Density

We can compare the weights of things made of different materials.

For a fair test, we weigh objects made of different materials which have the same size.

1 cm^3 of iron is heavier than 1 cm^3 of plastic.

This is because the iron has more mass even though the volume is the same.

Iron is more dense than plastic.

Glass marbles sink in water. This means that glass is more dense than water.

A cork floats in water. This means that cork is less dense than water.

1   "Iron is heavier than wood." This is not true. Give an example of something made of wood, and something made of iron where the wooden object is heavier.

   (a) Object made of wood:

   (b) Object made of iron:
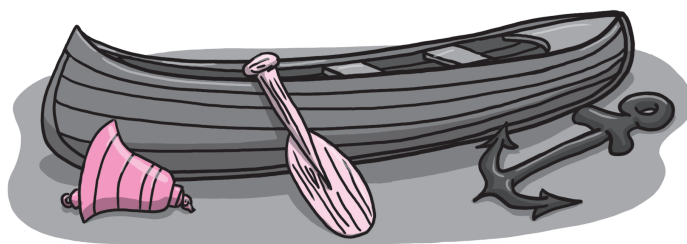
2   Rewrite "Iron is heavier than wood" to make it scientifically correct.

   (a) Rewrite it using the word **dense**.

   (b) Rewrite it without using the words **dense** or **density**. Explain what you meant in (a).

3   Here is a list of materials. Number them in order of density. Put 1 against the least dense material, and 5 against the most dense.

   air   wood   water   helium   steel

Density tells us the mass of 1 cm^3 of material. It enables materials to be compared.

4   A 100 cm^3 block of iron has a mass of 790 g.

   (a) Mass of 1 cm^3 of iron = ⬚ ÷ ⬚ = ⬚ grams

   (b) Complete the sentence: The density of iron (in g/cm^3) is ⬚ .

   (c) 1000 g of salt has a volume of 500 cm^3. Work out its density using an equation.

   mass (g)   =   density $\left(\text{g/cm}^3\right)$ ×   volume $\left(\text{cm}^3\right)$

   1000   =   ⬚   ×   500

(d) Work out the density of aluminium if 540 g has a volume of 200 cm^3.

(e) 8 kg of rice has a volume of 10 000 cm^3. Work out the density in g/cm^3. 1 kg = 1000 g

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5 Calculate the density of these materials in g/cm^3.

(a) Uranium: 20 cm^3 has a mass of 380 g.

(b) Lead: 60 cm^3 has a mass of 660 g.

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6 The volumes of liquids are measured in mℓ (millilitres). 1 mℓ = 1 cm^3.
Calculate the density in g/cm^3 of

(a) Olive oil, if 750 mℓ has a mass of 675 g,

(b) Water, if 350 mℓ has a mass of 350 g.

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7 Silver has a density of 10 g/cm^3.

(a) Complete the sentence: The mass of 1 cm^3 of silver is [   ] grams.

(b) Work out the mass of 15 cm^3 of silver using an equation.

mass (g)	=	density (g/cm^3)	×	volume (cm^3)
[ ]	=	10	×	15

(c) Work out the mass of 45 cm^3 of silver using an equation.

mass (g)	=	density (g/cm^3)	×	volume (cm^3)
[ ]	=	10	×	45

(d) Work out the mass of 100 cm^3 of silver.

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8 Calculate the mass in grams of

(a) 200 cm^3 of flour with a density of 0.8 g/cm^3,

(b) 60 cm^3 of cheese with a density of 1.1 g/cm^3.

9   Jelly has a density of 1.5 g/cm^3.
    (a) What is the mass of 1 cm^3 of jelly?

    (b) If you divide 180 g of jelly into 1.5 g pieces, how many pieces would you have?

    (c) What is the volume of 180 g of jelly? Count the 1 cm^3 (1.5 g) pieces.

    (d) Work out the volume of 800 g of salt using an equation.

mass (g)	=	density (g/cm^3)	×	volume (cm^3)
800	=	2	×	

    (e) Work out the volume of 1600 g of rice using an equation.

mass (g)	=	density (g/cm^3)	×	volume (cm^3)
1600	=	0.8	×	

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10 Calculate the volume in cm^3 of
    (a) 39 g of chocolate with a density of 1.3 g/cm^3,

    (b) 112 g of treacle with a density of 1.4 g/cm^3.

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11 Complete the word equations using **density**, **mass** and **volume**.
    (a) density =   (b) mass =   (c) volume =

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12 Rewrite your word equations using symbols.
    ρ (rho) is the density, m is the mass and V is the volume.
    (a) $\rho =$ (b) $m =$ (c) $V =$

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13 A gold bar is a 15 cm × 8 cm × 6 cm rectangular block. The density of gold is 19 g/cm^3.
    (a) Calculate the volume in cm^3.   (b) Calculate the mass in grams.

    (c) If each gram of gold is worth £50, calculate the cost of the bar.