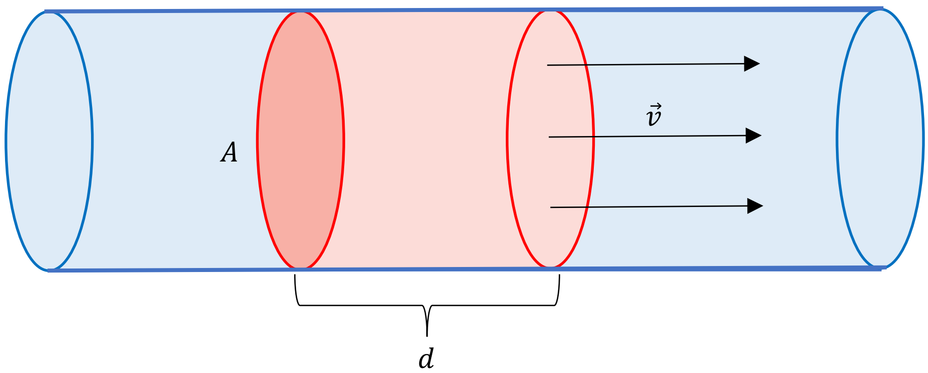
Hydrodinamics, hydrostatics and gas laws

Here is a short recap from our lectures to help you revise and remember the most important parts!

Remember:

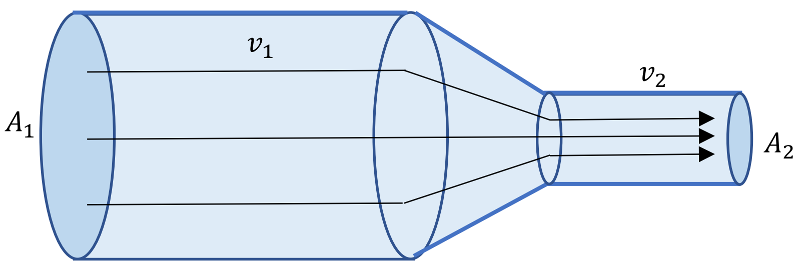
V	volume	m^3	p	pressure	Pa
t	time	s	F	force	N
d	distance	m	g	gravity field strength	ms^{-2}
A	area	m^2	ρ	density	kgm^{-3}
v	velocity	ms^{-1}	n	amount	mol
Q	volumetric flow rate	m^3s^{-1}	T	temperature	K
h	height/depth	m	N	number of molecules	-

Volumetric flow rate (Q) is the volume of fluid which passes through a given corss sectional area per unit time.



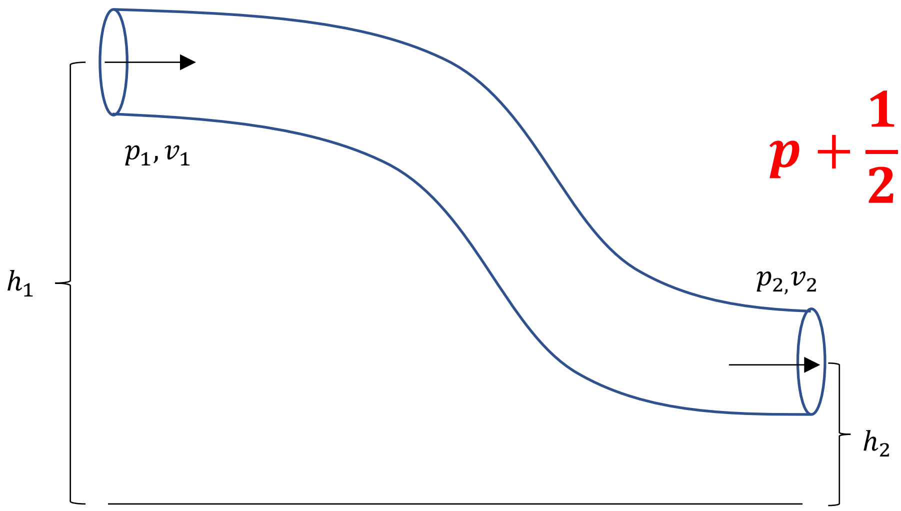
$$Q = \frac{V}{t} = \frac{Ad}{t} = Av$$

Continuity equation states that in the case of steady flow, the amount of fluid flowing through one cross-section must be same at the amount of fluid flowing through another cross-section.



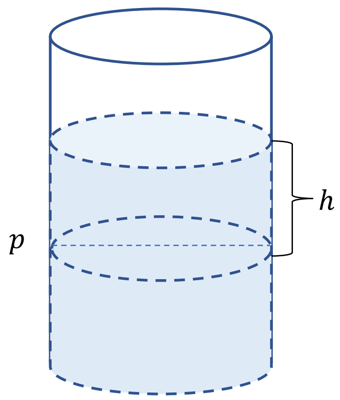
$$A_1v_1 = A_2v_2$$

Bernoulli theorem states that the work done on the fluid during its flow in a streamline is equal to the change in kinetic and potential energy.



$$p + \frac{1}{2}\rho v^2 + \rho g h = const$$

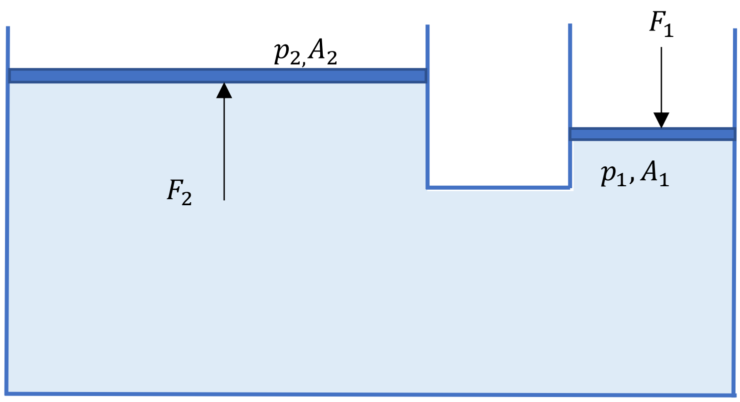
Hydrostatic pressure refers to the pressure that any fluid in a confined space exerts.



$$p = \rho g h$$

Pascal's law states that when external pressure is applied to a confined fluis, it is transmittes uniformly in all directions.

Hydraulic press



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

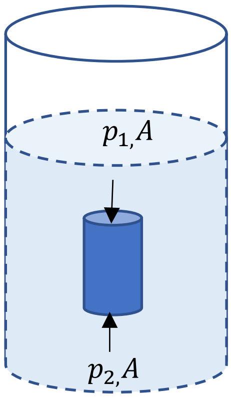
$$p_1 = p_2 \longrightarrow \frac{F_1}{A_1} = \frac{F_2}{A_2}$$

$$A_2 > A_1$$

$$\downarrow$$

$$F_2 > F_1$$

Buoyant force is an upward force extrended by the fluid that opposes the weight of a partially or fully immersed object.



$$F_b = p_2 A - p_1 A$$
$$p = \rho g h$$
$$F_u = A\rho g(h_2 - h_1)$$
$$h = h_2 - h_1$$
$$F_u = A\rho g h$$
$$V = Ah$$

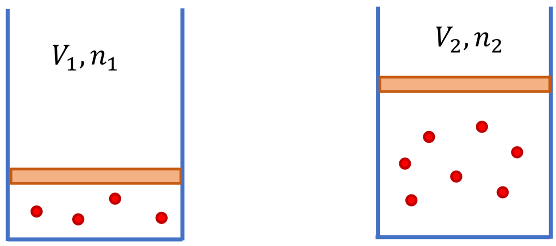
$$\boldsymbol{F = Vg\rho}$$

Amount: $$\boldsymbol{n = \frac{N}{N_A}}$$

Important consants:

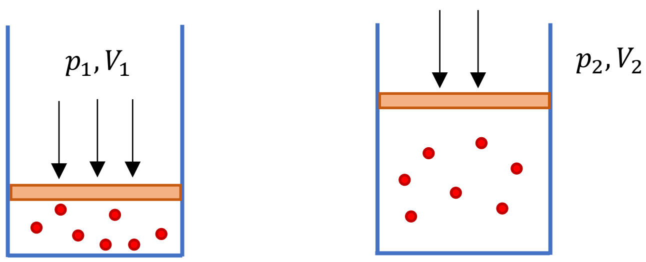
N_A	Avogadro's constant	$6{,}022 * 10^{23} mol^{-1}$
R	gas constant	$8{,}314\ JK^{-1}mol^{-1}$

Avogadro's law states that <u>under the same conditions of temperature and pressure</u>, relation between volume and amount of matter stayes the same.



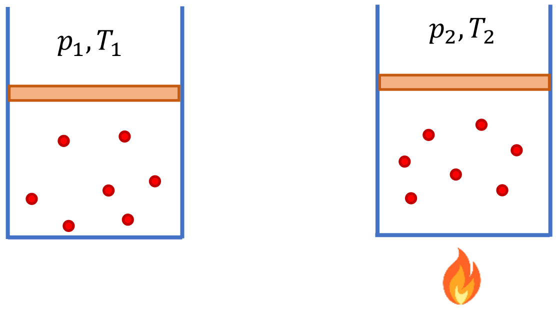
$$\boldsymbol{\frac{V_1}{n_1} = \frac{V_2}{n_2}}$$

Boyle's law states that <u>under the same conditions of temperature</u> the pressure and volume of a gas have an inverse relationship. If volume increases, then pressure decreases and vice versa.



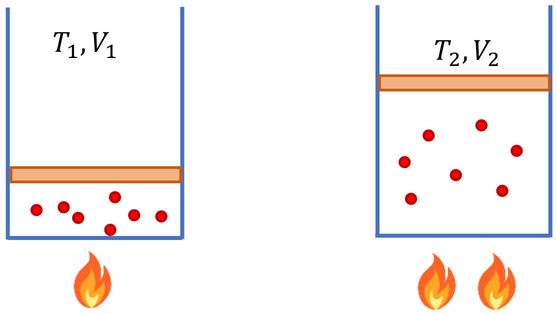
$$\boldsymbol{p_1 V_1 = p_2 V_2}$$

Gay – Lussac's law states that under the condition of constant volume pressure of a gas is directly proportional to the gas's temperature.



$$\frac{p_1}{T_1} = \frac{p_2}{T_2}$$

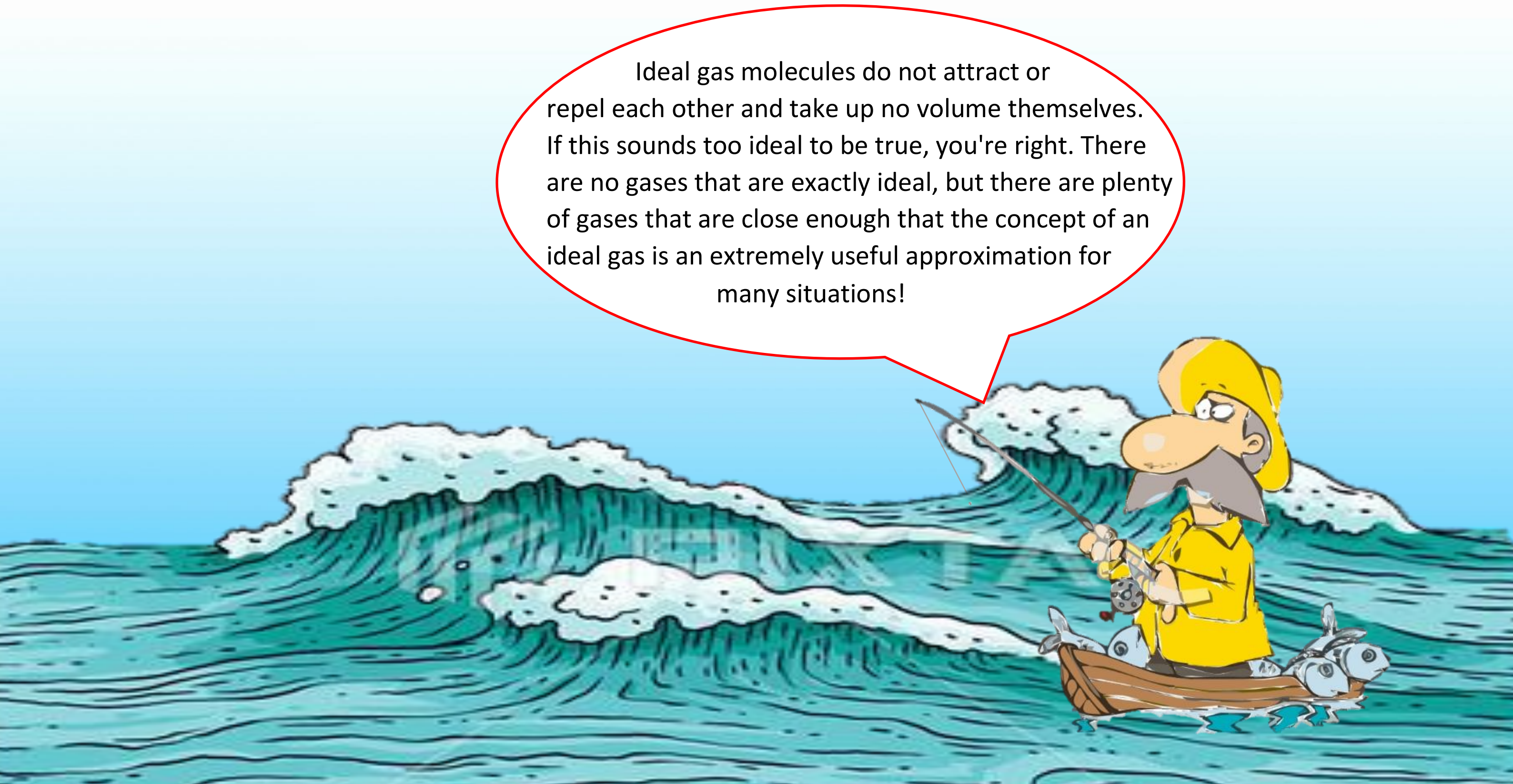
Charles's law states that under the condition of constant pressure the temperature and the volume of the gas will be in direct proportion.



$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

The pressure, p, volume, V, and temperature, T, of an ideal gas are related by a simple formula called the **ideal gas law**.

$$pV = nRT$$



Sources:

https://lh3.googleusercontent.com/proxy/Ru7EL0jOFCeG8s603en0yLFMoKQjQGBRiO72sTltXzfznOzqvUfWf4cWededQua4aeuKZGhf23_z4x-0NRK0PWVDNZf-1IuvGrZZuxfYoNBszMnh3YRU5mccPCWEvwwry7TvQib2oa4y_TkLb3DSAIe7V22V_9EUtDJHX1E6foUDKOJi7ExrZWg4OyPknBiX

https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcSIdxUCNhbLZ6oNWMYmcpQRP6SxnDsuYmNqGw&usqp=CAU

https://en.pimg.jp/060/511/283/1/60511283.jpg

https://lefseking.com/wp-content/uploads/2017/08/Gnome-Napping-lg.jpg

Creators: Lucija Vrankovečki, Petra Randić, Dora Peček