



QUESTION WORKBOOK

Fluids: pressure, upthrust and viscosity

Materials · Year 12

CIE 4.3 · OCR A 3.2.4

12 questions · 32 marks

PRINT EDITION

SECTION A · Warm-up

- A1** State the equation for the pressure due to a column of fluid, defining each symbol, and state one quantity the pressure does not depend on. [2]

- A2** Calculate the pressure due to the water at the bottom of a swimming pool 2.5 m deep (density of water 1000 kg m^{-3}). [2]

- A3** State what is meant by upthrust and give its size in terms of the fluid displaced. [2]

SECTION B · Standard

- B1** A stone of volume $3.0 \times 10^{-4} \text{ m}^3$ is fully submerged in water. Calculate the upthrust on it. [3]

- B2** A submarine cruises 30 m below the surface of sea water of density 1025 kg m^{-3} . Calculate the pressure due to the water at this depth, and state what must be added to find the total pressure on the hull. [3]

- B3** Explain, in terms of pressure, why the upthrust on a submerged object acts upwards. [2]

- B4** An iceberg of density 920 kg m^{-3} floats in fresh water of density 1000 kg m^{-3} . Calculate the fraction of its volume below the surface. [3]

- B5** State the conditions under which Stokes' law applies to the drag on a moving sphere. [2]

SECTION C · Stretch

- C1** A sphere of radius 1.5 mm moves at 0.12 m s^{-1} through oil of viscosity 0.25 Pa s . Calculate the viscous drag on it. [3]

- C2** A small sphere falls through glycerol of viscosity 0.85 Pa s . Its weight exceeds the upthrust on it by $1.8 \times 10^{-4} \text{ N}$, and its radius is 1.0 mm. Calculate its terminal velocity. [4]

- C3** Estimate the depth of fresh water that produces a pressure equal to one atmosphere ($1.01 \times 10^5 \text{ Pa}$), and comment on what this means for a diver at 20 m. [3]

- C4** A student measures the viscosity of syrup by timing a ball bearing falling between two marks. Explain why the marks must be placed well below the surface, and why the temperature must be recorded. [3]
