Ideal Gas Law $PV = nRT = n N_A \left(\frac{R}{N_A}\right) T$

$\uparrow \uparrow \uparrow$

#Mol. gas constant temp in K

$\uparrow$ Avagardos #

N_A = # molecules $\approx 6.022 \times 10^{23}$

Rewrite: $PV = NkT$

(Picture: $N = 500$)

$\frac{PV}{NkT} = 1$

$N = n N_A$ = # molecules

$\frac{R}{N_A} = k$ = Butzmann's Constant

Kinetic theory of (ideal) gas

Simple

A molecule is a tiny hard sphere

Translational kinetic energy >> potential energy

>> rotational kinetic energy

>> vibrational kinetic energy

Very good approximation for gasses not too close to condensation temperature & without too high pressure

Still decent approx from liquids, solids, non ideal gasses.

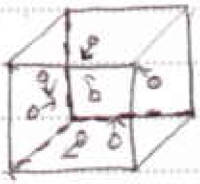
O_2

More compricated model of gas

Result:

$\boxed{PV = \frac{2}{3} K}$

Pages 477-8

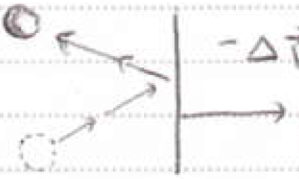


random distribution of velocities position

1 =

4 26 10

[✓ M] / TU / W / TH / F



$-\Delta \vec{p}_{\text{molecule}} = \Delta \vec{P}_{\text{box}} = \vec{F}_{\text{collision}} \Delta t_{\text{collision}} = \vec{J}_{\text{collision}}$

$\vec{F}_{\text{collision}}$

Total Force on a side $= \overset{\overset{PA}{\shortparallel}}{\vec{F}}$ A= Area of a side

$= \left| \sum \Delta \vec{P}_{\text{box},i} / \Delta t \right|$ Sum over collisions during Δt

$PV = \frac{2}{3} K$

Pressure x volume = total kinetic energy of all the gas molecules.

Pressure x volume $\propto$ energy $\underline{PV = \frac{2}{3}K}$ & $\underline{PV = NkT}$

kinetic theory ideal gas theory

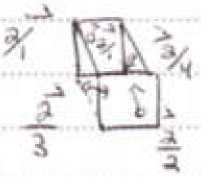
$\underset{\underset{\frac{\text{Force}}{\text{Area}}}{\shortparallel}}{\text{Pressure}} \propto \frac{\text{Energy}}{\text{Volume}}$

$\Rightarrow \frac{2}{3}K = NkT \Rightarrow K = \frac{3}{2} NkT$

$\bar{K} = \frac{K}{N}$ = average kinetic energy of a molecule $= \frac{3}{2} k \underset{\underset{\text{temperature in kelvins}}{\uparrow}}{T}$

m= mass of each molecules in our gas

(for simplicity assume molecules here same mass)

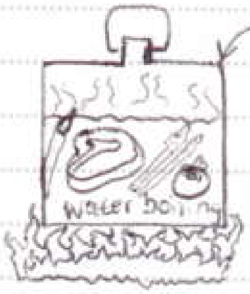


$\bar{K} = \frac{K}{N} = \frac{1}{N} \sum_i \frac{1}{2} m v_i^2 = \frac{1}{2} m \underbrace{\left(\frac{\sum_i v_i^2}{N}\right)}_{\bar{v}}$

$\bar{K} = \frac{1}{2} m \overline{v^2} \Rightarrow \overline{v^2} = \frac{2\bar{K}}{m} = \frac{3kT}{m} \Rightarrow v_{rms} = \sqrt{\overline{v^2}} = \sqrt{\frac{3kT}{m}}$

root mean square

pressure cooker



Inside = P > 1 atm

outside

P = 1 atm

Boiling temperature depends on Pressure

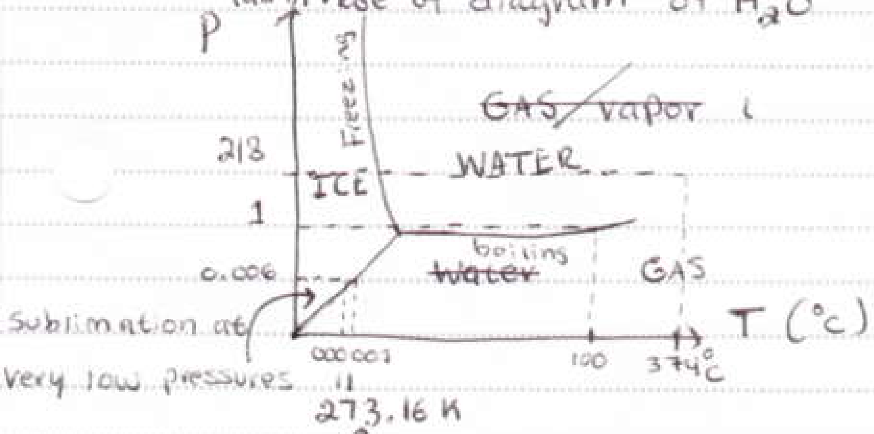
↗ pages 484 - 485

" saturated vapor pressure

↳ pressure at which water boils

↳ depend on temperature

(atm) Phase of diagram of H_2O



↳ by definition