sürüseg

DENSITY

Which is heavier – iron or wood? Many people say iron – and yet an iron nail is lighter than a wooden tree!

What people mean is that iron and wood have different *densities*. To measure density, we need to measure the mass of a definite volume of the substance. In fact:

$$\text{Density} = \frac{\text{mass}}{\text{volume}}$$

If the mass is measured in **kg** (kilograms) and the volume in **m³** (cubic metres), the density is measured in **kg/m³** (kilograms per metre cubed).

Sometimes the mass is measured in **g** (grams) and the volume in **cm³** (cubic centimetres) so the density is measured in **g/cm³** (grams per centimetre cubed).
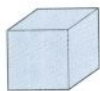
1 m³ of iron
mass = 8000 kg
∴ density = 8000 kg/m³

iron

1 m³ of oak wood
mass = 700 kg
∴ density = 700 kg/m³

wood

Here are the densities of several substances:

Substance			Density	
Solid	Liquid	Gas	kg/m³	g/cm³
Gold			19 000	19
	Mercury		14 000	14
Lead			11 000	11
Iron			8 000	8
	Water		1 000	1
Ice			920	0.92
	Petrol		800	0.80
		Air	1.3	0.0013

What do you notice about the numbers in the table?

Polystyrene has a very low density

Example
An engineer needs to know the mass of a steel girder which is 20 m long, 0.1 m wide and 0.1 m high. (Density of steel = 8000 kg/m³)

Calculate the volume first:

Volume of girder = length × width × height
= 20 m × 0.1 m × 0.1 m
= 0.2 m³

Formula:

$$\text{Density} = \frac{\text{mass}}{\text{volume}}$$

Then put in the numbers:

$$8000 = \frac{\text{mass}}{0.2 \text{ m}^3}$$

$$\therefore \text{ mass} = 8000 \times 0.2 = \underline{1600 \text{ kg}}$$