Dynamic viscosity } → takes density into account → $\boxed{\nu = \frac{\eta}{\rho} = \frac{\text{dynamic viscosity}}{\text{mass density}}}$

$\nu_{air} \approx 10^{-5}\ m^2 s^{-1}$

$\nu_{water} \approx 10^{-6}\ m^2 s^{-1}$

$\nu_{honey} \approx 10^{-2}\ m^2 s^{-1}$

Pressure vs depth → liquids incompressible so no change in density with depth
↳ gases compressible so density changes with depth

Liquid

→ Incompressible
↳ density fixed

Hydrostatic equation } $\boxed{\frac{dP}{dz} = -\rho g}$

ρ constant (incompressible)

$\boxed{P = P_0 + \rho g h}$ ★

P_0

$P(h)$

Gases

Gases compressible but obeys gas law → $PV = nRT = NK_BT$

n_d = no. density of gas $= \frac{N}{V} = \frac{P}{k_BT}$

$\boxed{\text{mass density} \Rightarrow \rho = \frac{mN}{V} = \frac{mP}{k_BT}}$

$\rho \propto P$ and $\propto \frac{1}{T}$

↳ $\frac{dP}{dz} = -\rho(z)g = \frac{-mPg}{k_BT}$

$\boxed{\frac{dP}{dz} = -\frac{mg}{k_BT}P}$

→ Solve to get:

$\boxed{P(h) = P_0 e^{-\frac{mg}{k_BT}h}}$

here mgh → energy at height h due to gravitational potential

$\Rightarrow e^{-\frac{E}{k_BT}}$

↳ Boltzmann Factor

More energetic states less probable than less energetic states