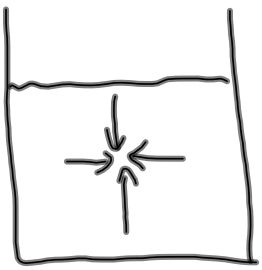
Pressure

$P = \frac{F}{A}$ units: Nm^{-2} or Pa (pascal)

scalar quantity

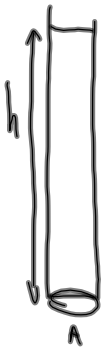


Fluid pressure can be caused by
- gravity
- acceleration
- forces in a closed container

The pressure inside a fluid applies in all directions

Atmospheric pressure (due to weight of atmosphere per unit area) at the Earth's surface is about 100 kPa (10^5 Pa)

Pressure due to a fluid of constant density



$P = \frac{F}{A}$

$(\text{density})\ \rho = \frac{m}{V}$

$P = \frac{mg}{A}$

$P = \frac{\rho V g}{A} \quad (V = hA)$

$P = \frac{\rho h A g}{A}$

$\boxed{P = \rho h g}$ ← pressure at the bottom

Example

The surface of the water in a storage tank is 30 m above a water tap in the kitchen of a house. Calculate the difference in pressure between the tap and the surface of the water in the tank. $\rho_{water} = 1.0 \times 10^3\ kg\ m^{-3}$

$P = \rho h g$

$P = (1.0 \times 10^3\ kg\ m^{-3})(30\ m)(9.81\ m\ s^{-2})$

$P = 2.9 \times 10^5\ kg\ m^{-3} m^2 s^{-2}$

$kg\ m^{-1} s^{-2}$ ← $\frac{kg\ m\ s^{-2}}{m^2}$ ← $\frac{N}{m^2}$

$\boxed{P = 2.9 \times 10^5\ Pa}$ $\quad \boxed{kg\ m^{-1} s^{-2}}$

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