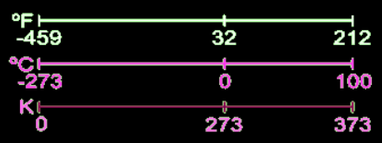
GAS PROPERTIES

- **Pressure**
  - It is the force applied over a surface area F/A, and its SI unit is pa or atm
  - The standard pressure is **1 atm**
- **Temperature**
  - It is the measuring of heat, or how fast a particle is moving
  - Generally, gasses have lower melting points than liquids and solids
  - We use the kelvin scale to deal with gasses
  - The standard temperature is **0C or 273K**
  - it is directly proportional with pressure
- **Volume**
  - Is the 3D space occupied by a gas, its SI unit is m^3
  - one mole of any gas at standard temperature and pressure will occupy a volume of 22.4 liters
- **Amount in moles**
  - One mole of gas contains $6.022x10^{23}$ atoms (Avogadro's number)



Natural law

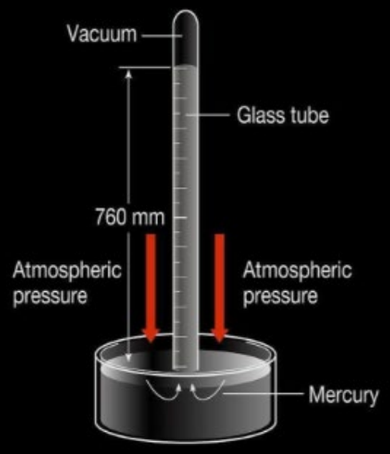
Is a concise verbal/mathematical statement of a relation that is constant under constant conditions, so it is the summary of observed/measurable behavior

THE ATMOSPHERE

A blanket of gasses which surrounds earth, it is held near the surface by gravity, the air is tasteless, odorless, colorless, formless, and blend together so well that they act like a single gas

Constituent	*Formula*	*Percentage by Volume*
Nitrogen	N_2	78.08
Oxygen	O_2	20.95
Argon	Ar	0.93
Carbon dioxide	CO_2	0.036
Neon	Ne	0.002
Helium	He	0.0005
Krypto	Kr	0.001
Xenon	Xe	0.00009
Hydrogen	H_2	0.00005

Barometer



How it works

- The mercury in the tube pushes down on the mercury on the tank, and the atmospheric pressure pushes down on the open surface of the mercury in the tank
- The mercury goes down until a certain level, where it's stopped by the atmospheric pressure, leaving a space in the column called the **Torricelli vacuum**
- The atmospheric pressure is equivilent to 76 cmHg or 760 mmHg (torr) at 0 degrees celcius and
- The higher the pressure, the higher the column and else

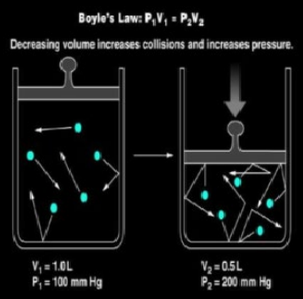
First: Pressure is equal at all the points that lie on the same level.
Second: Pressure at a point inside a fluid = atmospheric pressure + ρgh (pressure x gravity x height)

Boyle's law

It describes the relation between pressure & volume of gasses

He discovered that when a gas is at constant temperature, the volume varies inversely with its pressure
So when you compress gas in a container, the volume **decreases**, but the pressure **increases**, and vise versa
It can be broken down into this formula

$$p_1v_1 = p_2v_2$$



Charles's Law

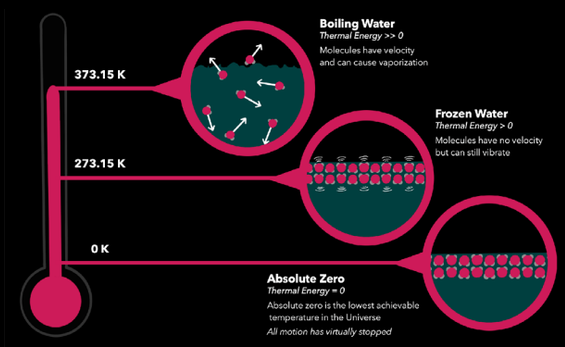
It describes the relation between pressure & temperature of gasses

He discovered that when a gas is at constant pressure, the temperature varies directly with its pressure
So when you heat up gas in a container, the temperature **increases**, and the pressure **increases**, and vise versa
It can be broken down into this formula

$$\frac{v_1}{T_1} = \frac{v_2}{T_2}$$

Absolute Zero

It is the lowest possible temperature, where there is no kinetic energy, and particles have minimal vibrational motion
It is 0K or -273°c
In absolute zero, the volume of gas should be zero, which is impossible, so it is impossible to reach



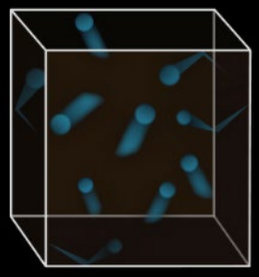
Kinetic theory

It states that the particles that make up matter (atoms, molecules, etc) are always in constant motion

The motion is determined by the amount of energy they have (temperature)

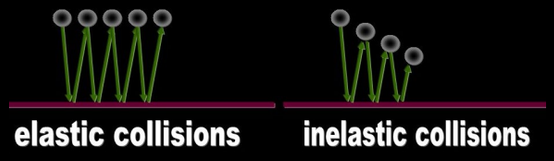
The 3 main points of the kinetic theory of matter

1. The gas is composed of a large number of identical molecules moving randomally, separated by large distances compared to their size

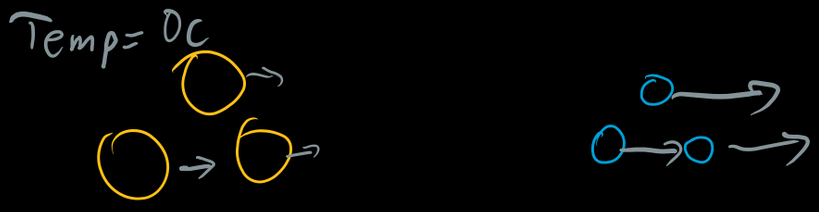


2. The molecules undergo perfectly elastic collisions (no energy loss) with each other and with the walls of the container

- **All collisions a gas particle undergoes are perfectly elastic.**
- **They exert a pressure but don't lose any energy during the collisions.**



3. Heavier particles move slower than the lighter particles at same temperature

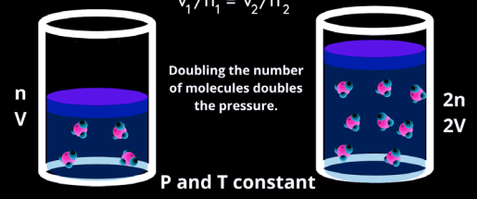


Avogadro's Law

Equal volumes of a gas contain the same number of molecules at the same temperature and pressure.

$V/n = k$

$V_1/n_1 = V_2/n_2$



Ideal gas

In a combination between Boyle's law, Charles's law, and Avogadro's law in one law known as the ideal gas law of the general gas equation

$$PV = nRT$$

Where

- P = pressure
- V = volume
- n = amount of substance in moles
- R = is the ideal gas constant which is **8.3145 L.Kpa/K.mol**
- T = temperature

The ideal gas law can describe the gas behavior experimentally and mathematically only if it is an ideal gas.