

pressure pushes everywhere at once, and a narrower pipe always means faster and lower

Pressure in a fluid

- pressure is force per unit area, acting **normal to the surface**
- a scalar: it has no direction of its own
- at a point in a fluid at rest it is the same in every direction
- it grows with depth, and one level of a connected fluid has one pressure

Pressure and depth

definition, SI unit the pascal

$$P = \frac{F}{A}, 1 \text{ Pa} = 1 \text{ N/m}^2$$

absolute pressure at depth h

$$P = P_a + \rho g h$$

gauge pressure

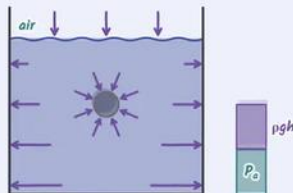
$$P - P_a = \rho g h$$

between two depths

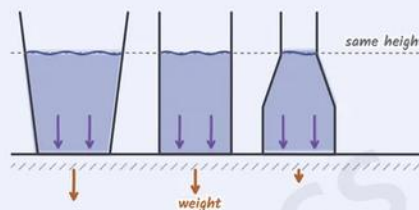
$$\Delta P = \rho g (h_2 - h_1)$$

depends only on ρ , g and h , never on the shape or width of the vessel. Pascal's law: extra pressure on an enclosed fluid goes undiminished to every point and wall

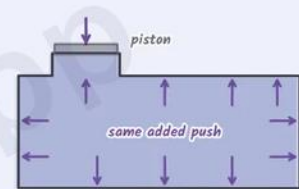
Depth, shape, piston



deeper, more pressure, every way



same height, same push below

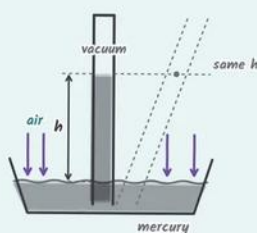


one push, the same extra everywhere

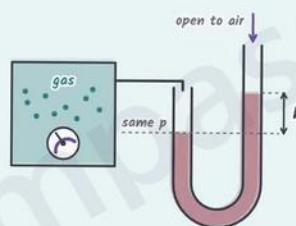
Measuring pressure *

- mercury barometer: $P_a = \rho g h$ of the standing column
- its height ignores the tube's tilt and width
- open tube manometer: h gives the gauge pressure
- 1 atm = 1.013×10^5 Pa = 76 cm of mercury; 1 torr = 1 mm of mercury

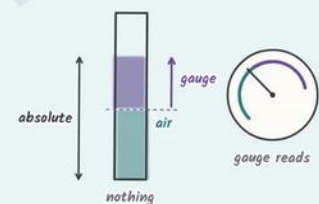
Barometer, manometer, gauge



the column stands at h , tilted or not



h shows the gauge pressure



the dial reads only the part above the air