11–14 years

Particles in motion?

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Particles in motion

Look at the image.

What do you see?

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Learning objectives

During this lesson, you will:

- investigate the motion of particles in a gas.
- use particle theory to explain your observations.

Key terms

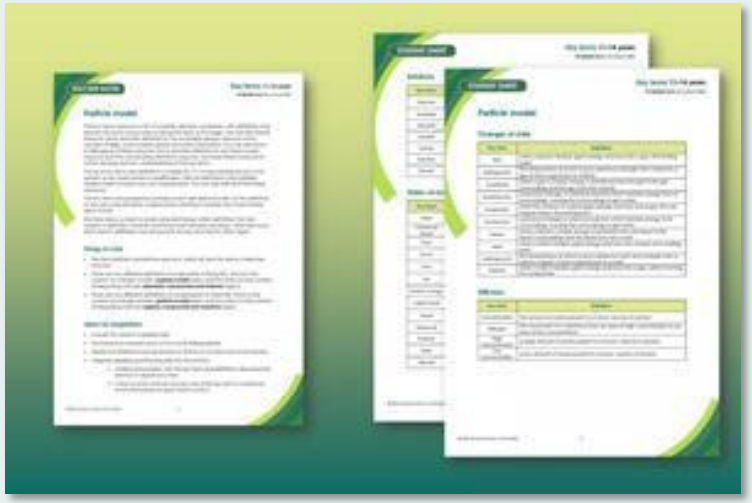
Equipment words:

- Bung or cork
- Delivery tube
- Dropper
- Measuring cylinder
- Test tube
- Timer

Chemistry words:

- Chemical change
- Chemical reaction
- Colourless
- Concentration
- Density
- Diffusion
- Gas
- Limewater
- Liquid
- Particle
- Particle theory

Find more support for vocabulary in our Key Terms support bundle for **11–14 Particle model**.



Available to download from: rsc.li/4cmvSbS

Practical experiment

You are going to carry out a practical activity to explore the motion of particles in a gas.

You will produce a test tube full of carbon dioxide by reacting calcium carbonate with hydrochloric acid.

You will then check to see if diffusion occurs by holding the test tube of carbon dioxide over a test tube of air and vice versa.

Equipment (per group)

Apparatus

- Test tubes, x 3
- Cork
- Delivery tube and bung

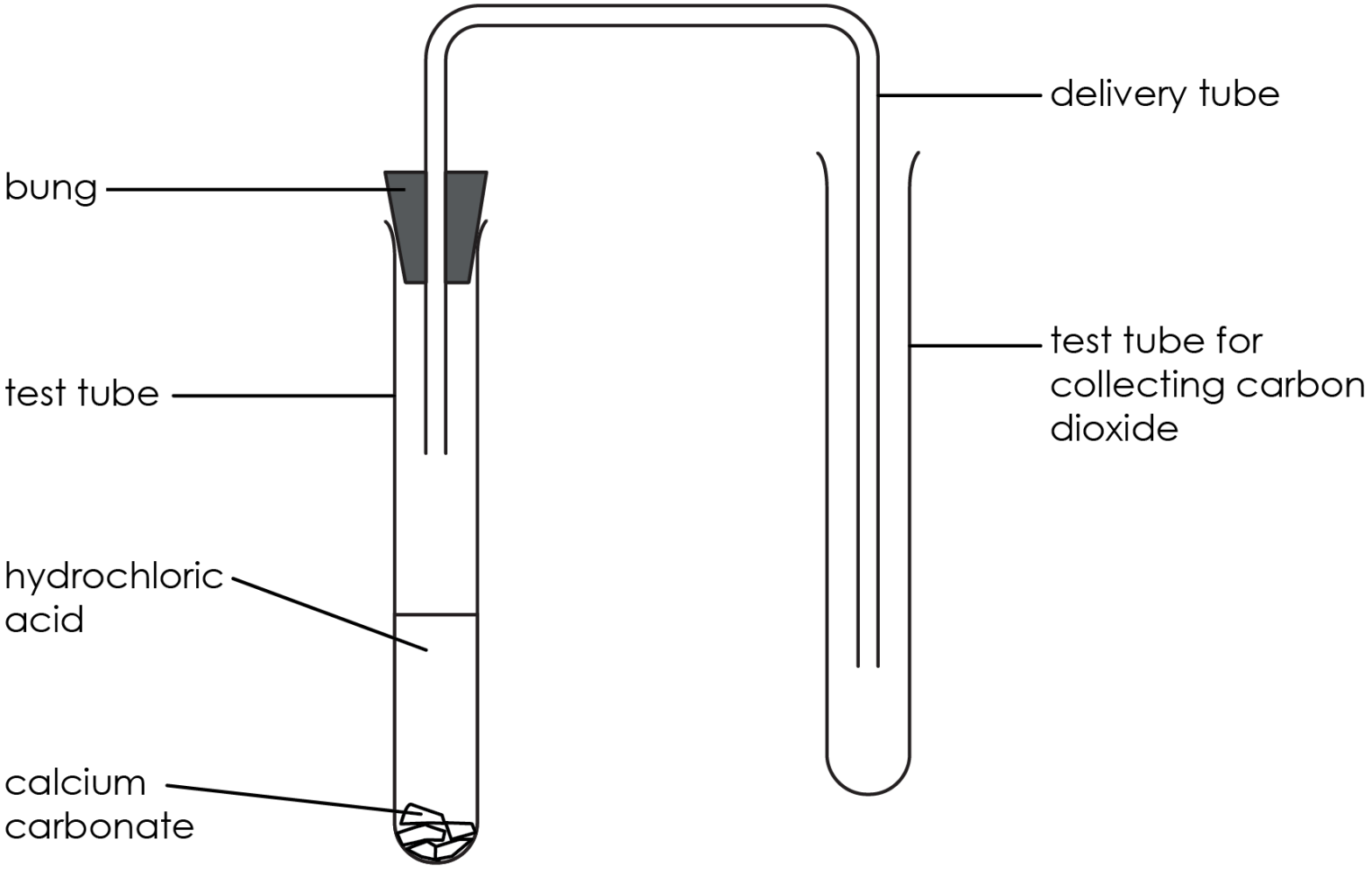
Safety equipment

- Eye protection: safety glasses to EN166F

Chemicals

- Limewater 0.02 mol dm^{-3}
- Calcium carbonate
- Hydrochloric acid 0.5 mol dm^{-3}

Diagram


delivery tube
bung
test tube for collecting carbon dioxide
test tube
hydrochloric acid
calcium carbonate

Method

1. Set up the apparatus as shown in the diagram.
2. Put a spatula of calcium carbonate into the first test tube.
3. Add 10 cm^3 of hydrochloric acid and quickly replace the bung and delivery tube.
4. Carbon dioxide gas is created. Allow the gas to pass into the second test tube for about 1 minute, then remove the delivery tube and cork this second test tube.
5. Hold the test tube of carbon dioxide upside down over a similar test tube containing air.
6. Remove the cork and place the tubes mouth-to-mouth.
7. After 5 minutes, add a drop of limewater to each test tube. Bung and shake the tubes. Record observations.
8. Repeat this experiment but this time at step 5 hold the test tube of air upside down over the test tube of carbon dioxide.

1 Add:
- sodium calcium carbonate ❑
- 10 cm^3 of HCl ❑

2 Quickly add bung and delivery tube ❑

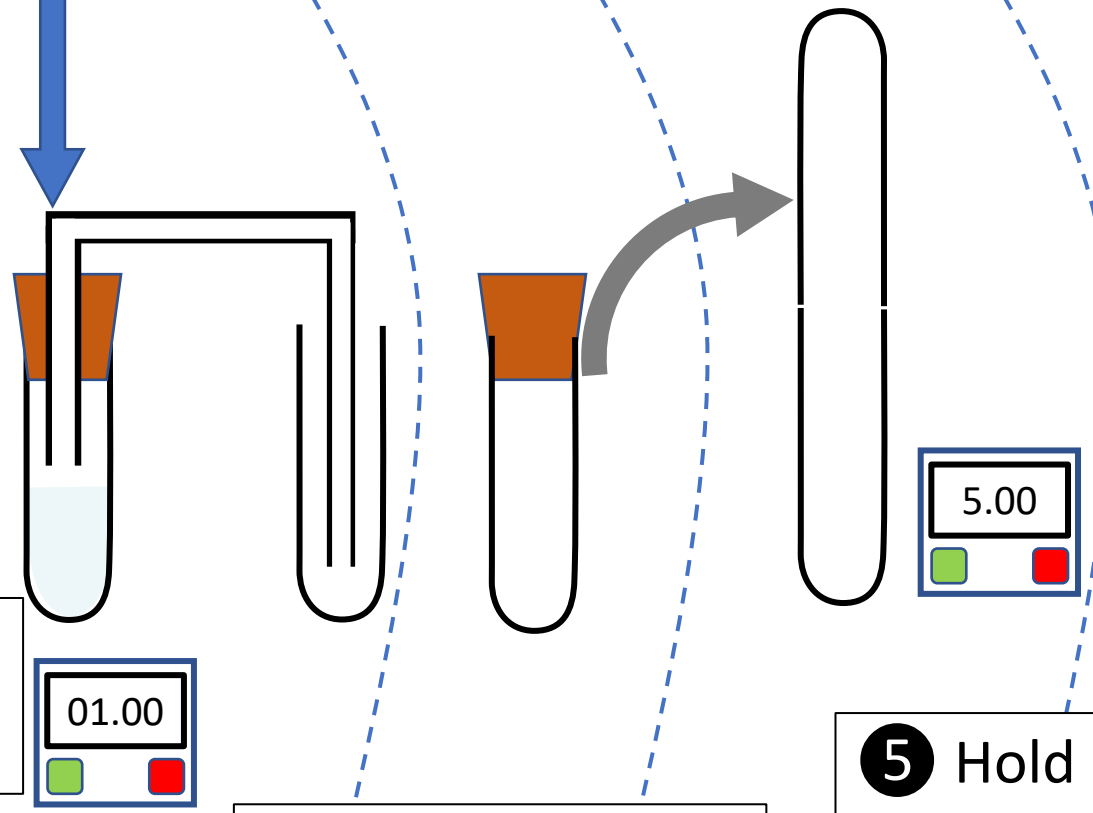
3 Allow gas to collect for 1 minute ❑

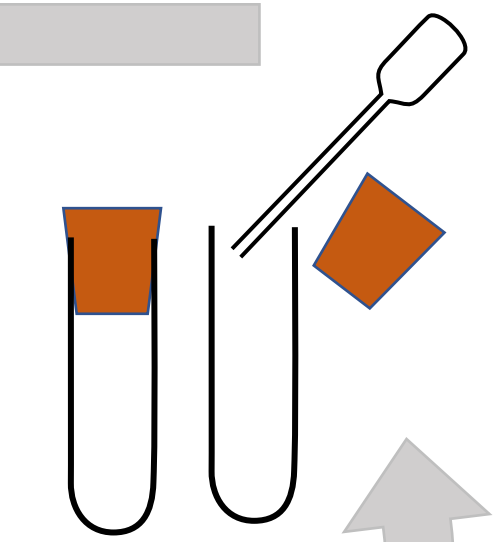
4 Cork collection test tube ❑

5 Hold collection test tube above a test tube containing air. Remove bung for 5 minutes ❑

6 Add a drop of limewater to each test tube, cork and shake ❑

7 Repeat, but at 5 hold test tube of air on top ❑





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Questions

1. Write a word equation for the reaction of calcium carbonate with hydrochloric gas.

2. State the test for carbon dioxide gas.

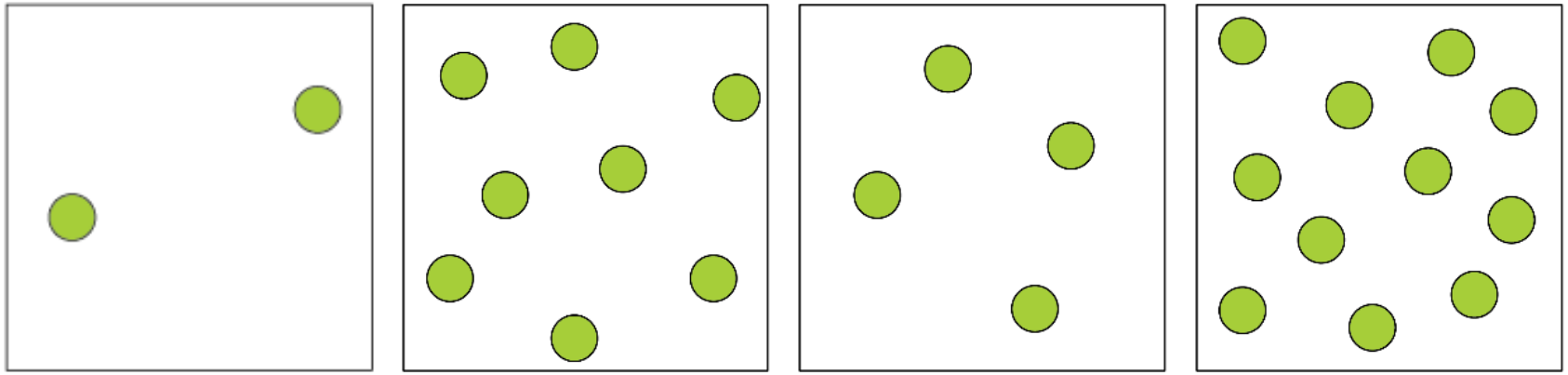
3. Which of the four test tubes contained carbon dioxide gas at the end of the experiment?

4. Which is denser, air or carbon dioxide?

Questions

5. Concentration is a measure of the number of particles per unit area.

The diagrams show a sample of gas particles at different concentrations.



A B C D

List the samples in order from highest concentration to lowest concentration.

Questions

6. Complete the sentence.

Diffusion is …

7. Does this experiment support the idea that particles of a gas are in motion? Suggest a reason for your answer.