

We can survive without food for several weeks. You may have heard about people going on a fast or hunger strike to protest against injustice. They survive for many days without eating anything. But they drink some water or other liquids every day. We can survive for a few days if we get a little water, but we feel suffocated if we don't get air even for a short while.

In this chapter we shall see what happens when human beings respire. What difference is there between the air we breathe in and the air we breathe out? Do plants also respire? We shall perform some experiments to find out.

Experiment 1

Respiration in human beings

Let's first find out how long a person can hold her breath. Use a watch with a seconds' hand to time your breathing. If you don't have a watch, then practice

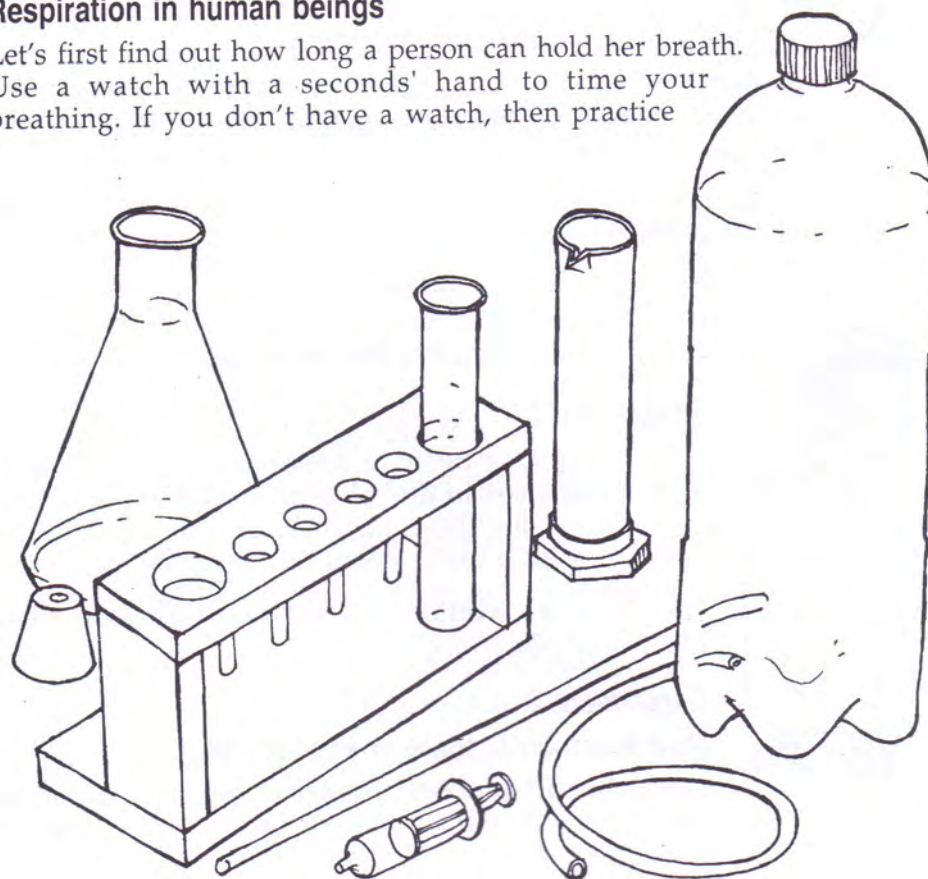




Figure 1

counting at a uniform rate. You can measure the time by counting. Close your mouth and nose with your fingers so that air cannot pass through them.

How long could you close your mouth and nose? (1)

What did you feel when you kept your mouth and nose shut for so long? (2)

Experiment 2

How many breaths in a minute?

Hold a finger under the nose of one of your friends. The side with the fingernail should face the nostrils. Ask your friend to breathe in and out normally.

What did you feel on your finger when your friend exhaled? (3)

Use this method to find out how many times your friend inhales and exhales in a minute. (4)

Did your friend inhale as many times as she exhaled in a minute? (5)

The process of breathing in air is called **inspiration** and breathing out air is called **expiration**. The number of times we breathe in and breathe out in a minute is called the **expiration rate**.



Figure 2

Exercise and breathing

You may have noticed that we pant after running or exercising. Do you think exercise and running affect the rate at which we breathe in and out?

In your opinion does the expiration rate increase or decrease after exercising? (6)

The air we breathe in fills our lungs that are located in our chest. In the following experiment we shall see what happens to our chest when we inhale or exhale air.

Experiment 3

Take a length of twine or a measuring tape. Wrap it around the chest of one of your friends and measure the width of his chest. Hold the tape lightly and ask your friend to breathe in and out deeply a few times.

How does the width of the chest change when air is inhaled or exhaled? (7)

Experiment 4

How much air is there in your breath?

Use a two-litre plastic bottle to make a measuring cylinder. To do this, pour 100 ml of water at a time, in



Figure 3

the bottle and mark the water level after each addition.

Now fill water in the bottle to the brim and invert it in a bucket of water. Remember, the bottle should contain no air bubbles after you invert it. Insert one end of a rubber tube into the mouth of the bottle under water. Hold the other end of the tube in your hand. Inhale as much air as you can and blow the air into the measuring cylinder through the rubber tube. Blow out as much air as you can in a single breath. This air will collect in the measuring cylinder. As a result, the water level in the cylinder will fall.



Figure 4

How much air were you able to exhale in a single breath? (8)

Find the amount of air the others in your group breathe out in a single breath and compare these amounts.

Was the amount of air the same for all your friends? (9)

Experiment 5

Is there a difference between inhaled and exhaled air?

Exhale air through your nose on the back of your index finger.

Is this air warm? (10)

Now use a syringe to pump some air on your finger.

Is the air from the syringe also warm? (11)

Experiment 6

On cold winter mornings you may have noticed that the air you breathe out is misty.

Why does this happen?

We shall do an experiment to find out.

Take a mirror. Wipe it clean with a cloth. Blow air from your mouth onto the surface of the mirror.

Examine the mirror surface carefully. What did you see? (12)

Clean the mirror again and blow air onto it with a syringe.

Did you see the same effect on the mirror this time? (13)

On the basis of this experiment would it be correct to say that exhaled air is more moist than air from a syringe? (14)

Why did we use a syringe in Experiments 5 and 6? (15)

You must have understood from these experiments that there are differences in the air we breathe out and the air from a syringe.



Figure 5

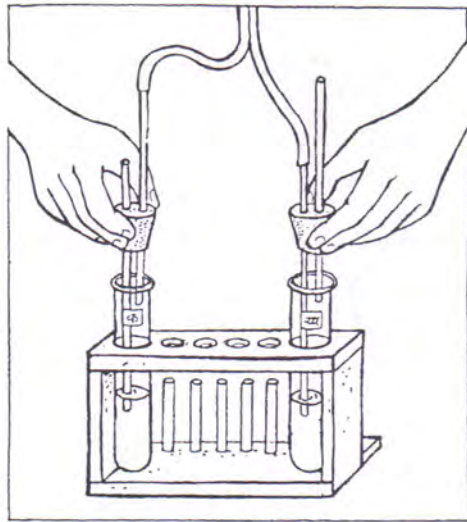


Figure 6

What does your breath contain?

Let's now do an experiment to find out the effect of inhaled and exhaled air on pink phenolphthalein indicator solution and lime water.

Prepare pink phenolphthalein indicator solution and lime water in the same way you did when studying "gases".

Experiment 7

Set up the apparatus shown in Figure 6 for this experiment. Be careful while inserting the glass tube in the cork. It can break. So take the help of your teacher in doing this.

Fill one-fourth of both boiling tubes with pink phenolphthalein solution. Mark them A and B. Now

repeatedly blow in and suck out air from this apparatus as shown in Figure 7.

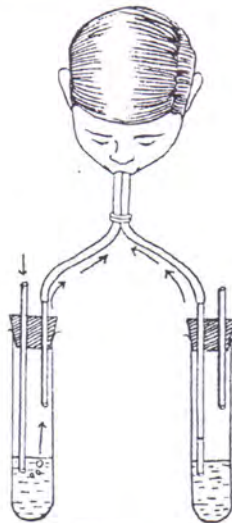


Figure 7

Find the answers to the following questions while doing the experiment:

1. When you suck in air, through which boiling tube does the outside air flow in? How can you find out?
2. When you blow air out, through which boiling tube does the air flow outside? Do you know why the air does not go out through the other boiling tube as well?
3. In which boiling tube did the colour of the indicator solution change?
4. Is the inhaled air similar to the exhaled air? If not, what are the differences? (16)

Wash and clean the two boiling tubes, and fill one-fourth of both with lime water.

Repeat the experiment of blowing in and sucking out air.

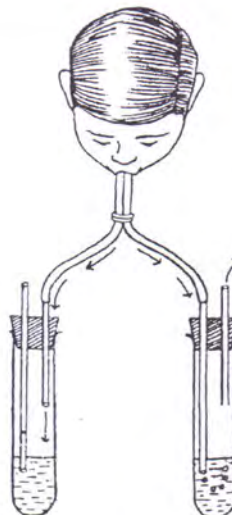
Answer the following questions on the basis of this experiment:

1. What was the colour of lime water in boiling tubes A and B before you began the experiment?
2. In which boiling tube did the lime water turn milky after you blew in and sucked out air?
3. What difference did you find between the inhaled and exhaled air in this experiment? (17)

You studied the properties of oxygen and carbon dioxide in the chapter "Gases".

On the basis of what you learned can you say which gas is present in exhaled air? (18)

Can you explain how and from where this gas came, in the exhaled air? (19)



The air we breathe in does not contain only oxygen. It is a mixture of many gases. Similarly, the air we breathe out is not only carbon dioxide, but a mixture of several gases. The quantity of gases in every 1,000 ml of inspired and expired air is as follows:

S.No.	Gases	Inhaled air (ml)	Exhaled air (ml)
1	Oxygen	210	165
2	Carbon dioxide	0.4	40
3	Nitrogen and other gases	790	795

Can you state the difference between inhaled and exhaled air on the basis of Experiments 5, 6, 7 and this table? (20)

Experiment 8 Respiration in plants

Do plants respire in the way humans do? Let's do an experiment to find out.

Take a conical flask. Fit a two-holed rubber cork tightly into its mouth and insert glass tubes into the two holes. Fit a rubber tube on one of the glass tubes and a funnel on the other. If the funnel does not sit tightly on the glass tube, make a funnel with an ink dropper. A simple way to do this is shown in Figure 8. Fill about one-fourth of a test tube with lime water and dip the rubber tube into it.

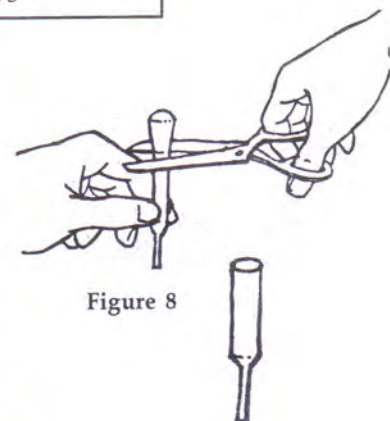


Figure 8

Now add water to the funnel drop by drop (Figure 9). Keep adding water till the conical flask is filled one-fourth with water. Observe the test tube carefully while you add water.

Did the lime water change colour? (21)

Now remove the water from the conical flask and put some flowers and buds in it. Fit a cork on the flask and let it stand for half an hour.

Now add water drop by drop to the conical flask through the funnel as you did in the previous experiment. Examine the test tube carefully while doing so.

Did the lime water change colour this time? (22)



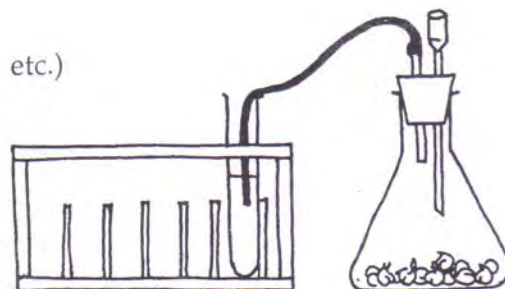
Figure 9

Experiment 9 Respiration in sprouted seeds

Repeat Experiment 8, using sprouted seeds (*moong*, gram, etc.) instead of flowers and buds.

How was the lime water affected when sprouted seeds were used in the experiment? (23)

On the basis of your observations, can you say that flowers, buds and sprouted seeds respire? Give reasons for your answer (24)



Plants respire like us. But it is difficult to observe their respiration through experiments. Both plants and animals use oxygen during respiration.

You may have heard of big hospitals keeping cylinders filled with oxygen. When a person has breathing problems s(he) is given oxygen. An oxygen mask is fitted over her/his nose and mouth and connected to the oxygen cylinder with a rubber tube. Sometimes a patient is given oxygen during an operation.

A brain teaser

Scientists knew there is no oxygen on the surface of the moon even before man landed there.

Do you think the first person who landed on the moon could have found living beings like us on its surface? Give reasons for your answer. (25)

How do people who go to the moon survive without oxygen? (26)

ARTIFICIAL RESPIRATION

If a person cannot breathe (s)he needs first aid immediately. This is what you should do:

1. If something is stuck in the mouth or throat of the person, remove it immediately. If the throat is choked with phlegm, try to clear it immediately. Straighten the tongue and pull it to the front of the mouth.
2. Make the person lie on a couch/bed with her/his head hanging over the edge. Open the mouth by pulling down the jaw.
3. Close the person's nose with your fingers. Open her/his mouth fully and blow in air through your mouth. You should blow in enough air to fill her/his chest so that it expands. Then pause while the air comes out of the person's lungs. Repeat the process at least 15 times per minute. In the case of newborn babies you require a lesser amount of air but it should be blown at a faster rate of at least twenty five times a minute. The patient should be given mouth-to-mouth artificial respiration in this manner until (s)he starts breathing on her/his own.



Questions for revision

1. In this chapter you did experiments on respiration in flowers, seeds etc. Can you suggest an experiment to study respiration in an entire plant?
2. In Experiment 8 why was the experiment first done with an empty flask?
3. Can you identify any similarities between respiration and burning on the basis of what you learned in this chapter?

New words

Inspiration
Expiration rate

Living beings
Artificial respiration

Expiration