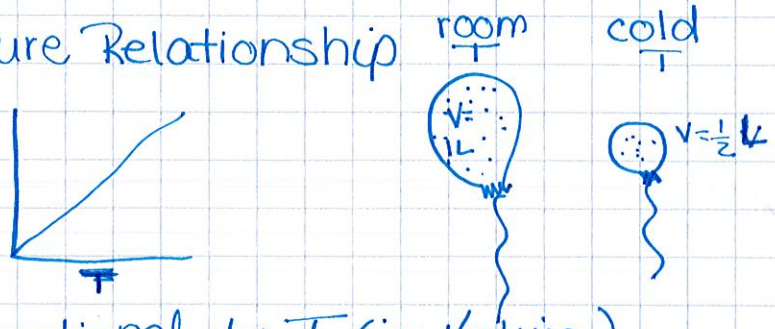
Gases

Gas Laws

- we assume there are no IMFs between the gas molecules - they behave ideally

(1) Volume - Temperature Relationship



If T ↓, V ↓
If T ↑, V ↑

Charles's Law

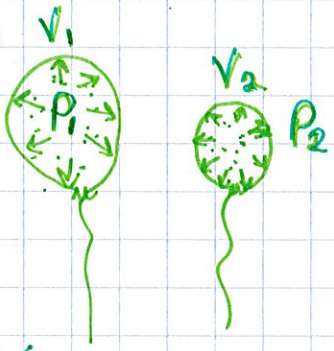
V is directly proportional to T (in Kelvin) at constant P

$$V_1 T_2 = V_2 T_1$$

To convert T from °C to K - add 273

(2) Pressure - Volume Relationship

(force/area) (amount of space)



If V ↓, the P ↑
If V ↑, the P ↓

Boyle's Law

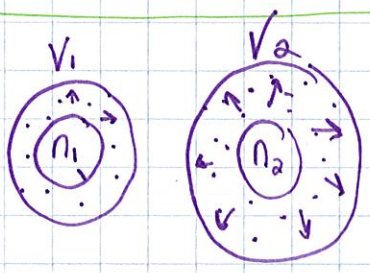
P is inversely proportional to V at constant T

$$P_1 V_1 = P_2 V_2$$

Pressure units

1 atm = 760 torr
= 760 mm Hg
= 101.325 kPa

(3) #moles - Volume Relationship



If n ↑, V ↑
If n ↓, V ↓

Avogadro's Law

V is directly proportional to the #moles of gas

$$V_1 n_2 = V_2 n_1$$

Boyle's, Charles's, and Avogadro's Laws Worksheet **Name:**_____

Directions: Decide which Gas Law to use to answer each problem. You need to show work (including units in your set up and final answer) to get credit. Circle your final answer.
Write in the Gas Law that you use.

Boyle's Law $P_1V_1 = P_2V_2$ **Avogadro's Law $V_1/n_1 = V_2/n_2$** **Charles's Law $V_1/T_1 = V_2/T_2$**

V_1 T_1 V_2

1. A balloon has a volume of 253.2 mL at 356 K. The volume of the balloon is decreased to 165.4 mL. Determine the new temperature. **Gas Law used:** Charles's Law $V_1T_2 = V_2T_1$

? = T_2 $V_1 = 253.2\text{mL}$ $T_1 = 356\text{K}$ $V_2 = 165.4\text{mL}$

$\frac{(253.2\text{mL})T_2}{253.2\text{mL}} = \frac{(165.4\text{mL})(356\text{K})}{253.2\text{mL}}$

$T_2 = 233\text{ K}$

2. A sample of oxygen gas occupies a volume of 365.2 mL. When the volume is increased to 478.2 mL, the new pressure is 241.3 torr. What was the original pressure? **Gas Law used:**_____

3. If 72.3 L of an ideal gas is cooled from 36°C to -156 °C, what will the volume of the gas become?
Gas Law used: _____

4. 95.8 L of fluorine gas is being held at a temperature of 24.5°C. If the temperature were raised to 46.9 °C, what would the new volume be? **Gas Law used:**_____

V_1 P_1 P_2

5. Ammonia gas occupies a volume of 57.9 L at a pressure of 532.4 atm. If the pressure were lowered to 256.8 atm, what would the new volume be? **Gas Law used:** Boyle's Law $P_1V_1 = P_2V_2$

$P_1 = 532.4\text{atm}$ V_2
$V_1 = 57.9\text{L}$
$P_2 = 256.8\text{atm}$
$V_2 = ?$

$\frac{(532.4\text{atm})(57.9\text{L})}{256.8\text{ atm}} = \frac{(256.8\text{ atm})V_2}{256.8\text{ atm}}$

$120.\text{ L} = V_2$

6. A tank full of xenon gas has a volume of 696 L. When the gas is transferred to a new tank, the pressure is measure at 3.52 torr and the volume is 423 L. What was the original pressure? **Gas Law used:**_____

n_1 V_1 V_2

7. A sample of bromine gas has 0 .906 mol and a volume of 478 mL. When the volume is increased to 684 mL as more bromine gas is added, what is the new amount of moles? **Gas Law used:** Avogadro's Law $V_1n_2 = V_2n_1$

$n_1 = .906\text{ mol}$
$V_1 = 478\text{ mL}$
$n_2 = ?$
$V_2 = 684\text{ mL}$

n_2

$\frac{(478\text{mL})n_2}{478\text{mL}} = \frac{(684\text{mL})(.906\text{mol})}{478\text{mL}}$

$n_2 = 1.30\text{ mol}$

8. A 12.5 L container of neon had a pressure change from 125 kPa to 35 kPa. What is the new volume?
Gas Law used:_____