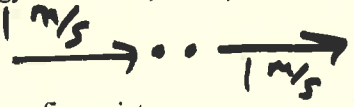
**Characteristics of Gases Notes** **(keep in notebook)** Name

Density = g/L

Kinetic Molecular Theory of Gases

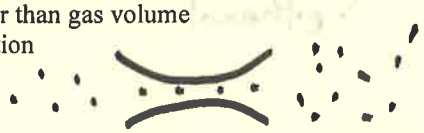
1) Gas particles are far apart – volume of gas = 1,000 times volume of same liquid
   - low density values (expressed in g/L)
   - most of gas volume = empty space (you don't even calculate the gas particles volume into the overall volume)
   - compressibility
2) Collisions between particles are ***elastic*** – no net loss of Kinetic Energy due to heat, sound, attractive forces.
3) Gas particles are in continuous, rapid, random motion
4) There are no intermolecular forces between gas particles




--MOST gases act IDEALLY, meaning that they fall in line with the above five points.

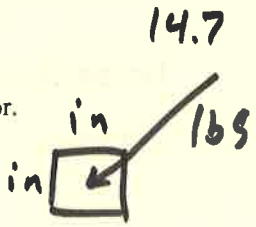
**Ideal GAS BEHAVIOR:**

1) Expansion – gases will fill volume given.
2) Fluidity – gas particles slide past one another with no attraction.
3) Low Density
4) Compressibility – can be compressed down to about 100 times smaller than gas volume
5) Diffusion – spontaneous mixing of the particles and their random motion



Effusion – gas particles can pass through a small opening

Gases with ***some intermolecular force*** or ***large molecular size*** are most likely to ***deviate*** from ideal gas behavior.

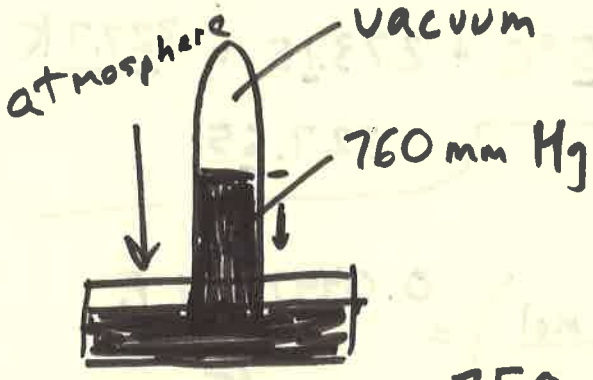



**Pressure** – force per unit area on a surface $\frac{\text{Force}}{\text{area}}$

Measuring atmospheric pressure: barometer – first one made with mercury by Evangelista Torricelli

At sea level, atmospheric pressure can hold up a 760 mm column of mercury. This is called 1 atm (atmosphere) of pressure.

**Barometer:**




**Pressure Units:**

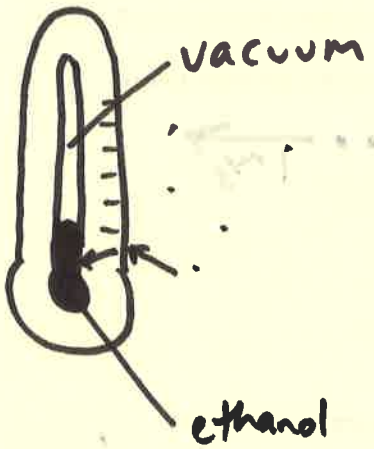
sea level

1 atm (atmosphere) =
760. mm Hg =
760. torr =
101.325 kPa (kiloPascals)
101,325 Pa =
14.7 Psi

$$750.\ \text{mm Hg}\left(\frac{1\ \text{atm}}{760.\ \text{mm Hg}}\right) = 0.987\ \text{atm}$$

**Temperature** - the average kinetic energy of a substance
- a measure of the average molecular motion in a substance
- higher temp = faster average motion of particles

Measuring device: Thermometer




373 K — 100°C $H_2O$ boil

273 K — 0°C $H_2O$ Freeze

0 K — -273.15 °C Absolute zero

**Temperature Units:**

1) Celsius °C
- created by Anders Celsius (Swedish)
- he set 0°C to water's freezing point and 100.°C to water's boiling point

2) Kelvin K
- created by Lord Kelvin (Scottish)
- he wanted a temp scale that accurately reflected molecular motion
- at 0 K, "absolute zero" there is no molecular motion
- there are no negative Kelvin temperatures

STP - standard temp and pressure

$\frac{T}{273.15\ K \quad 0°C}$ $\frac{P}{1\ atm \quad 760.\ mm\ Hg}$

Conversions:

$°C + 273.15 = \_\_ K$

$K - 273.15 = \_\_ °C$

$54.5°C + 273.15 = 327.7\ K$

327.65

Density at STP

$F_2$ : 1.70 g/L

$N_2$ : 1.25 g/L

$O_2$ : 1.43 g/L

$\frac{1.70\ g}{L}\left(\frac{1\ mol}{38.00\ g}\right) = \frac{0.0447\ mol\ F_2}{L}$ ($F_2$)

$= \frac{22.4\ L}{1\ mol\ F_2}$