

Exercise walk-through

5.1

Density pressure and change of state

Pearson Edexcel · International GCSE · Physics

1

The method

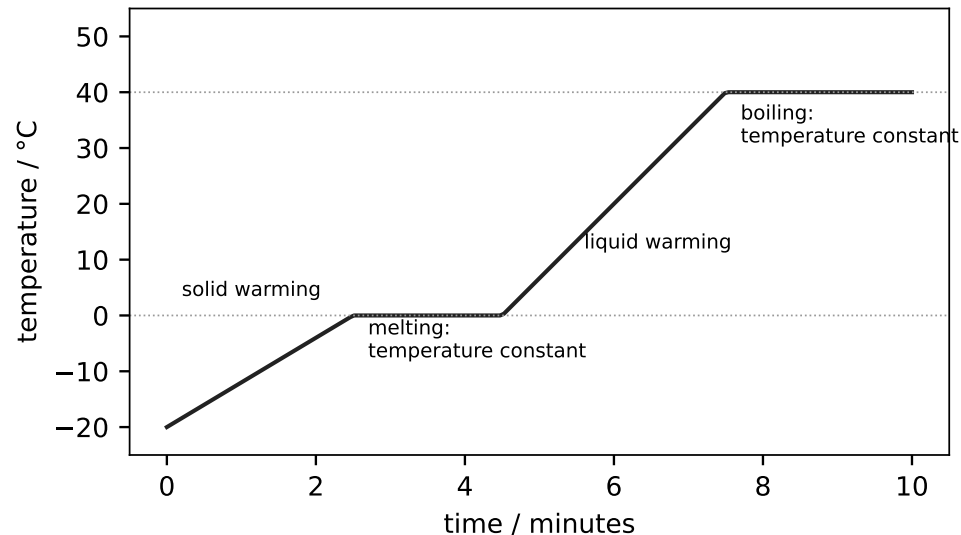
Method — Three equations

$$\rho = m/V \quad p = F/A \quad p = h\rho g$$

Worked check. A 96 g cube of side 2 cm: $V = 8 \times 10^{-6} \text{ m}^3$,
 $\rho = 0.096 / 8 \times 10^{-6} = 12\,000 \text{ kg/m}^3$.

Method — The heating curve's flat parts

(P) $\Delta Q = mc\Delta T$ – and at a phase change, $\Delta T = 0$: the energy breaks bonds instead.



A heating curve with constant-temperature plateaus at melting and boiling.

Exercises 2.1·2.3

2.1 A stone of mass 150 g displaces 50 cm³ of water. Calculate its density in g/cm³ and kg/m³. [3]

2.2 Calculate the pressure of a 60 N force on 0.2 m². [2]

2.3 Calculate the pressure difference 5 m deep in water ($\rho = 1000 \text{ kg/m}^3$, $g = 10 \text{ N/kg}$). [2]

Exercises 2.1·2.3

2.1 A stone of mass 150 g displaces 50 cm³ of water. Calculate its density in g/cm³ and kg/m³. [3]

2.1 $\rho = 150/50 = 3 \text{ g/cm}^3; = 3000 \text{ kg/m}^3.$

2.2 Calculate the pressure of a 60 N force on 0.2 m². [2]

2.2 $p = 60/0.2 = 300 \text{ Pa}.$

2.3 Calculate the pressure difference 5 m deep in water ($\rho = 1000 \text{ kg/m}^3$, $g = 10 \text{ N/kg}$). [2]

2.3 $p = 5 \times 1000 \times 10 = 50\,000 \text{ Pa}.$

Exercises 2.4·3.1

2.4 (P) State what happens to the temperature while a pure substance boils. [1]

2.5 (P) Calculate the energy needed to heat 4 kg of water ($c = 4200 \text{ J/(kg } ^\circ\text{C)}$) by 15°C . [3]

3.1 Describe how to find the density of an irregular stone, naming the measuring instruments. [4]

Exercises 2.4·3.1

2.4 (P) State what happens to the temperature while a pure substance boils. [1]

2.4 (P) It stays constant – energy goes to breaking intermolecular bonds.

2.5 (P) Calculate the energy needed to heat 4 kg of water ($c = 4200 \text{ J/(kg } ^\circ\text{C)}$) by 15°C . [3]

2.5 $\Delta Q = 4 \times 4200 \times 15 = 252\,000 \text{ J}$.

3.1 Describe how to find the density of an irregular stone, naming the measuring instruments. [4]

3.1 Measure the mass on a balance; half-fill a measuring cylinder with water and read its volume; lower the stone in and read the new volume – the rise is the stone's volume; density = mass $\div$ volume.

Exercises 3.2·3.3

3.2 Explain, using the particle model, why the temperature stops rising while ice melts.[3]

3.3 (P) A 2 kg metal block ($c = 500 \text{ J/(kg } ^\circ\text{C)}$) is heated from $20 \text{ }^\circ\text{C}$ with 60 000 J of energy. Calculate its final temperature. [3]

Exercises 3.2·3.3

3.2 Explain, using the particle model, why the temperature stops rising while ice melts.[3]

3.2 Energy supplied breaks the bonds holding particles in the solid lattice; potential/chemical energy of the arrangement increases while kinetic energy stays the same; temperature measures average kinetic energy, so it stays constant until all the ice has melted.

3.3 (P) A 2 kg metal block ($c = 500 \text{ J/(kg } ^\circ\text{C)}$) is heated from $20 \text{ }^\circ\text{C}$ with 60 000 J of energy. Calculate its final temperature. [3]

3.3 $\Delta T = Q/(mc) = 60\,000/(2 \times 500) = 60 \text{ }^\circ\text{C}$; final temperature = $20 + 60 = 80 \text{ }^\circ\text{C}$.