

Exercise walk-through

Internal Structure and Density ■ 8.1

eXercise

You must be able to

- define **density** 密度 as mass per unit volume, $\rho = \frac{m}{V}$
- relate a substance's density to the **spacing** and mass of its particles
- compare the densities of solids, liquids, and gases

Method — Density

$$\rho = \frac{m}{V}, \text{ measured in kg m}^{-3}. \text{ Rearranged: } m = \rho V.$$

Method — Particle picture

Closely packed, more massive particles give a higher density. Gases have widely spaced particles, so they are far less dense than solids or liquids.

Method — Example

A 240 g block of volume 30 cm³: $\rho = \frac{240}{30} = 8.0 \text{ g cm}^{-3}$.

Practice 2.1 ■ 2 marks

A 240 g block has a volume of 30 cm^3 . Find its density.

Solution 2.1

Method: Example

Worked steps

$$\rho = \frac{m}{V} = \frac{240}{30} = 8.0 \text{ g cm}^{-3} \quad \text{M1} \quad \text{A1}.$$

Practice 2.2 ■ 1 mark

State which state of matter is usually the least dense.

Solution 2.2

Worked steps

a gas **B1**.

Practice 2.3 ■ 2 marks

A liquid has density 800 kg m^{-3} . Find the mass of 2.0 m^3 of it.

Solution 2.3

Method: Density

Worked steps

$$m = \rho V = 800 \times 2.0 = 1600 \text{ kg} \quad \text{M1} \quad \text{A1}.$$

Exam-style 3.1 ■ 1 mark

Density is defined as

A mass $\times$ volume

B mass $\div$ volume

C volume $\div$ mass

D force $\div$ area

Solution 3.1

A mass $\times$ volume

B mass $\div$ volume 

C volume $\div$ mass

D force $\div$ area

Worked steps

B.

Exam-style 3.2 ■ 1 mark

Which state of matter is usually the densest?

A gas

B liquid

C solid

D all are equal

Solution 3.2

A gas

B liquid

C solid



D all are equal

Worked steps

C.

Exam-style 3.3 ■ 1 mark

A metal cube of side 0.10 m has a mass of 2.7 kg.

- (a) Find its volume.
- (b) Find its density.

Solution 3.3

Worked steps

$$(a) V = (0.10)^3 = 1.0 \times 10^{-3} \text{ m}^3 \quad \text{B1}. \quad (b) \rho = \frac{2.7}{1.0 \times 10^{-3}} = 2700 \text{ kg m}^{-3}$$

M1 A1.