Solutions

Each answer shows the steps, then the **result**.

2.1

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

2.2

- $p_1V_1 = p_2V_2$

$$p_2 = \frac{p_1V_1}{V_2} = \frac{(120\ \text{kPa})(300\ \text{cm}^3)}{100\ \text{cm}^3} = \mathbf{360}\ \text{kPa}$$

2.3

- far apart, in no regular arrangement
- moving quickly in random directions

2.4

- in a gas the particles are far apart, with large spaces between them that can be reduced
- in a solid the particles are already touching, closely packed

3.1 B

- pressure comes from particles colliding with the walls

3.2

(a) $p_1V_1 = p_2V_2$

$$p_1V_1 = p_2V_2: \quad (150\ \text{kPa})(400\ \text{cm}^3) = (250\ \text{kPa})V_2$$

$$V_2 = \frac{p_1V_1}{p_2} = \frac{60\,000\ \text{kPa cm}^3}{250\ \text{kPa}} = \mathbf{240}\ \text{cm}^\mathbf{3}$$

(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

3.4

- at constant temperature $pV =$ constant, so $p_1V_1 = p_2V_2$
- rearrange: $p_2 = \dfrac{p_1V_1}{V_2}$

$$p_2 = \frac{p_1V_1}{V_2} = \frac{(2.0 \times 10^5\ \text{Pa})(0.050\ \text{m}^3)}{0.080\ \text{m}^3} = \mathbf{1.25 \times 10^5}\ \text{Pa}$$

3.5

- the particles gain kinetic energy and move faster
- they hit the walls more often
- and with a greater force, so the pressure increases