

8.1 Internal Structure and Density

Name: _____ Class: _____ Date: _____

Total: 10 marks

Objective

Build the skills to answer exam questions on **internal structure and density**.

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

1 Worked examples

Study these first. Each one shows the method for a question type used later.

■ Density

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

■ 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.

■ Example

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

2 Practice

2.1 A 240 g block has a volume of 30 cm^3 . Find its density. [2]

2.2 State which state of matter is usually the least dense. [1]

2.3 A liquid has density 800 kg m^{-3} . Find the mass of 2.0 m^3 of it. [2]

3 Exam-style questions

3.1 Density is defined as [1]

- **A** mass $\times$ volume
 - **B** mass $\div$ volume
 - **C** volume $\div$ mass
 - **D** force $\div$ area
-

3.2 Which state of matter is usually the densest? [1]

- **A** gas
 - **B** liquid
 - **C** solid
 - **D** all are equal
-

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

(a) Find its volume. [1]

(b) Find its density. [2]

4 Go further

- work through the **8.1 Internal Structure and Density** lesson on the **Learn** page;
- read the **Fluids** section of the AP Physics 1 handout on the **Know** page.

Solutions

2.1 $\rho = \frac{m}{V} = \frac{240}{30} = 8.0 \text{ g cm}^{-3}.$

2.2 a gas.

2.3 $m = \rho V = 800 \times 2.0 = 1600 \text{ kg}.$

3.1 B.

3.2 C.

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