# Gases

properties : shape of container, fill container

compress

Kinetic Molecular theory

1) particles are always moving

2) $V_{gas} = V_{container}$

3) no attractive forces between particles

4) Temp is related to the K.E.

# 4 variables used to describe a gas

P - collisions

V - size

n - # of particles
moles

T - speed

___ °C + 273.15 = ___ K

STP + Molar volume

↙ Standard temp + Pressure

0°C   1 atm

↘ volume of a gas at STP

1 mol = 22.4 L

ex: calculate the volume of 2.5 moles of oxygen gas at STP.

2.5 mol → ___ L @ STP

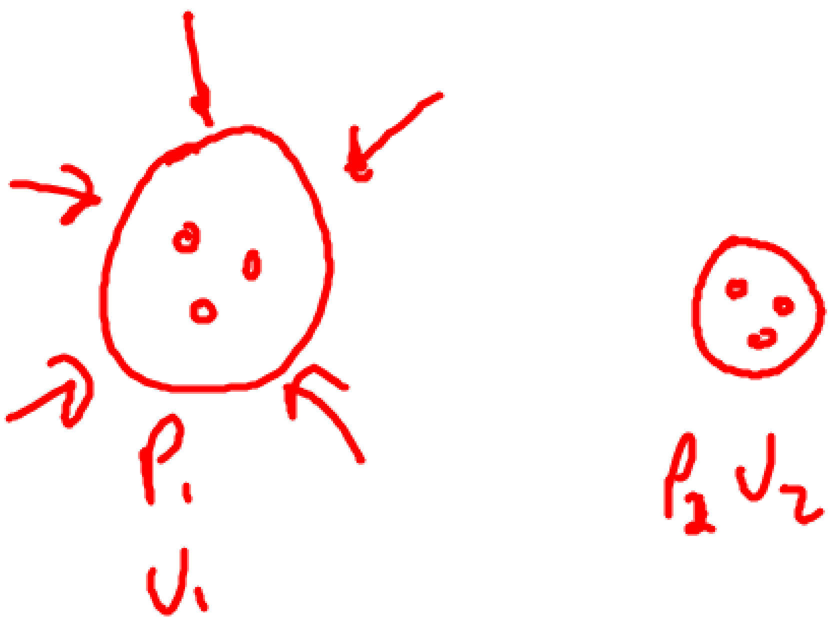
$$2.5\ \text{mol}\ O_2 \times \frac{22.4\ L\ O_2}{1\ \text{mol}\ O_2} = \underline{56}\ L\ O_2$$

# Boyle's Law

P's & V's at constant n & T

How are $\underline{P}$ and $\underline{V}$ related?

inversely




$P\uparrow \; V\downarrow$

$$P_1V_1 = P_2V_2$$

Ex: A balloon has a volume of 12.5 L (V) at 1.04 atm (P). What volume will the balloon have at 1200 mmHg (P)?

$V_1 = 12.5\ L$

$P_1 = 1.04\ atm \times \frac{760\ mmHg}{1\ atm} = 790\ mmHg$

$P_2 = 1200\ mmHg$

$V_2 = ?\ L$

$P_1 V_1 = P_2 V_2$

$$V_2 = \frac{P_1 V_1}{P_2} = \frac{(790\ mmHg)(12.5\ L)}{1200\ mmHg} = 8.2\ L$$

Breathing

Read p. 130 - 131

# Gay-Lussac's Law

P + T     constant n + V

How are __P__ and __T__ related?

directly     P↑ T↑

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

Ex: A tire has a pressure of 40. psi at 25°C, what is the pressure of the tire at -10.°C ?

$P_1 = 40.\text{ psi}$

$T_1 = 25°C + 273 = 298\text{ K}$

$T_2 = -10.°C + 273 = 263\text{ K}$

$P_2 = \underline{\ ?\ }\text{ psi}$

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

$$P_2 = \frac{P_1 T_2}{T_1} = \frac{(40.\text{ psi})(263\text{ K})}{298\text{ K}}$$

35 psi

# Charles' Law

V + T constant P + n

How are __V__ and __T__ related?

directly V ↑ T ↑

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

Ex: a flexible container occupies 5.0 L (V) at 20.°C (T). If the temp is increased to 60.°C (T), what is the new volume?

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

$V_1 = 5.0\ L$

$T_1 = 20.°C + 273 = 293\ K$

$T_2 = 60.°C + 273 = 333\ K$

$V_2 = ?\ L$

bigger

$$V_2 = \frac{V_1 T_2}{T_1} = \frac{(5.0\ L)(333\ K)}{293\ K}$$

$= 5.7\ L$

# Combined Gas Law

$P, V, T$

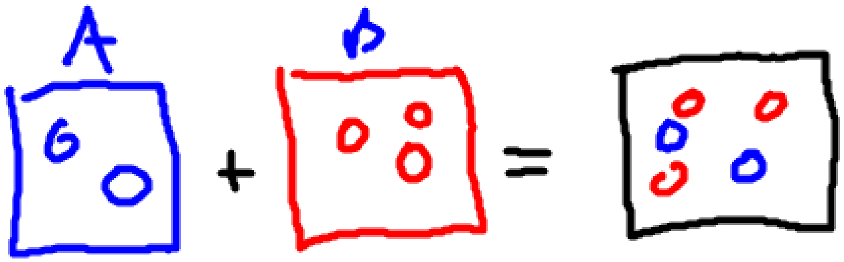
what two Laws are combined?

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

Boyle's T constant

charles'

# Mixture of Gases




$$P_A + P_B = P_{Total}$$

## Dalton's Law of Partial Pressure

- usually exp. collecting a gas over water

# Henry's Law

Read 136 - 137

$$P = k \cdot C$$

$P$ → pressure

$k$ → constant, solvent

$C$ → concentration

$$M = \frac{mol}{L}$$