IGCSE PHYSICS • EXERCISE SHEET

2.1 Kinetic particle model of matter

Name: _____ Class: _____ Date: _____ **Total: 11 marks**

Objective

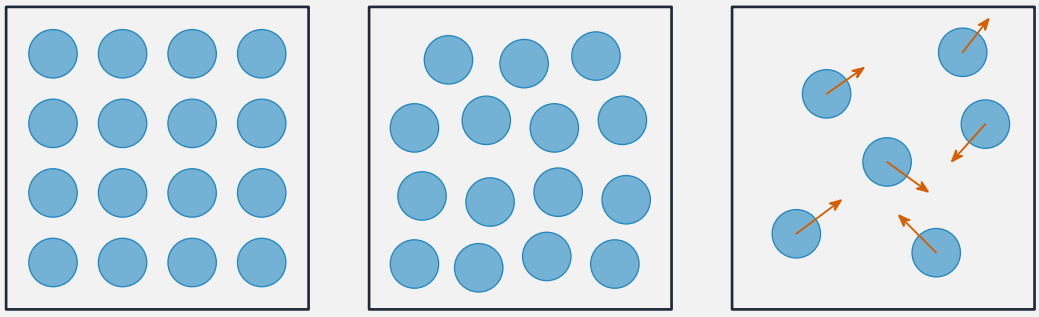
Build the skills to answer exam questions on the **kinetic particle model** 分子动理论—the three states, **gas pressure** 气体压强, pV = constant, and **Brownian motion** 布朗运动.

You must be able to:

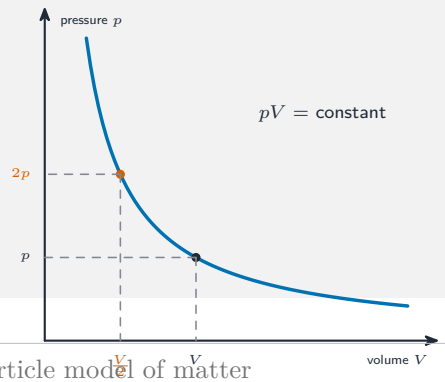
- describe the particle arrangement and motion in solids, liquids, gases
- explain gas pressure and use $p_1V_1 = p_2V_2$ (constant temperature)
- describe Brownian motion as evidence for the particle model

1 Worked examples

States and gas laws



Solid: fixed and ordered; liquid: close but disordered; gas: far apart and fast



At constant temperature pV is constant —halve V and p doubles

200 **cm^3 at** 100 **kPa squeezed to** 50 **cm^3:** $100 \times 200 = p_2 \times 50 \Rightarrow p_2 = 400$ kPa.

2 Practice

2.1 Describe the arrangement of particles in a solid. [1]

2.2 A gas of volume 300 cm^3 at 120 kPa is compressed to 100 cm^3 at constant temperature. Find the new pressure. [2]

3 Exam-style questions

3.1 Gas pressure on the container walls is caused by: [1]

- **A** particles vibrating in fixed positions
- **B** particles colliding with the walls
- **C** the gas expanding
- **D** the walls heating up

3.2 A fixed mass of gas at constant temperature has $p_1 = 150$ kPa and $V_1 = 400$ cm^3.

(a) Find the volume when the pressure is increased to 250 kPa. [3]

(b) Explain, using the particle model, why the pressure rises as the volume falls. [2]

3.3 Explain how Brownian motion provides evidence for the kinetic particle model. [2]

4 Go further

You are now ready for the real exam questions on this subtopic. Open the **2.1 Kinetic particle model of matter** past-paper sheet in the Library, or try these in **Practice mode**:

- 0625/21 N25 —Q10 (gas / particle model)
- 0625/21 N25 —Q11 (Brownian motion)

Solutions

2.1 particles are close together in a fixed, regular pattern, vibrating about fixed positions.

2.2 $120 \times 300 = p_2 \times 100 \Rightarrow p_2 = 360$ kPa.

3.1 B. Pressure comes from particles colliding with the walls.

3.2 (a) $p_1V_1 = p_2V_2$: $150 \times 400 = 250 \times V_2$; $V_2 = \frac{60000}{250}$; $= 240$ cm^3.
(b) in a smaller volume the particles hit each unit of wall area more often, so the pressure increases.

3.3 the visible specks (e.g. smoke) move in a random, jerky way; this is because they are struck by fast, invisible air particles —showing matter is made of moving particles.