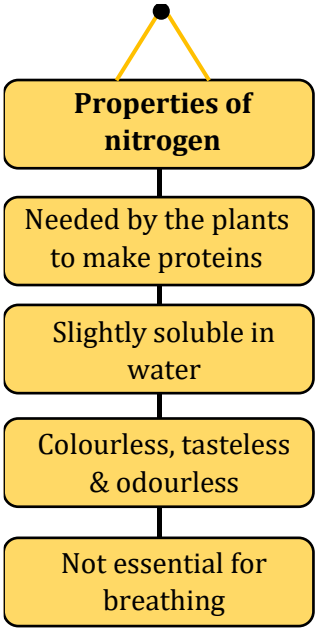
Carbon dioxide → 0.03%

**Water vapour**

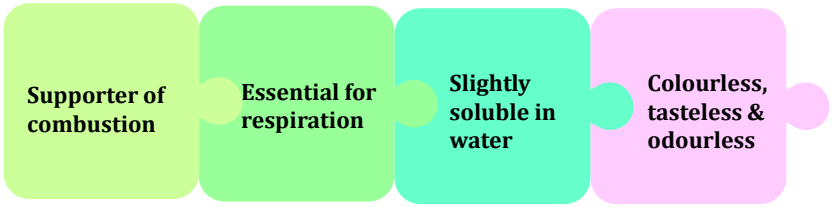
We have learnt earlier that air contains water vapour. We also saw that, when air comes in contact with a cool surface, it condenses and drops of water appear on the cooled surfaces. The presence of water vapour in air is important for the water cycle in nature.

Quick Tips

★ **Properties of Nitrogen**




★ **Properties of Oxygen**




Active Chemistry 7

**Aim**

To show that air contains oxygen.

**Materials required**

Two small candles, two containers, two glasses.

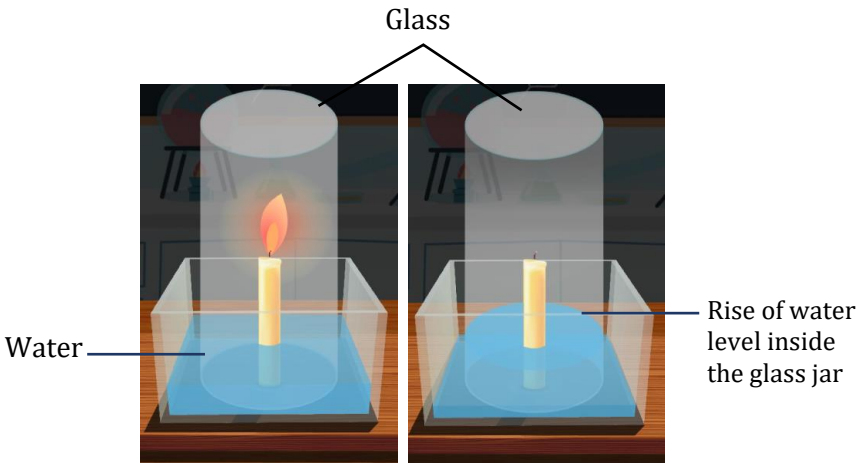
**Method**

1. Fix two small candles of the same size in the middle of two shallow containers.
2. Fill the containers with some water.

3. Light the candles and then cover each one of them with an inverted glass (one much taller than the other).
4. Observe carefully what happens to the burning candles and the water level. Do the candles continue to burn or go off?

   Does the level of water inside glasses remain the same?

**Experiment with candle**




Air has oxygen

The burning of the candle must be due to presence of some component of air, isn't it? Do you find any difference in your observation with the two glasses of different heights? What can be the reason for this?

**Observation and conclusions**

As burning can occur only in the presence of oxygen, we see that, one component of air is oxygen.

But, the amount of air and oxygen inside each glass is limited. Thus, most of this oxygen is used up by the burning candle, it will no longer burn and thus it blows out. Hence, water rises up in the glass once the candle blows out. But, this rise in water level is not associated with the amount of oxygen utilised in burning of the candle.

**Building Concepts 2**

**How will you show that oxygen is present in air?**

**Explanation**

Invert a glass on a burning candle flame. After few seconds, the flame of the covered candle goes off. This happens because the oxygen inside the glass is used up in burning.

**Carbon dioxide**

In a closed room, if there is some material that is burning, you may have felt suffocation. This is due to excess of carbon dioxide that may be accumulating in the room, as the burning continues.

Carbon dioxide makes up a small component of the air around us. Plants and animals consume oxygen for respiration and produce carbon dioxide. Plant and animal matter also consumes oxygen on burning and produces mainly carbon dioxide and a few other gases. It is advisable not to burn dry leaves and discarded remains of the crop, which pollute our surroundings.

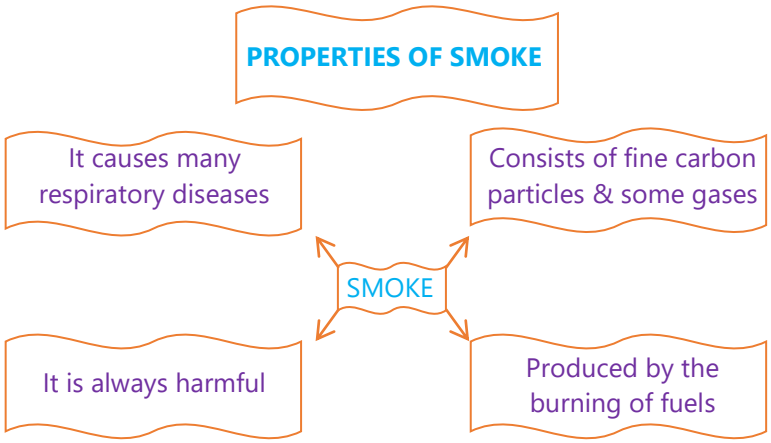
**Dust and smoke**

The burning of fuel also produces smoke. Smoke contains a few gases and fine dust particles and is often harmful. That is why you see tall chimneys in factories. This takes the harmful smoke and gases away from our noses, but brings it closer to the birds flying up in the sky! Dust particles are always present in air.

**Quick Tips**

★ **Properties of Carbon dioxide**


★ **Properties of smoke**



## Active Chemistry 8

**Aim**

To show that air contains dust particles.

**Method**

Observing presence of dust in air with sunlight.

1. Find a sunny room in your school/home. Close all the doors and windows with curtains pulled down to make the room dark.
2. Now, open the door or a window facing the sun, just a little, in such a way that it allows sunlight to enter the room only through a slit, look carefully at the incoming beam of sunlight.

**Observation**

We will see some tiny shining particles moving in the beam of sunlight.

**Conclusion**

This shows that air also contains dust particles. The presence of dust particles in air varies from time to time and from place to place.

## Check your Concepts 2

**1.** How does the quantity of water vapour vary from place to place?

**2.** What is the ratio of oxygen and nitrogen in the atmosphere, respectively?

(1) 2 : 4 (2) 4 : 2 (3) 4 : 1 (4) 1 : 4

**3.** The atmosphere consists mainly _____.

(1) Oxygen and Nitrogen

(2) Nitrogen and Hydrogen

(3) Hydrogen and Oxygen

(4) None of the above

**4.** The volume of water vapour is high in the regions of _____.

(1) coastal areas (2) plateau regions

(3) industrial areas (4) All the above

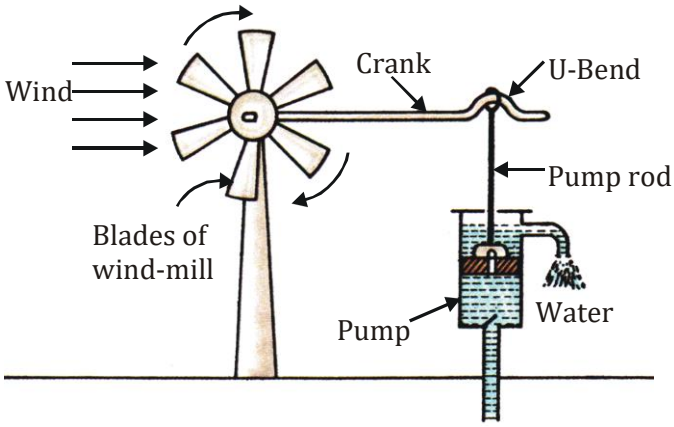
**5.** Air contains _____ in a little quantity.

(1) Neon (2) Chlorine

(3) Hydrogen (4) Fluorine

## 5. Uses of air

1. Air supports life.
   We all need air to survive. Air contains oxygen and carbon dioxide which is very useful for plants and animals. Plants use carbon dioxide present in the air to make their own food by a process called **photosynthesis.**
2. Air is used for burning fuels. (like wood, coal and kerosene, etc.)
3. Compressed air is used to fill tyres.
4. Air helps in the dispersal of seeds.
5. Blowing air (called wind) is used to turn the blades of wind-mills.




A wind-mill being used to run a pump to draw water from the ground.

Let us see how this wind-mill works to draw water from the ground. The blowing air (or wind) rotates the wind-mill blades continuously. When the blades rotate, the crank attached to the blades also rotates. When the crank rotates, then its U-bend lifts the pump rod up and down continuously. The rod works the pump which lifts the water from ground.

6. Air helps in the movement of yachts (sailing boats), parachutes, gliders and aeroplanes.
7. Air helps the birds, bats and insects in flying.
8. Air plays an important role in the water cycle in nature.
9. Earthworm takes in air through their skin surface. The skin is kept moist with the help of a substance called mucous. Oxygen present in the air gets directly absorbed through the moist skin and carbon dioxide is given out.

SPOT LIGHT

Some aquatic animals such as dolphins and whales come to the surface of the water regularly to take in air, since they breathe with the help of lungs.

Antoine Lavoisier, was the person who recognised oxygen as the gas responsible for combustion.

## Check your Answers 2

**1.** (a) The volume of water vapour is high in the sea coastal area.
(b) It is low in the plateau regions.
(c) The temperature shows its effect on water vapour in air.
(d) When the temperature is high, the volume of water vapour increases in air.
(e) In winter season mist and fog are formed due to the presence of water vapour in air in excess.

**2.** (4)

**3.** (1)

**4.** (1)

**5.** (1)

## Building Concepts 3

**How will you prove that air supports burning?**

**Explanation**

Two lighted candles are taken. One candle is covered and fixed in a tumbler containing water. This candle is covered by an inverted glass. After sometime, the covered candle gets extinguished as soon as all the oxygen present in tumbler is used up.

### 6. Oxygen cycle

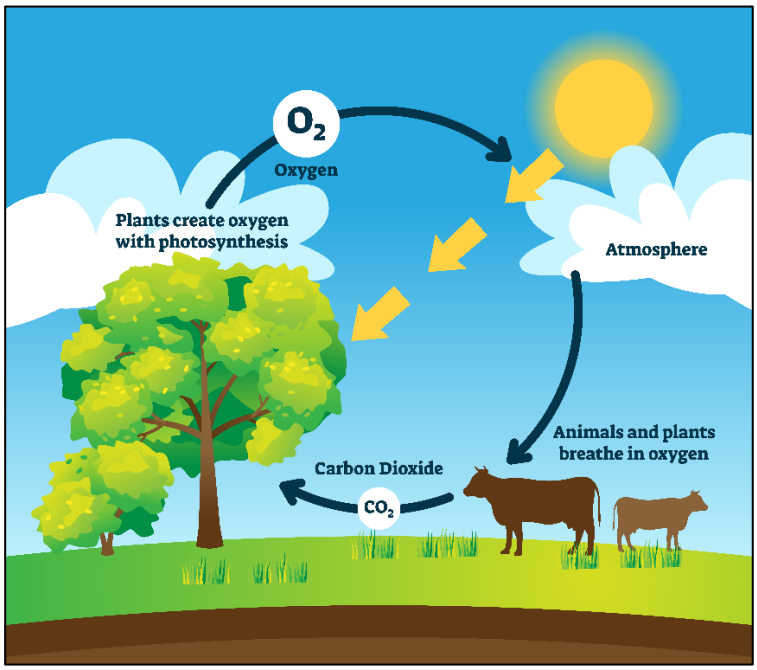
The continual interchange of oxygen between the atmosphere and the water, the plants and animals and mineral matter is called the oxygen cycle.

In photosynthesis plants make their own food and oxygen is produced along with it. Plants also consume oxygen for respiration, but they produce more of it than they consume. That is way we say plants produce oxygen.

It is obvious that animals cannot live without plants. The balance of oxygen and carbon dioxide in the atmosphere is maintained through respiration in plants and animals and by the photosynthesis in plants. This shows the interdependence of plants and animals.

Oxygen cycle is critical to both our health and the health of our environment. We need it for respiration. The oxygen that we breath oxidises the sugar in the food to generate energy. During this process carbon dioxide is released in the atmosphere.

- Humans need oxygen to breathe.
- Oxygen is needed for decomposition of organic waste.
- Water can dissolve oxygen and it is this dissolved oxygen that supports aquatic life.




Oxygen cycle

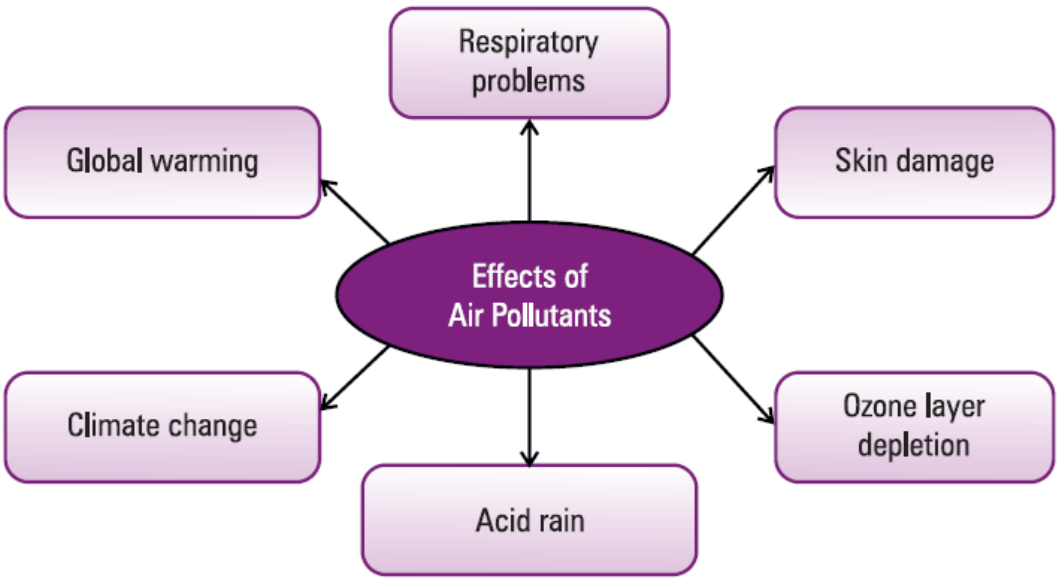
## 7. Air pollution

When the air contains harmful or undesirable substances, generated by the activities of man or nature, such that their concentration interferes with human health or is injurious to plants or animals. It is said to be polluted air and the undesirable substances are called pollutants.

The traffic police constables wear face masks. This is because our nose is not adequate to stop all the dust particles. So they need face masks to stop dust particles present in air.

SPOT LIGHT

**Effects of air pollutants**



**Controlling methods for air pollution**

(i) By checking the emission of smoke from motor vehicles.

(ii) By checking or controlling the emission of smoke from factories.

(iii) By using the devices which can filter the agents causing the pollution.

(iv) Reforestation methods.

(v) Controlling the usage of fertilisers, spreading of dust particles and educating the people about the pollution of air and its prevention methods.

(A) Deforestation

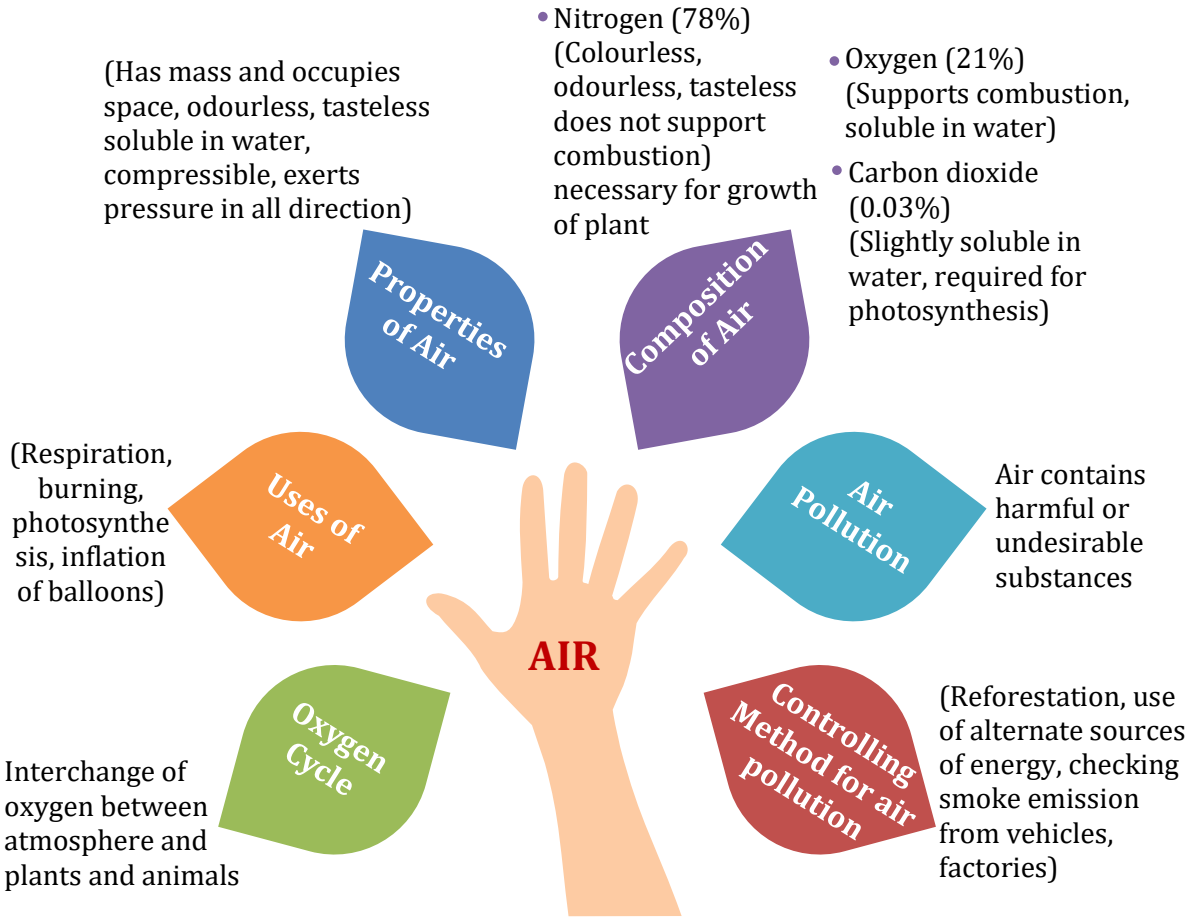
(B) Reforestation

Reforestation is a controlling method for air pollution.

## Basic terminology

1. **Atmosphere –** A layer of air surrounding the earth.
2. **Weather cock –** It is a instrument which shows the direction of wind.
3. **Mixture –** A substance which have two or more component.
4. **Transparent –** Material through which we can see clearly.
5. **Odourless –** Things which do not have any smell is called odourless.
6. **Gas –** State of matter which do not have fix shape, size and volume.
7. **Element –** Those substance which is made up of single type of atom is called element. Eg: Gold, Silver, Hydrogen, etc.
8. **Compound –** Those substance which is made up of two or more different of atom combine chemically is called compound. Eg: water, salt, etc.
9. **Wind –** Moving air is called wind.
10. **Windmill –** Windmill is device for tapping the energy of the wind by means of sails mounted on a rotating shaft.

## Memory Map


(Has mass and occupies space, odourless, tasteless soluble in water, compressible, exerts pressure in all direction)
Properties of Air
• Nitrogen (78%) (Colourless, odourless, tasteless does not support combustion) necessary for growth of plant
• Oxygen (21%) (Supports combustion, soluble in water)
• Carbon dioxide (0.03%) (Slightly soluble in water, required for photosynthesis)
Composition of Air
(Respiration, burning, photosynthesis, inflation of balloons)
Uses of Air
AIR
Air Pollution
Air contains harmful or undesirable substances
Interchange of oxygen between atmosphere and plants and animals
Oxygen Cycle
Controlling Method for air pollution
(Reforestation, use of alternate sources of energy, checking smoke emission from vehicles, factories)