

Concern yourself with sig figs and be sure that your answer has proper unit labels. No naked numbers.

1. A block of aluminum has a mass of 33.2 g and displaces 12.3 ml of milk. What is the density of the aluminum?
2. A cube of iron 5.4 cm on each side has a mass of 1,100 g. Determine the density of the iron.
 - Is it likely that this cube of iron has some lead or aluminum mixed in with it?
3. A cube of gold has a mass of 154.4 g. Determine the length of the sides of this cube.
4. Determine the volume of water that a lump of lead with a mass of 75.5 g would displace.
 - Determine the volume of oil that a lump of lead with a mass of 75.5 g would displace.
5. Determine the mass of a bar of gold that measures 15.0 cm x 6.50 cm x 5.00 cm.
 - If gold costs \$29.67 per gram, how much money is the block of gold worth?
6. Which is larger in size? 38.5 g of iron or a piece of aluminum that has the same mass?
 - How many times larger?
7. Determine the density of margarine if 197 g occupies 312 ml of space?
 - Would the margarine sink or float in water?

ANSWERS - Pay attention to your unit labels. Note which cancel out, and which do not. $D = \frac{m}{V}$

1. If the aluminum displaces 12.3 ml of milk, that is its volume, so solve: $V = \frac{m}{D}$ $V = \frac{33.2g}{12.3ml} = 2.70g/ml$ (3sf)

2. First you must calculate the volume of the cube. $L \times W \times H = \text{Volume}$ so $5.4 \text{ cm} \times 5.4 \text{ cm} \times 5.4 \text{ cm} = 157.5 \text{ cm}^3$

then solve $\frac{1,100g}{157.5cm^3} = 7.0 \text{ g/cm}^3$ or 7.0 g/ml (2sf) Remember that $\text{cm}^3 = \text{ml}$

- Aluminum, since the actual density of iron is 7.87 g/ml , and the density of the block of iron in this problem less than the theoretical value, it must be mixed with a metal that is less dense than iron in order lower the density. Since Aluminum is less dense than iron (lead is more dense than iron), it would be a likely choice.

3. First you must calculate the volume of the cube using the density of gold = 19.3 g/ml . Remember that $\frac{m}{D} = V$

$\frac{145.4g}{19.3g/ml} = V$ thus the Vol = 8.0 ml which of course equals 8.0 cm^3 . Since the volume of a cube is (side = s) $s \times s \times s$, thus

$s^3 = 8 \text{ cm}^3$ if you cube root the volume, you can determine the side. Thus the cube root of 8 cm^3 is = 2 cm .

4. Use your algebra skills to rewrite the density equation: $\frac{m}{D} = V$ then solve: $\frac{75.5g}{11.35g/ml} = 6.65ml$

OR $m \times \frac{1}{D} = V$ $5g \times \frac{1ml}{11.35g} = 6.65ml$ (3sf)

The volume of the object is the volume of water it will displace.

- the same – the volume of fluid displaced by the object, does not change just because it is put in a different liquid.

5. First you must calculate the volume of the cube. $L \times W \times H = \text{Volume}$

solve: $15.0 \text{ cm} \times 6.50 \text{ cm} \times 5.00 \text{ cm} = 487.5 \text{ cm}^3$ Remember that $487.5 \text{ cm}^3 = 487.5 \text{ ml}$

Use your algebra skills to rewrite the density equation: $m = D \times V$ then solve: $19.3 \text{ g/ml} \times 487.5 \text{ ml} = 9410 \text{ g}$ (3sf)

- Solve using the original unrounded mass $9408.75 \text{ g} \times \$29.67 = \$279,157.61$

Although significant figures should require us to round to $\$2,790,000$ – no gold dealer would round away the extra $\$1,576.61$ Since currency comes with its own rules – ignore sig figs and always round to 2 places after the decimal.

6. Aluminum is larger. You can tell this because if ever you have objects of the same mass, the one with the smaller density will always have the larger size. Of course you could calculate if you wish by using your algebra skills to rewrite the density equation $\frac{m}{D} = V$ and solve with the two different densities.

$V \text{ for Fe} = \frac{38.5g}{7.87g/ml} = 4.89ml$ and $V \text{ for Al} = \frac{38.5g}{2.70g/ml} = 13.3ml$

- 2.9 times larger You can calculate this by making a ratio of the two densities. $\frac{Fe}{Al}$ solve: $\frac{7.87g/ml}{2.70g/ml} = 2.9 \times \text{greater}$

Since the iron density is 2.9 times greater, the aluminum will 2.9 times larger in size.

7. Solve: $\frac{197g}{312ml} = 0.631g/ml$ (3sf)

- Margarine would float in water because the density of the margarine is less dense than water (1.0 g/ml)