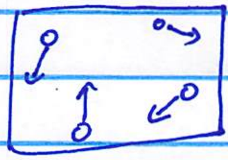
10/17/2018

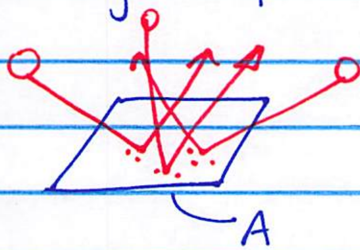
Chapter 5 — Gases.

State of matter where particles are v. far apart!



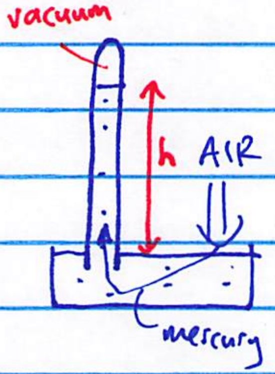
Pressure

Formally: $\text{pressure} = \frac{\text{force}}{\text{area}}$



$p = f/A$

Can measure atmospheric (air) pressure using a Mercury Barometer



air pressure $\propto h$ = 760 mm on a "standard day" @ sea level

regular atmospheric pressure = 1 atm

1 atm = 760 mm Hg = 760 torr (exact)

Torricelli's barometer (1643)

SI unit of pressure: pascal (Pa)
(international system)

$1\ Pa = 1\ N/m^2$

1 atm = 101,325 Pa
= 101.325 KPa

1 atm = 29.92 inHg = 14.7 psi
lbs/in^2

(you can read about manometers --- p200)

Gas Laws

Other characteristics of gases:

pressure, p
volume, V
temperature, T
amount of moles, n

} gas laws are used to predict these inter-relationships.

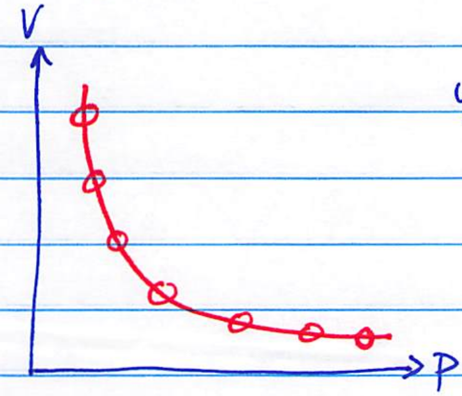
Boyle's law: p, V (const n, T)

Charles: V, T (const n, p)

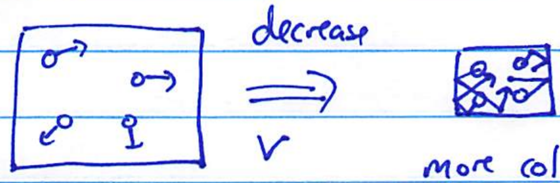
Avogadro: V, n (const T, p)

Boyle's law

$V \propto 1/p$ (n, T const.) $\quad p\uparrow, V\downarrow \; ; \; p\downarrow, V\uparrow$



WHY?



more collisions w/ walls @ lower V

$\Rightarrow p\uparrow$

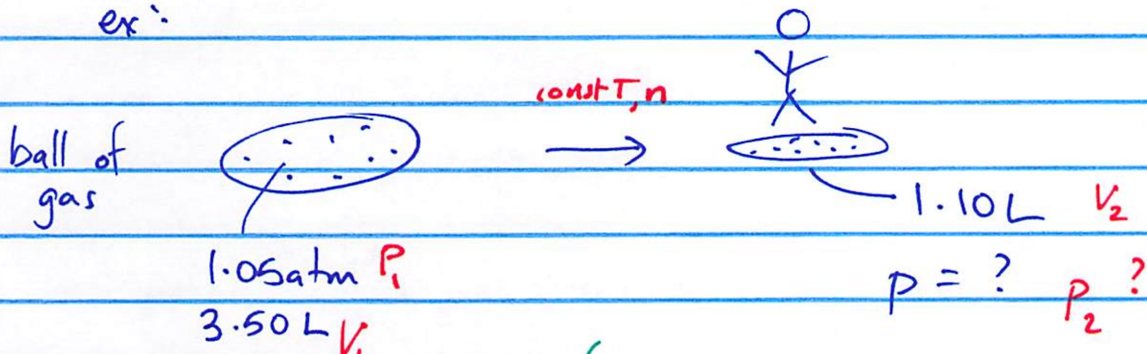
$V \propto 1/p$, so... $V = \frac{(\text{constant})}{p} \Rightarrow p \times V = (\text{constant})$

in a change: $P_1 V_1 = (\text{constant}) = P_2 V_2$

$$\boxed{P_1V_1 = P_2V_2}$$

const T, n [Boyle's law]

ex:



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

$$\Rightarrow P_2 = \frac{1.05\,\text{atm} \times 3.50\,\cancel{\text{L}}}{1.10\,\cancel{\text{L}}} = 3.34\,\text{atm}$$

Charles's law

$V \propto T$ (n, p constant).