

Density, pressure and pressure in liquids

Physics grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · Lab answers

The model answers use the sample data in the results table. Your own values will differ a little, but the ranking and the main conclusions should be the same. Show each equation, each substitution and the final value with its unit.

Level: Physics grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · **Curriculum:** GCSE P3, IGCSE 1.8

Question 1 Wooden cube

$$V = 4.00 \times 4.00 \times 4.00 = 64.0 \text{ cm}^3. \rho = 38.4 \div 64.0 = \mathbf{0.600 \text{ g/cm}^3}.$$

Question 2 Convert the stone

$$\text{Volume} = 55.0 - 40.0 = 15.0 \text{ cm}^3. \rho = 43.5 \div 15.0 = 2.90 \text{ g/cm}^3 = \mathbf{2900 \text{ kg/m}^3}.$$

Question 3 Identify the bolt

$$\text{Volume} = 44.0 - 40.0 = 4.0 \text{ cm}^3; \rho = 31.2 \div 4.0 = 7.8 \text{ g/cm}^3 = \mathbf{7800 \text{ kg/m}^3}, \text{ so the bolt is steel (iron).}$$

Question 4 Float or sink

The wooden cube (0.60 g/cm^3) **floats**. The oil (0.92 g/cm^3) **floats**. The bolt (7.8 g/cm^3) and the stone (2.9 g/cm^3) **sink**, because their densities are greater than 1.00 g/cm^3 .

Question 5 Fraction under water

A floating object displaces water equal to its own weight, so the submerged fraction = $\rho(\text{object}) \div \rho(\text{water}) = 0.60 \div 1.00 = \mathbf{0.60 (60 \%)}$.

Question 6 Reading uncertainty

Each reading has an uncertainty of $\pm 0.5 \text{ cm}^3$, so the rise has $\pm 1.0 \text{ cm}^3$. Bolt: $1.0 \div 4.0 \times 100 = \mathbf{25 \%}$. Stone: $1.0 \div 15.0 \times 100 = \mathbf{6.7 \%}$. The stone density is more reliable because its volume is larger.

Question 7 Improve the lab

Any two: use a larger sample, or several bolts together, to get a bigger volume change; use a displacement can with a small measuring cylinder; remove air bubbles from the solid; read

the meniscus at eye level; use a smaller-diameter cylinder; repeat and average. **Reducing the percentage uncertainty in V is the key idea.**