

Question 4 (Answer: **B**)

- Whether one liquid floats on another depends on *density*, not on total mass or volume.
- A liquid floats if it is less dense than the one below it.
- So liquid P must have the lower density.

Question 4 (Answer: **C**)

- Work out each liquid's density from its mass and its volume.
- The least dense floats on top and the densest sinks to the bottom.
- So rank the three by density and read the order from the top down.

Question 5 (Answer: **D**)

- The least dense liquid floats on top and the densest sinks to the bottom.
- The densities are R 1.2, P 1.8, Q 2.4 g/cm³.
- So from the top down the order is R, then P, then Q.

4(a)(i)	930 kg / m ³
4(a)(ii)	1400 N
	$(\Delta)p = \rho g(\Delta)h$ OR $930 \times 9.8 \times 1.1$ OR 10 000 (N / m ²)
	area = length $\times$ width OR 0.45×0.30 OR 0.14 (m ²)
	$(F=) p \times A$ OR $10\,000 \times 0.14$
	<u>Alternative method:</u>
	1400 N
	volume (of liquid above block) = length $\times$ width $\times$ height OR $0.45 \times 0.30 \times 1.1$ OR 0.15 (m ³)
	mass (of liquid above block) = $\rho \times v$ OR 930×0.15 OR 140 (kg)
	$(F =) mg$ OR 140×9.8
4(b)	thermal expansion OR to prevent buckling / bending when heated any one from: • particles vibrate faster • particles have greater speed / <u>kinetic</u> energy / momentum • vibrations (of particles) take up more space • (average) space / separation between particles increases
4(c)	(plastic is a good) insulator / poor conductor (handle) will not get too hot to touch OR reduces heat flow to hand

1(a)(i)	$l = 6.9$ (cm) $w = 2.5$ (cm) $h = 3.0$ (cm) all to nearest mm
1(a)(ii)	$V_A = 52$ (cm ³)
1(b)	irregular dimensions / owtte repeat in several places (for each dimension) <u>and</u> take averages
1(c)	effect of uncertainties increased/ larger % uncertainty/owtte
1(d)(i)	$V_1 = 152$ (cm ³)
1(d)(ii)	line of sight perpendicular / owtte
1(e)	V_2 present <u>and</u> $V_B = V_2 - V_1$
1(f)	suitable source of inaccuracy e.g. graduations on measuring cylinder too large / thread affects volume / cylinder is wide / clay may absorb water matching improvement e.g. use smaller measuring cylinder / more precise scale / thinner thread / no thread and place carefully / measure volume of thread / narrower cylinder / cover clay with paint or cling film

Question 3 (Answer: **D**)

- Identical dimensions means the two blocks have identical volume.
- Different force-meter readings mean different weights, so different masses.
- Same volume with different mass means different density – the heavier block is the denser one.

1(a)(i)	two measurements in cm 2.7 and 2.5, both given to nearest mm
1(a)(ii)	correct average: expect 2.6 (cm)
1(a)(iii)	any reasonable advantage for the method in the question given OR it is difficult to measure the diameter directly OR hard to find centre of ball a ruler for measuring the diameter directly would give rise to parallax errors
1(b)	$V = 9.1(4)$ unit: cm ³
1(c)	correct method for calculation of m_B shown $m_B = 11.6$ (g)
1(d)	ρ on answer line correctly calculated to 2 or more significant figures unit: g / cm ³ answer given to 2 or 3 significant figures

Question 4 (Answer: **B**)

- Convert to matching units first: 2.5 kg = 2500 g.
- $\rho = m/V = 2500/480$.
- = 5.2 g/cm³.

Question 4 (Answer: **A**)

- Density is mass divided by volume: $X = 120/200 = 0.60$, $Y = 80/67 = 1.2$, $Z = 100/120 = 0.83 \text{ g/cm}^3$.
- The least dense liquid floats on top and the densest sinks to the bottom.
- So from the top down the order is X, then Z, then Y.