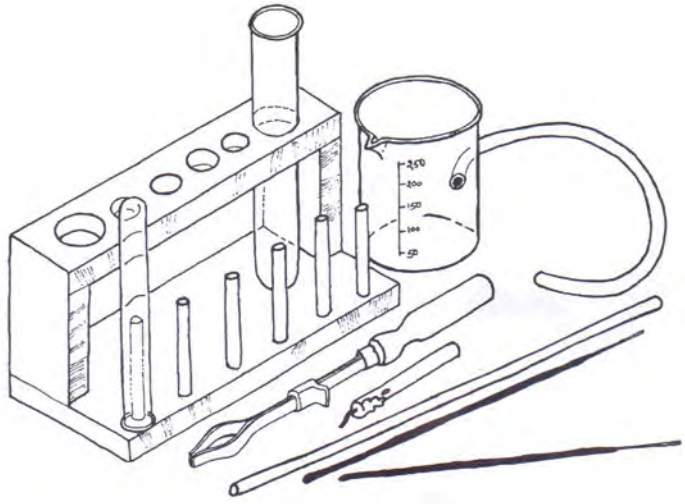
GASES

Chapter 13



You have done a number of experiments with air. You learned that air occupies space in the same way that solids and liquids do. And like liquids, gases also do not have a stable or definite shape. They take the shape of the container in which they are kept. You also learned another important difference between air and liquids - the volume of air can be reduced by compressing it.

All substances like air that do not have a definite shape or volume are called gases.

Let us prepare some gases and study their properties. Before we begin our experiments the teacher will prepare lime water and pink phenolphthalein indicator solution for the whole class.

Preparation of lime water

Fill a beaker halfway with water. Add about 5 gm of the lime that we apply to betel leaves. Stir the beaker well and let it stand overnight. Filter this **solution** the following day (Figure 1). Use this filtrate in all the experiments you perform. This solution should be transparent.

Figure 1

Pink phenolphthalein indicator solution

Fill a beaker halfway with water and add ten drops of phenolphthalein solution. Add a few drops of lime water. Do you observe any change in colour?

If the solution is light pink in colour, use it for the experiment. If the colour is dark pink, add some water to make it light pink before using it. Phenolphthalein solution is an **indicator**, like litmus paper.

You have already seen that there are two types of phenolphthalein indicator solutions: a pink solution and a

colourless solution. If the pink solution becomes colourless when it is added to a substance, it indicates that the substance is acidic in nature. If the colourless solution turns pink when added to a substance, it indicates that the substance is alkaline in nature. Neutral substances do not affect either the pink or the colourless phenolphthalein solution.

Experiment 1

Carbon dioxide

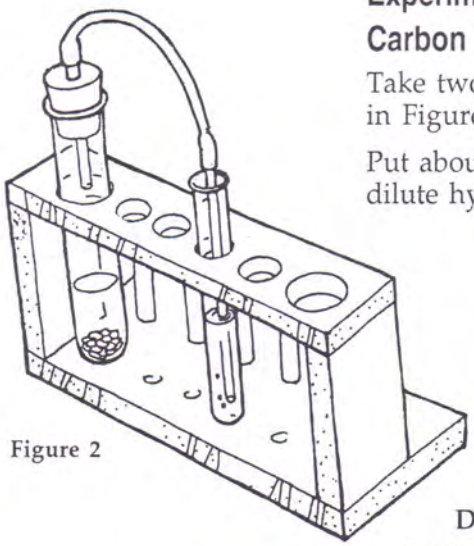


Figure 2

Take two glass tubes and join them with a rubber tube as shown in Figure 2.

Put about 5 gm of marble chips into a boiling tube. Pour enough dilute hydrochloric acid into the boiling tube to cover the marble chips. Fix one glass tube in a one-holed rubber cork and fit it tightly in the mouth of the boiling tube. Ensure that the lower end of the glass tube dips into the boiling tube without touching the hydrochloric acid.

Fill a test tube halfway with a lime water solution. Dip the second glass tube into this solution in the test tube.

Do the marble chips react with the hydrochloric acid? (1)

Look at the solution in the test tube. Has a gas formed in the boiling tube? Give reasons for your answer. (2)

Does the lime water undergo a change? (3)

Which observation suggests that a new substance was formed in the boiling tube? (4)

Test the properties of the gas by doing the following experiment.

Experiment 2

Fill one fourth of a test tube with pink phenolphthalein solution.

Pass the gas through the phenolphthalein solution like you did in Experiment 1.

What effect did the gas have on the phenolphthalein solution? On the basis of your observation, can you tell whether the gas is acidic, basic or neutral? (5)

Experiment 3

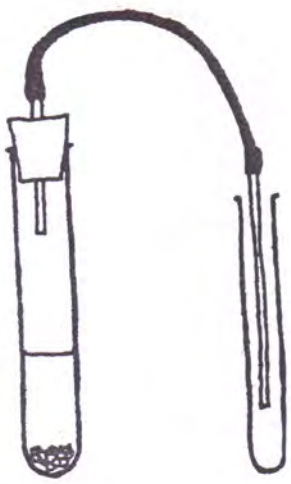


Figure 3

Collect the gas in a test tube using the method shown in Figure 3.

What is the colour of this gas? (6)

How does it smell? (7)

Now put strips of wet blue and red litmus paper into the test tube, one by one.

Which of the two litmus papers changed colour? What was the

change? Can you tell the nature of the gas on the basis of your observation? (8)

Return the litmus papers to your teacher. You can use them again.

Experiment 4

Take an empty glucose bottle or any other glass bottle. Drop a burning matchstick into the bottle and note the time it takes to extinguish (Figure 4).

Fill the bottle with gas as you did in Experiment 3. Drop a burning matchstick into the bottle.

How much time did the matchstick take to extinguish this time? (9)

What did you learn about the nature of the gas formed by the reaction between marble chips and hydrochloric acid? (10)

How can this property be used in our daily life? (11)

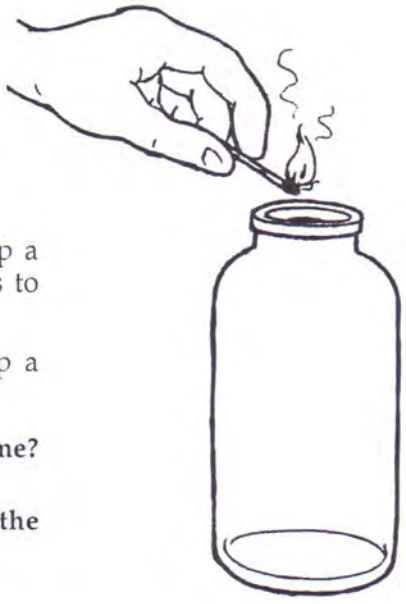


Figure 4

Experiment 5

Put a wet blue litmus paper in a boiling tube.

Did the colour of the litmus paper change? (12)

Fill the bottle with gas as you did in Experiment 4. Pour the gas into the boiling tube in the same way you pour water. While pouring the gas, take care not to invert the bottle over the boiling tube. Hold it at a slight tilt so that the air inside the boiling tube can escape as the gas from the bottle flows into the boiling tube (Figure 5).

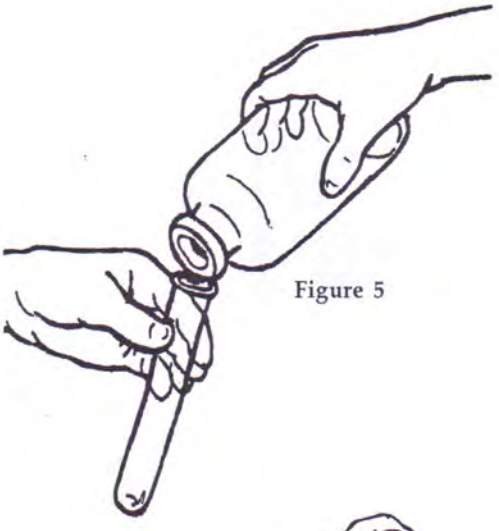


Figure 5

Remove the bottle after some time and put a wet blue litmus paper in the boiling tube.

Did the colour of the litmus paper change? (13)

On the basis of your answers to Questions 12 and 13 can you conclude that the gas from the bottle flowed into the boiling tube? (14)

On the basis of this experiment can you tell which is heavier - the air or the gas? (15)

You learned about several properties of this gas in these experiments. Make a list of these properties. (16)

The name of this gas is **carbon dioxide**.

Do this before you start the next experiment

Fill a test tube to the brim with water, close its mouth with your thumb and invert it. Place the inverted test tube in a container of water and remove your thumb. The water in the test tube should not flow out when you remove your thumb (Figure 6a and b).

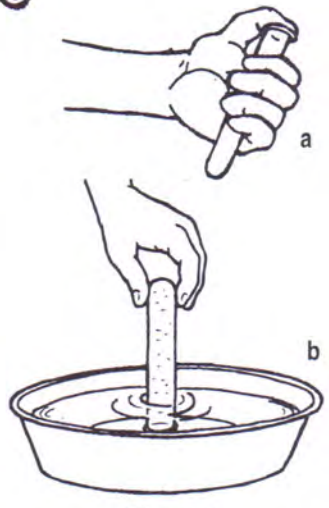


Figure 6

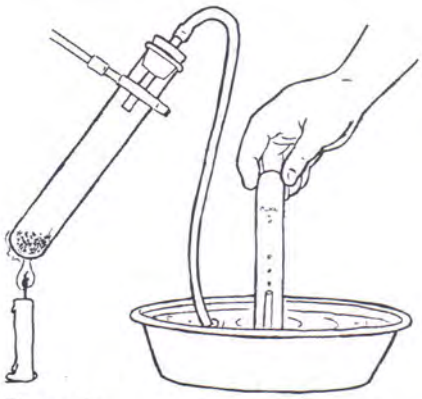


Figure 6c

Experiment 6

Oxygen

Put about 2 gm to 3 gm of potassium permanganate in a boiling tube. Set up the apparatus as shown in Figure 6c and heat the boiling tube. Use a test tube holder to hold the boiling tube over the flame.

What happened to the chemicals in the boiling tube? (17)

Did a gas collect in the test tube containing water? How can you tell that a gas has collected there? (18)

What is the colour of the gas? (19)

Keep the test tube containing the gas aside. We won't do any experiments with this gas because it contains some air.

Fill another boiling tube with this gas. Close its mouth with a cork and place it on a stand.

How does the gas smell? (20)

Figure 7

Experiment 7

Light an incense stick. Dip the smouldering end in the boiling tube (Figure 7)

What happened? Which property of the gas did you learn from your observation? (21)

Take another boiling tube filled with the gas. Light a matchstick and drop it in. Let it burn completely. Keep dropping lighted matchsticks until you no longer observe the effect of the gas on the flame. Now drop a final lighted matchstick into the boiling tube.

What happened? (22)

What happened to the gas in the boiling tube that helped the matchsticks to burn? Where did it go? (23)

Does this experiment show that the gas in the boiling tube is consumed by the burning matchsticks? (24)

Now recall what you did in Experiment 4. Can you say which gas was formed by the burning matchsticks that now extinguishes them? (23)

Experiment 8

Fill another boiling tube with this gas as you did in Experiment 7. Test the gas with wet blue and red litmus papers. Close the mouth of the boiling tube with a cork and place it on the stand.

Which of the two litmus papers was affected by the gas? (26)

Experiment 9

Pass this gas through lime water and pink phenolphthalein indicator solution, like you did in Experiments 1 and 2.

What happened to the lime water? (27)

What happened to the colour of the pink indicator solution? (28)

On the basis of your answers to Questions 26 and 28, assess whether the gas is acidic, basic or neutral. (29)

This gas is called **oxygen.**

Comparing carbon dioxide and oxygen

You produced two gases in this lesson. Compare the two gases by filling the following table.

Table 1

S. No	Property	Carbon dioxide	Oxygen
1	Colour		
2	Smell		
3	Effect on blue litmus		
4	Effect on red litmus		
5	Effect on burning matchstick		
6	Effect on smoldering incense stick		
7	Effect on lime water		
8	Effect on pink indicator solution		

Experiment 10

The science of burning : carbon dioxide and oxygen

Place two small candles on a table or the floor and light them. Cover one candle with a beaker or glass tumbler (Figure 8).

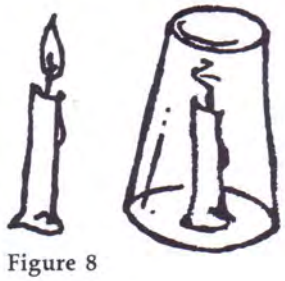


Figure 8

Can you now guess why the covered candle was extinguished? (31)

Take four containers of different sizes. For example, you can take a 250 ml conical flask, 500 ml glucose bottle, a one-litre plastic bottle and a two-litre plastic bottle.

Cover the burning candle one by one with these containers and find out how long it takes for the candle to extinguish in each case.

Record your observations in Table 2

Table 2

S.No	Volume of the container (ml)	Time taken for candle to extinguish (second)

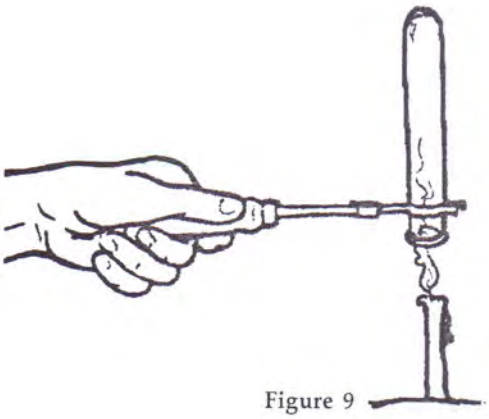


Figure 9

Experiment 11

Invert a boiling tube over the flame of a candle with the help of a test tube holder. The flame should not touch the sides of the boiling tube (Figure 9). After some time, remove the boiling tube and add some lime water to it, shaking it well.

What happened to the lime water? (33)

Which gas collected in the boiling tube? (34)

From where did this gas come? (35)

You performed a number of experiments on burning different substances in air, oxygen and carbon dioxide.

Fill in the blanks on the basis of what you have learnt.

1) ..... gas helps a lighted matchstick to burn brighter.

2) ..... gas is consumed when a matchstick burns.

3) Without ..... gas a matchstick cannot burn.

4) From Experiment 11 we can conclude that the gas formed when we burn various things is .....

5) ..... gas extinguishes burning objects.

6) Things burn in air. That means air contains ..... gas.

7) When a substance burns in air ..... gas is consumed and .....gas is formed. (36)

Write in your own words what changes take place in air when any substance burns. (37)

Exercises for revision

1. **A gas turns blue litmus red. Is it acidic or basic? How will it effect pink phenolphthalein indicator solution?**
2. **A candle burns in a large room in which a bulb is lit. Suppose we remove all the air from the room. What effect will this have on the bulb and the candle? Give reasons for your answer.**
3. **A fire extinguisher does not contain water. Rather, a gas comes out of it that puts out the fire. On the basis of what you have learnt in this chapter, can you say which gas this is?**
4. **What would happen if there is no oxygen in the air?**
5. **You learned about two gases in this chapter. Do you know about any other gases? List them and their properties.**

New words

Oxygen Carbon dioxide Indicator
Solution