Pressure in fluids and upthrust

Name _____ Class _____ Date _____

Fluids (liquids and gases) exert pressure on every surface they touch. Pressure increases with depth.

KEY EQUATIONS

p = F ÷ A
pressure (Pa), force normal to the surface (N), area (m^2)

p = h ρ g (Higher)
pressure due to a column of liquid (Pa), height (m), density (kg/m^3), g (N/kg)

Section A · Recall and calculate

Grade 4–5

1 A force of 600 N acts on an area of 0.2 m^2. Calculate the pressure. [2]

p = 600 ÷ 0.2 = 3000 Pa

2 State the direction in which the pressure of a fluid acts on a surface. [1]

At right angles (normal) to the surface.

3 Explain why atmospheric pressure decreases as you go higher up a mountain. [2]

There is less air above you (and the air is less dense),

so the weight of air pushing down is smaller.

Section B · Apply

Grade 5–6

4 Explain why a dam is built much thicker at the bottom than at the top. [2]

Pressure in a liquid increases with depth,

so the water pushes hardest at the bottom of the dam.

5 Calculate the pressure due to the water at a depth of 15 m in a lake. (ρ = 1000 kg/m^3, g = 9.8 N/kg) (Higher) [2]

p = hρg = 15 × 1000 × 9.8

p = 147 000 Pa

Section C · Stretch

Grade 7+

6 Explain why an object submerged in water experiences an upward force (upthrust). (Higher) [3]

The bottom surface is deeper than the top surface,

so the water pressure is greater on the bottom.

This gives a resultant upward force: upthrust.

7 Explain why a block of wood floats but a stone of the same size sinks. [3]

Both have the same upthrust when fully submerged (same volume).

The wood's weight is less than the upthrust, so it rises and floats.

The stone's weight is greater than the upthrust, so it sinks (it is denser than water).

Exam-style question

AQA style

8 A diver is swimming 12 m below the surface of the sea. The density of sea water is 1030 kg/m³.

a Calculate the pressure due to the water on the diver. (g = 9.8 N/kg) [2]

p = 12 × 1030 × 9.8

p = 121 128 Pa (≈ 121 000 Pa)

b The diver's face mask has an area of 0.015 m². Calculate the force of the water on it. [2]

F = pA = 121 128 × 0.015

F ≈ 1800 N

c Explain why the total pressure on the diver is greater than your answer to (a). [1]

Atmospheric pressure also acts on the surface of the water.

Total: _____ / 20

How confident am I?	Not yet	Nearly	Got it
I can use p = F ÷ A	☐	☐	☐
I can explain how pressure changes with depth and height	☐	☐	☐
I can explain upthrust and floating	☐	☐	☐