



MODULE 2

Carbon dioxide in exhaled air

TIMING

1 hour 20 min

MATERIALS PER GROUP

2 glass containers
2 straws
1 bike pump
Tube with dissolved potash lye (10% KOH)
Tube with colour indicator (Phenolphthalein solution)
Pipette
Photocopies of sheets E4, E5
Film in Media Gallery

SKILLS

Precise working with a pipette and chemicals
Observing

KEYWORDS

Exhaled air
Carbon dioxide
Oxygen
Inhaled air

CROSS CURRICULAR ACTIVITY

Mathematics

Overview

In the previous module, children will have established that the air they exhale contains less oxygen than fresh air. With the following experiment children can test if there is more carbon dioxide in the exhaled air using a colour change indicator.

Aims

To understand that the air people exhale contains more carbon dioxide (and less oxygen) than the air they inhale.

Teaching sequence

1. Divide the children into groups and distribute activity sheet E4. To review the composition of air, children colour in the different components of fresh air on the activity sheet. (See Teachers' notes, Module 1). 5% of the oxygen that makes up inhaled air is missing in the exhaled air. Ask children to consider what may replace this missing oxygen. Ask them to consider how they could test their ideas. Scientists can use highly specialised machines in a laboratory to test but we can still investigate air using basic equipment.
2. Tell the children that the next experiment can test whether there is more carbon dioxide in exhaled air. A colour change indicator will show if the carbon dioxide concentration in the liquid is increasing.
3. Distribute the necessary materials (except for the chemicals and air pumps).
4. If this is the first time that children have used a pipette show them how to use it properly by practising pipetting water and releasing it drop by drop.
5. Go through appropriate H&S measures with the children. As they will be working with chemicals, it is very important for them to work carefully and precisely. If there is some liquid left in the pipette, it should be dripped back into the small jar (tubes). Only then distribute the tubes with chemicals.
6. Children follow the instructions on the activity sheet about using the colour change indicator.
7. Before carrying out the experiment, children should discuss what they want to find out, i.e. to investigate if the carbon dioxide content of exhaled air is different from fresh air. The pink solution (phenolphthalein) changes colour when it comes into contact with carbon dioxide.
8. Children carry out the first part of the experiment. Discuss what happened and why it happened.
9. Children think about how to get fresh air into the second jar. Let children work in pairs to come up with ideas and then come together as a class to decide what to do. Distribute activity sheet E5 and the air pumps. Children pump fresh air into the second jar. Note: the colour is not going to change (or should only change slightly).
10. Discuss with the children what the experiment is designed to find out. It can show that there is more carbon dioxide in exhaled air than in the fresh air.



11. Complete the drawing with the fresh air.
12. Children summarise two things which they found out today

Teachers' notes

A film of this subject is available on the Media Gallery Experiments about plant growth M2 Carbon dioxide in exhaled air.

Health and Safety

10% KOH is **CORROSIVE**. It should not come into contact with skin or the eyes. Children should use gloves, or this specific part of the activity should be carried out only by the teacher. COSHH regulations will apply. After the experiment the solutions in the jars can be disposed of down the sink.

For preparation and experiment methodology see activity sheets E4 and E5.

Explanation

KOH produces a slightly alkaline solution, which is coloured pink by an indicator. Exhaled carbon dioxide produces carbonic acid in the water, so that the alkaline solution turns acidic (changing the pH-value). The pink solution becomes colourless when exhaled air is added to the solution.

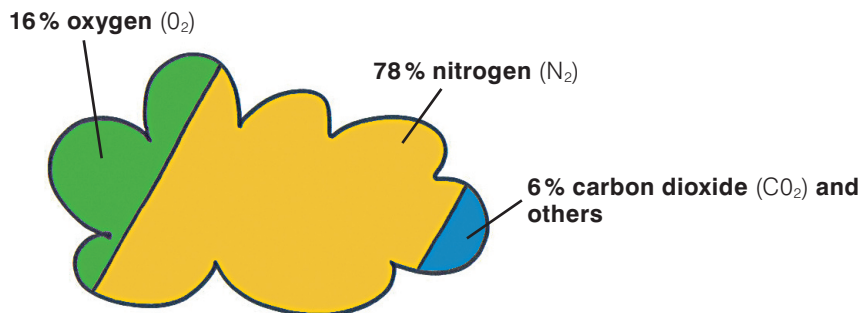
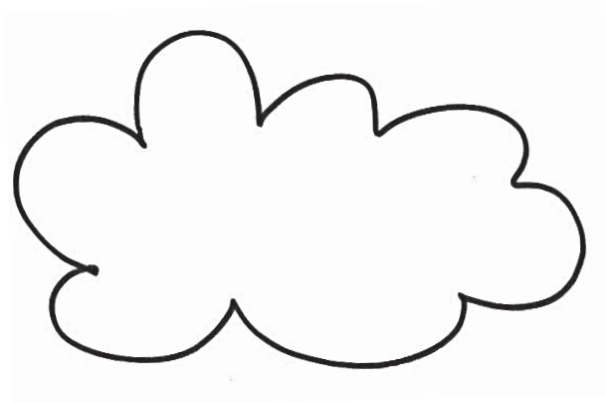


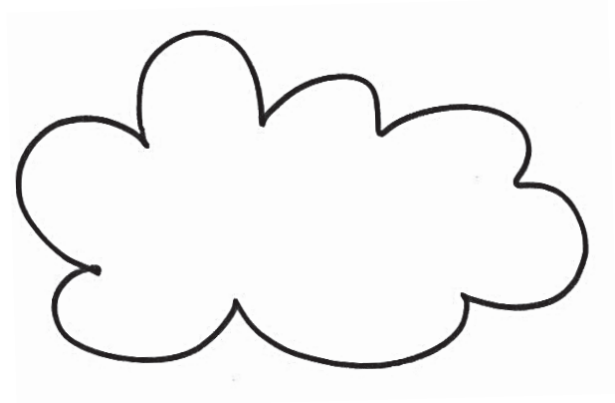
Figure 4: Composition of exhaled air

Carbon dioxide in exhaled air

Using different colours, show what makes up the air in these clouds.



Fresh air



Exhaled air

Carry out the following experiment:

1. Take two glass containers and fill both with 200 millilitres water
2. Add 20 drops of 10% potash lye to both containers
3. Clean the pipette in the sink or a glass with fresh tap water
4. Add 20 drops of indicator and stir it with a straw.

What are we trying to investigate with this experiment?

5. One of your groups breathes through a straw, using strong breaths, into container
6. Write down what happens and also why:

Carbon dioxide in exhaled air

In order to test if there is more carbon dioxide in the exhaled air than in the fresh air, we need to get fresh air into the second container.

How could you do this? Consider your ideas as a group and then discuss it with the class.

1. Pump fresh air into container 2 and
2. Write down what happens and why

Complete the composition of the exhaled air in E4.



Today I learned