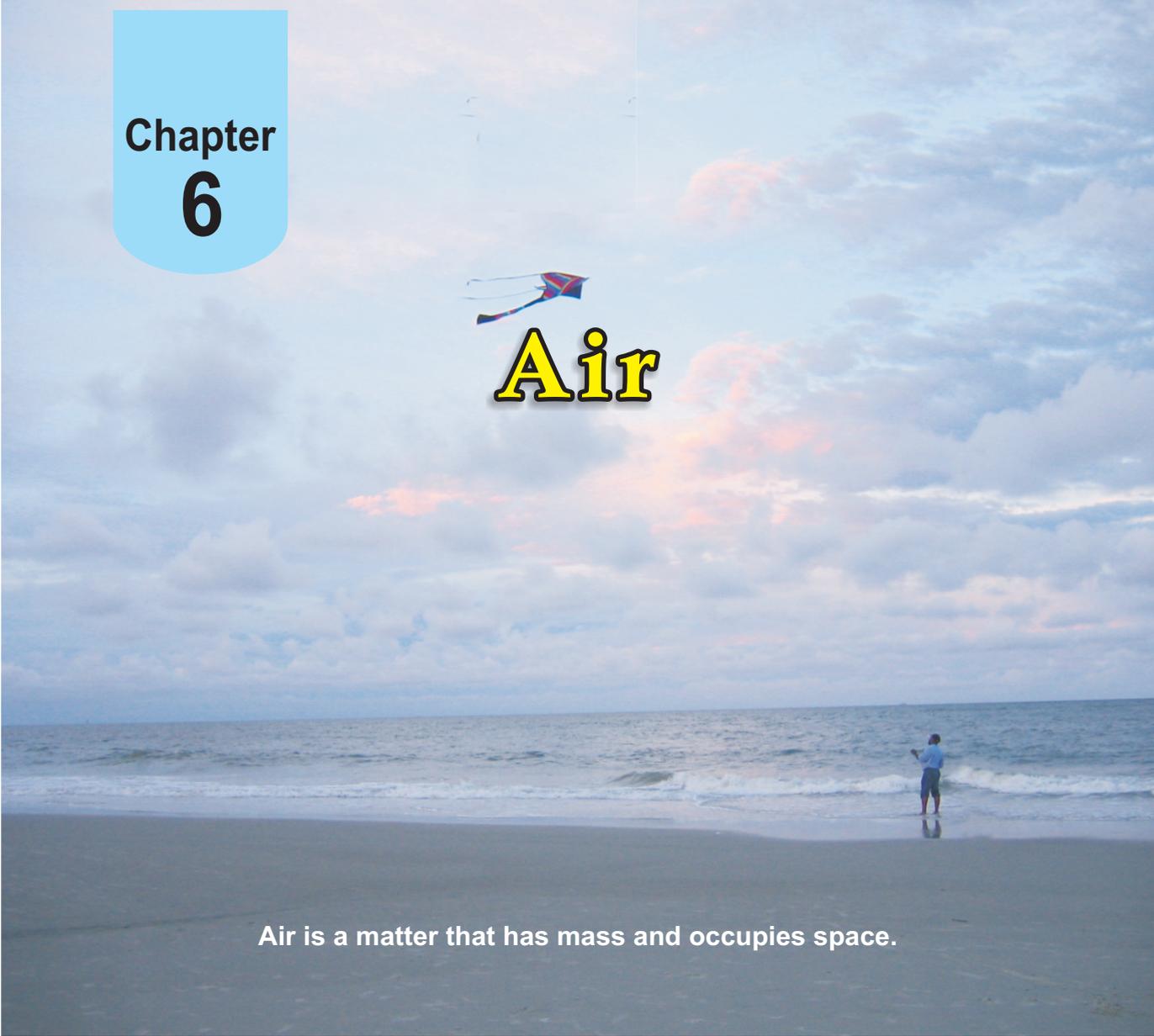


Chapter 6

A photograph of a beach at sunset or sunrise. The sky is filled with soft, colorful clouds in shades of blue, pink, and orange. A kite with a colorful diamond shape and long tails is flying in the sky. In the foreground, a person is standing on the wet sand near the water's edge, looking out at the ocean.

Air

Air is a matter that has mass and occupies space.

Student Learning Outcomes

After completing this chapter, you will be able to:

- Recognize the importance of air.
- Identify the composition of air.
- Relate the properties and uses of gases in air with the composition of air.

Air and its Importance

Air is a mixture of gases. Air is present everywhere. Even in water and soil, air is present. Air covers the Earth like a thick blanket. This blanket of air is called the **atmosphere**.

Many layers of air are present in the atmosphere. Scientists have divided the atmosphere into four layers (Fig.6.1). These are troposphere, stratosphere, mesosphere and thermosphere.

Each layer of the atmosphere mixes with the layer above. Only the lowest layer of the atmosphere has enough air to support the life. Troposphere starts at Earth's surface and goes up about 8 kilometres to 16 kilometres above the surface. Most weather conditions happen in this layer.

As we go up through the layers of the atmosphere, temperature and air pressure change. Air pressure decreases as we go up.

Air is very important to us:

- We breathe in the air. We can't live without it.
- Air is needed for burning.
- We pump air into footballs, balloons and tyres of our vehicles.
- In our homes, we use air pressure to draw dust into the bag of vacuum cleaner.
- Fish and other animals in water use the air dissolved in water for respiration.
- Plants use air (carbon dioxide) to make their food.

Moving air is called **wind**. Differences in air temperature create winds. Winds can move slow or fast. Wind comes from different directions. A **wind vane** shows wind direction. Scientists make forecasting about weather with the help of a wind vane.

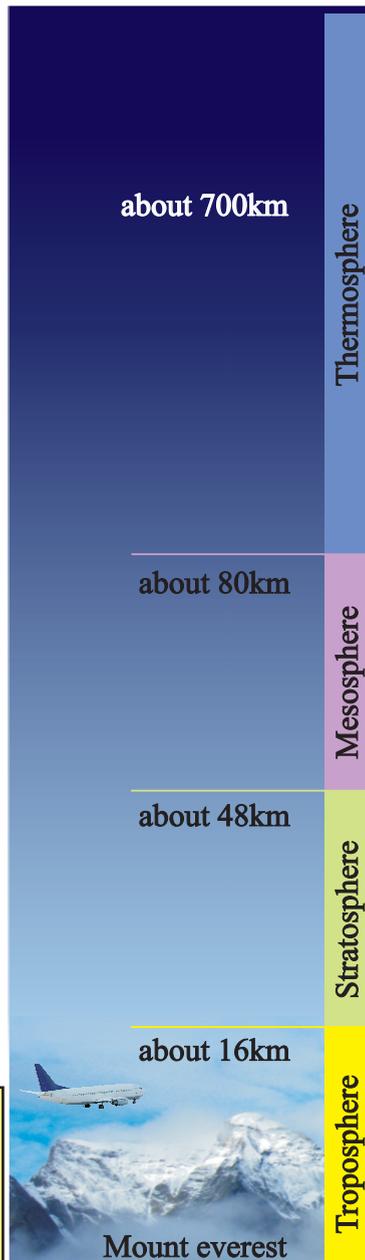


Fig.6.1: Layers of atmosphere

Composition of Air

We know that air is a mixture of different gases. Major gases in the air are:

- ◇ About 78 percent of the air is **nitrogen** gas.
- ◇ About 21 percent of the air is **oxygen** gas.
- ◇ About 0.03 to 0.04 percent of the air is **carbon dioxide** gas.
- ◇ Remaining air contains **rare gases** like helium and argon.

Some amount of water vapours, ozone, smoke and dust particles are also present in air.

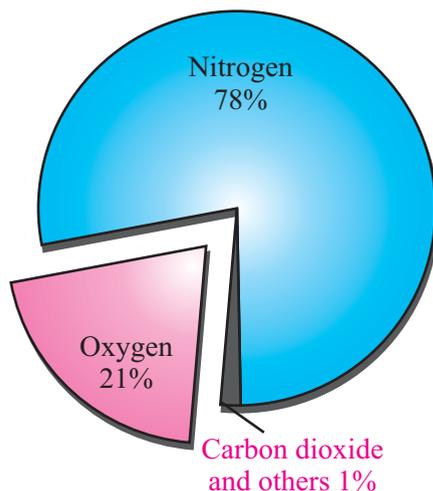


Fig.6.2: Air is a mixture of gases.

Properties and Uses of Gases in the Air

Nitrogen

Nitrogen is the major part of the air. It is a colourless gas. It has no taste or smell. It is slightly soluble in water. Nitrogen does not burn and does not support the process of burning. Actually, it is not a very active gas.

Uses of Nitrogen

1. Nitrogen is used to preserve freshness of foods.
2. As nitrogen does not burn, it is used in explosive storage tanks.
3. Nitrogen is used in light bulbs to prevent the filament from burning up.
4. Fertilizers like ammonia, urea, ammonium sulphate, contain nitrogen. These fertilizers increase the fertility of land.
5. Nitrogen is used in dyes, medicines and explosives.
6. Presence of nitrogen in the air reduces the process of rusting of iron.
7. Liquid nitrogen is used as a coolant for freezing of blood and large computer systems.



Fig.6.3: Nitrogen is present in some medicines.

Do you know?

Presence of nitrogen slows down the process of burning. If there would be mostly oxygen in the air, even small fires would have caused great damage.

Oxygen

Second major gas of the air is oxygen. It is a colourless gas. It has no smell. Oxygen is slightly soluble in water. It is very active gas. Oxygen does not burn. But it helps in burning and rusting of iron.

Uses of Oxygen

1. All the living organisms use oxygen for respiration.
2. It is essential for burning of wood, coal and natural gas.
3. It dissolves in water. Due to this property animals and plants breathe in the water.
4. Some patients of lungs and heart diseases need oxygen in hospitals.
5. Mountain climbers, sea divers and astronauts carry oxygen in cylinders for breathing.
6. It is used in welding and cutting of metals.
7. Rockets use liquid oxygen during their space journeys.

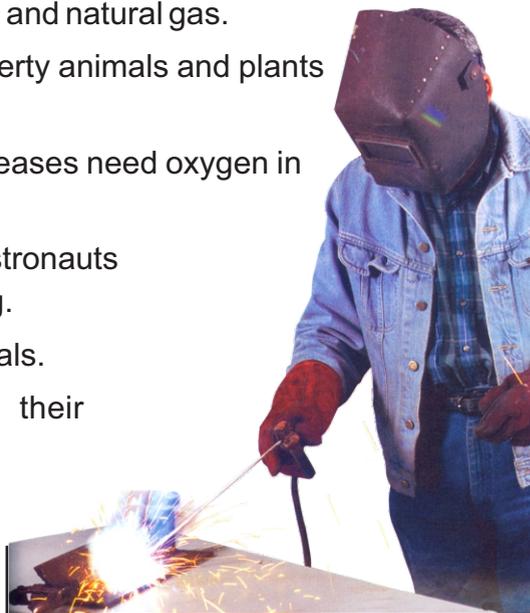


Fig.6.4: Oxygen is used in the flame of welding.

Do you know?

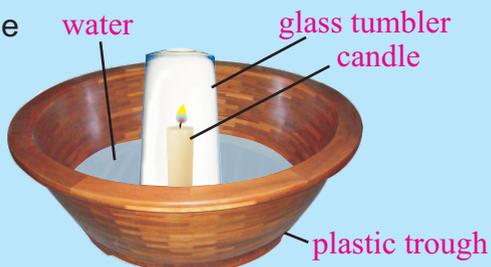
One tree produces as much oxygen which can fulfil the needs of 36 children.

You will need:] plastic trough] a candle
] a glass tumbler] matchbox] water

- Procedure:** 1. Fix a candle in a plastic trough.
2. Pour some water in the trough.
3. Light the candle.
4. Invert a glass tumbler over the candle.

You will see that the candle continues burning for sometime and then puts out. The water rises in the glass to some extent.

Things to think: Why does the flame go off? Why has water risen in the glass tumbler?



Carbon Dioxide

The amount of carbon dioxide in air is less than one percent. It is a colourless gas. It has no smell but a sour taste. It is slightly soluble in water but its solubility increases under high pressure. It is heavier than air. It can turn lime water milky. Carbon dioxide does not burn. It also does not support the burning process.

Uses of Carbon dioxide

1. All green plants absorb carbon dioxide from the air to make food.
2. Carbon dioxide is filled in soda water bottles under some pressure.
3. A fire extinguisher releases carbon dioxide to put out fires.
4. When the cake is baked, bubbles of carbon dioxide are given out. These bubbles cause the cake to rise and become fluffy.
5. Carbon dioxide is easily frozen into its solid form which is called dry ice. The dry ice is used to preserve the food.



Fig.6.5: Carbon dioxide makes the cake fluffy.

Do you know?

Dry ice is crushed into powder. This powder is carried high up in the clouds by an aeroplane. The dry ice is sprinkled on the clouds which will fall as rain. This process is done in an Australian desert.

You will need:] lime stone] a basket] a brush] water

Procedure

1. Take some lime stone in the basket. Pour as much water in the basket, so that all the lime stone sink in it.
2. After one hour apply the lime water on a wall with the help of brush.

What colour do you see on the wall? After some time the lime water absorbs carbon dioxide from the air. What colour do you see now?

Rare Gases

Rare gases include argon, neon, helium, etc. They do not react with other elements. They do not cause burning. They are present in rare amounts in air.

Uses of Rare Gases

1. Argon is used in electric bulbs and fluorescent lamps.
2. Neon is used in colourful advertisement lights.
3. Helium is a very light gas. It is filled in weather balloons.

Water Vapours

Very small amount of water vapours is also present in air. But the amount of water vapours in the air changes with changing weather. Heavy amount of water vapours in the air causes rain. Water vapours in the air control the rate of evaporation from plants and animals. The presence of water vapours in air sometimes produces **smog** which is a combination of smoke and fog.

You will need:] a glass tumbler] pieces of ice

Procedure

1. Wipe the outer surface of the glass tumbler with a dry cloth.
2. Fill the tumbler with pieces of ice.

What do you see on the outer surface of the tumbler?

Things to think: From where does the water come on the outer surface of the tumbler?



Dust Particles

Smoke and dust particles are also present in the air. We can see dust particles in the air.

Close all the doors and windows of your room during a sunny day. Let the sunlight enter the room through a small hole and see the dust particles.

1. Air is present everywhere.
2. Atmosphere is the blanket of air around the Earth. It has four layers.
3. All organisms respire in air.
4. Air is a mixture of different gases.
5. Nitrogen and oxygen are major constituents of air.
6. Nitrogen is not a very active gas.
7. Oxygen is a very active gas.
8. Carbon dioxide is used in photosynthesis.

1. Write proper term/word against each statement.

- i. The layer of the atmosphere that supports all life _____
- ii. The gas that makes up the largest part of air _____
- iii. The gas that makes up about 21% of air _____
- iv. A gas which is filled in soda water bottles _____

2. Encircle the letter of the best answer.

- i. Thick blanket of air around the Earth is:
(a) Earth cover (b) atmosphere
(c) wind (d) Earth's coat
- ii. We can produce a lot of urea fertilizer because:
(a) There is oxygen in the air.
(b) There is a lot of nitrogen in the air.
(c) There is carbon dioxide in the air.
(d) There is water in the air.
- iii. During their space journeys, rockets use:
(a) liquid oxygen (b) liquid nitrogen
(c) liquid hydrogen (d) liquid carbon dioxide
- iv. We want our bun to be fluffy. Which gas can help us?
(a) nitrogen (b) oxygen
(c) carbon dioxide (d) helium
- v. Percentage of CO₂ in air is about:
(a) 0.01 – 0.02% (b) 0.02 – 0.04%
(c) 0.03 – 0.04% (d) 0.06 – 0.08%
- vi. Which gas is considered as life supporting?
(a) argon (b) nitrogen
(c) hydrogen (d) oxygen

3. Answer the following questions in detail.

- i. What is the atmosphere? How is air important for us?
- ii. Write some uses of oxygen in our daily life.
- iii. Write some properties of carbon dioxide .

4. Extend your thinking.

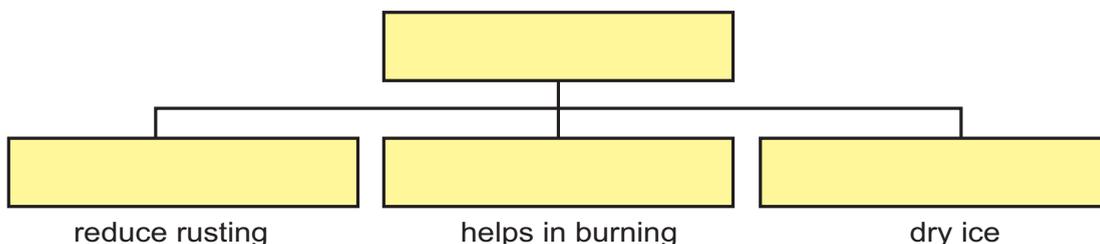
- i. How would air composition change if there were no plants?
- ii. When an empty glass is inverted vertically into a tub of water, the water does not enter the inverted glass. Why do you think this is so?

- iii. Why is carbon dioxide important to the survival of life on Earth? Name one other gas in Earth's atmosphere and explain its importance to living things.
- iv. Based on what you have learnt, can you give three ways in which oxygen and nitrogen are the same and two ways in which they are different?

5. Concept Map

Fill the concept map using following words:

carbon dioxide, oxygen, air, nitrogen



- 1 A pile of books can be lifted with air. Place a plastic bag (fitted with a valve) on the table. Place four books on it. Blow the air in the plastic bag. Observe what happens.
- 2 Tape four equal lengths of string to the corners of a square polythene sheet. Tie the strings to a small doll. Drop the parachute from a height. The parachute floats down smoothly. It comes down due to the force of gravitational attraction. Why does it come down slowly?

When percentage of carbon dioxide increases in the atmosphere, it increases the temperature of the Earth. This behaviour of carbon dioxide is called **greenhouse effect**. The greenhouse effect is important. Without the greenhouse effect, the Earth would not be warm enough for humans to live. But if the greenhouse effect becomes stronger, it could make the Earth warmer than usual. Even a little extra warming may cause problems for humans, plants, and animals. How can we decrease the greenhouse effect?

Computer Links

- http://www.sciencekidsathome.com/science_topics/hot_air.html
- <http://www.sciencewithme.com/experiments.php>