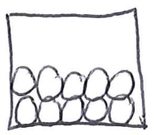
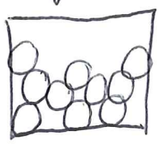
Thermal Physics

States of matter

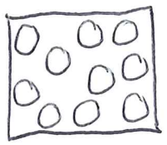
Solid — "particles"



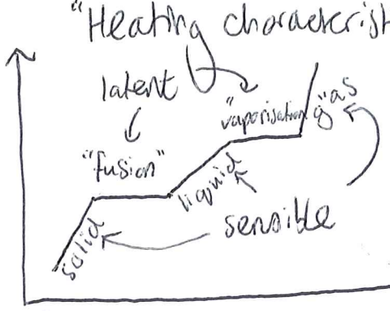
Liquid



Gas — "molecules"



"Heating characteristic"



Absolute zero
- 0 K
- -273 °C

} Particles have no kinetic energy

Temperature

★ Specific Latent Heat = heat required to change the state of 1kg material with no change in temperature ($J kg^{-1}$)

★ Specific heat capacity = energy required to increase the temperature of 1kg of a substance by 1°C. ($J kg^{-1} K^{-1}$)

Internal energy

$$U = \sum^{N} E_K + \sum^{N} E_P$$ random!

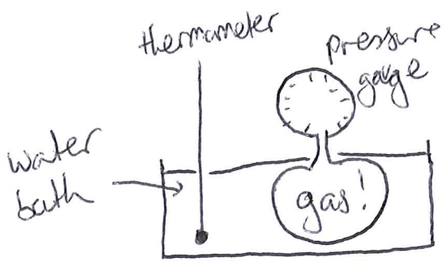
Ideal Gas!

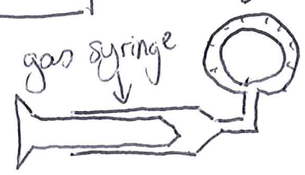
$$pV = nRT$$

- p: pressure (Pa)
- V: volume (m^3)
- n: moles
- T: absolute temperature (K)

- spherical particles
- elastic collisions
- time between collisions >> duration of a collision
- no intermolecular forces → zero potential energy
- particles move in random, rapid motion

Gas Laws

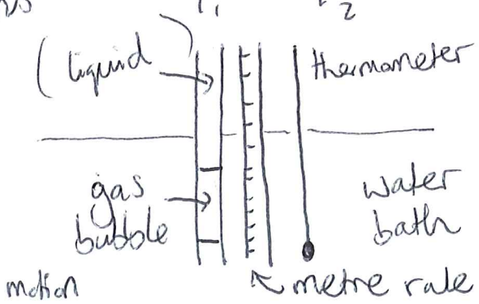




$$P_1V_1 = P_2V_2$$

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$

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



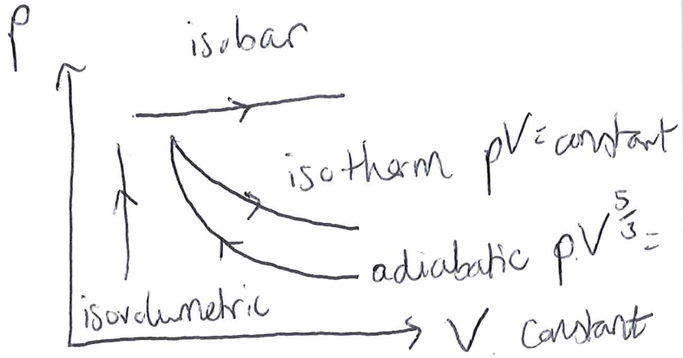
$$pressure = \frac{force\ (N)}{area\ (m^2)}$$

(for use in Paper 1 and Paper 2!)

moles

- number of particles = particles in 12g of carbon-12 = $6 \times 10^{23} = N_A$

$$n = \frac{N}{N_A}$$



Thermodynamics!

1st: $Q = U + W_K$

- Q: heat entering the gas
- U: internal energy of the gas (∝ E_K of particles if ideal)
- W_K: work done on surroundings by the gas ($p\Delta V$)