Kinetic Molecular Theory

Gases are made of particles that move in straight lines until they hit something.

Collisions involving gas particles are elastic (no loss of KE)

The particles of a gas have no volume.

Law v. Theory

Law: a provable, mathematically stated relationship between variables.

Theory: an explanation of a law or laws. unprovable. can only be proven wrong, or not proven wrong

What's wrong/right about KMT

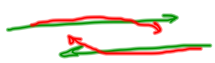
gas particles have no volume...wrong

the truth: $V_{part.} <<< V_{container}$

$V_{part} <$ uncertainty in V

lie fails @ high density

gas particles move in straight lines and collide elastically...
wrong, because... they attract → sticky



the truth:

ignore because of Sodd Street

lie fails at low T

Gas Laws - the assumptions

each law compare only 2 variables

the other two must be const

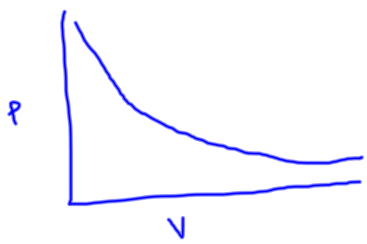
Boyle's Law

V↑ P↓

$V \propto \frac{1}{P}$ $P \propto \frac{1}{V}$

$V = k\frac{1}{P}$

$PV = k$



as V↑ — SA↑
— fewer collisions
(more time to go wall to wall)

$P = \frac{F}{A} = \frac{\downarrow}{\uparrow}$ ∴ P↓

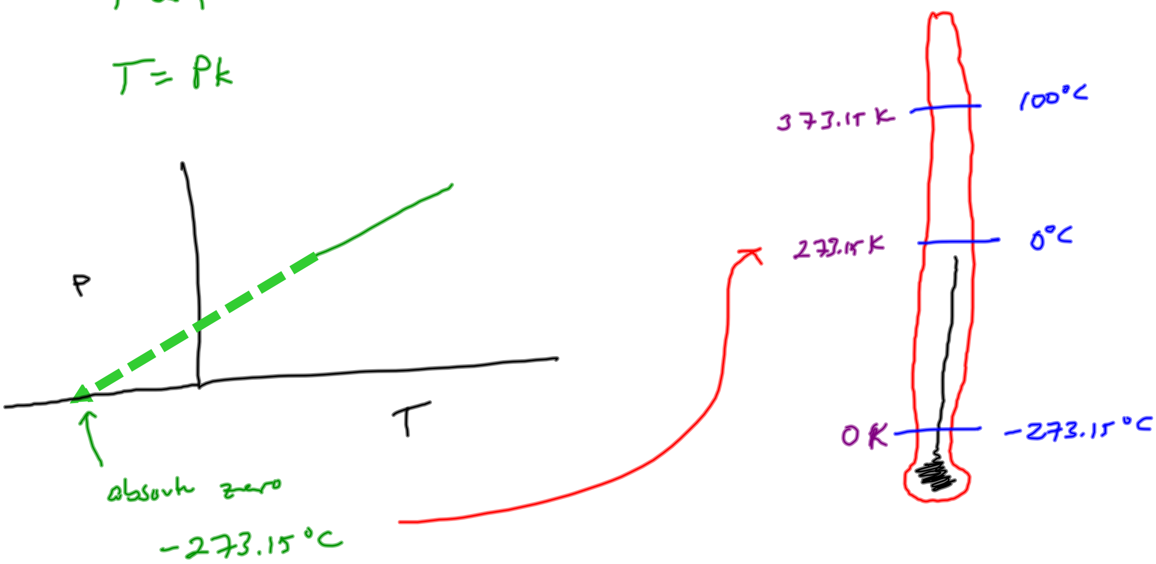
Gay Lussac's Law

T↑ P↑

$T \propto P$

$T = Pk$

as T↑, mc faster
— hit walls → more often
→ harder

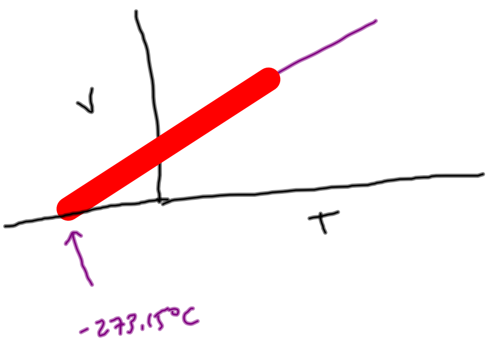


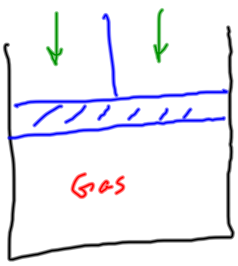
Charles' Law

T↑ V↑

$T \propto V$

$T = Vk$





if T↑ ... P↑ b/c G.L.

now P↑ > P↓

so ... piston go up ... V↑

as V↑ ... P↓ (Boyle)

until P = P

Foos' Law

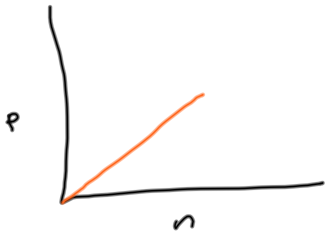
$n\uparrow P\uparrow$

$n \propto P$

$n = Pk$

$n\uparrow$ .... more collisions

$\therefore P\uparrow$

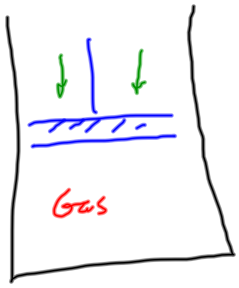


Avogadro's Law

$n\uparrow V\uparrow$

$n \propto V$

$n = Vk$



$n\uparrow$ .... $P\uparrow$ (Foos)

$P\uparrow > P\downarrow$

so.... piston pushed up

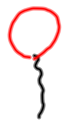
so ... $V\uparrow$

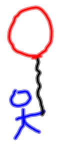
until $P = P$

b/c as $V\uparrow$ $P_{inside}\downarrow$ (Boyle)

IF problems

Δing condition problems





. . . . later

P↓ V↑

I	F
1.02 atm	.61 atm
3.00 L	?

$3.00 L \times \frac{1.02 atm}{.61 atm} = L$

$\frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2}$

$\frac{P_1V_1}{P_2} = V_2$

34.6 g of CO_2 are placed in a container at 89.0°C and 3.28 atm. If 21.2 g of CO_2 leak out of the container and the temperature drops to -13.9°C, what will the new pressure in the container be?

I	F
34.6 g	13.4 g
89.0°C 362.2 K	-13.9°C 259.3 K
3.28 atm	?

$\frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2}$

$\frac{P_1 n_2 T_2}{n_1 T_1} = P_2 = \frac{(3.28)(13.4)(259.3)}{(34.6)(362.2)}$

T↓ P↓ n↓ P↓

$3.28 atm \times \frac{259.3 K}{362.2 K} \times \frac{13.4 g}{34.6 g} = 0.909 atm$