AR Chemistry Notes Name_____ M T 1 2 5
The Combined Gas Law

1. Pressure = _____

   Standard Air Pressure = _____

   Measurements: _____ atm = _____ lbs/in^2 = _____ mm Hg = _____ kPa = _____ torr

2. Temperature = _____

   Lowest Possible Temperature = _____

   Conversion between ^{o}C and K: _____

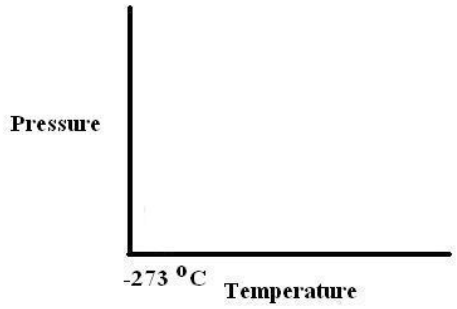
   Standard Temperature = _____

3. Volume = _____

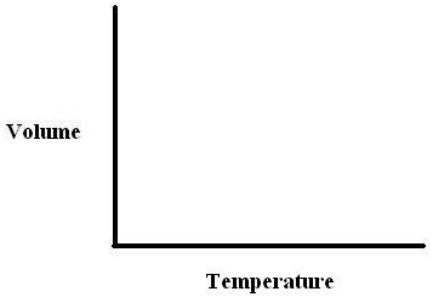
   ******* 1 Mole of ANY GAS = _____ @ STP (Standard Temperature and Pressure)**

4. The Gas Laws

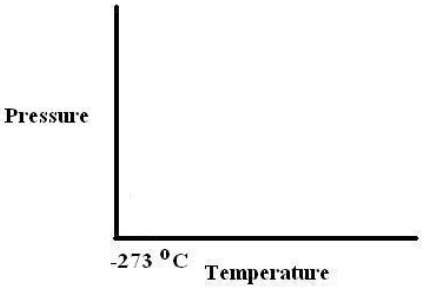
   a. Boyle's Law: Pressure and Volume at Constant Temperature



   b. Charles' Law: Volume and Temperature at Constant Pressure



   c. Gay-Lussac's Law: Pressure and Temperature at Constant Pressure



5. The Combined Gas Law!!!

$$\frac{P\ V}{T} = K \qquad \text{Or} \qquad \frac{\mathbf{P_1\ V_1}}{\mathbf{T_1}} = \frac{\mathbf{P_2\ V_2}}{\mathbf{T_2}}$$

a. Units:

Pressure:_____

Volume: _____

Temperature: _____

b. Make a chart!!!! Just like Q = c m t

Ex 1: You have a 2.0 L balloon at 20. C and a pressure of 760. mm Hg. You drive to the mountains where the new pressure is 640. mm Hg and the new temperature is 10. C. What is the new volume of the balloon?

P_1 =

V_1 =

T_1 =

P_2 =

V_2 =

T_2 =

Ex 2: You have a 1000 L weather balloon that is at 20 C and 1.15 atm pressure. The balloon rises to a height where the pressure is 0.30 atm and the temperature is -50. C. What is the new volume of the balloon?

P_1 =

V_1 =

T_1 =

P_2 =

V_2 =

T_2 =

AR Chemistry Notes Name_____ M T 1 2 5
The Combined Gas Law

1. Pressure = Force / Area

   Standard Air Pressure = average air pressure at sea level.

   Measurements: 1.00 atm = 14.7 lbs/in^2 = 760. mm Hg = 101.3 kPa = 760. torr

2. Temperature = measures the average KE in a sample

   Lowest Possible Temperature = -273 Celsius or 0 Kelvin

   Conversion between ^oC and K: C = K + 273

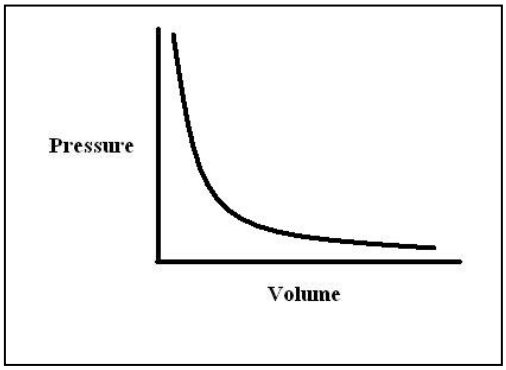
   Standard Temperature = 0 Celsius or 273 K

3. Volume = the space that a material occupies

   ***** **1 Mole of ANY GAS = 22.4 @ STP (Standard Temperature and Pressure)**

4. The Gas Laws

   a. Boyle's Law: Pressure and Volume at Constant Temperature

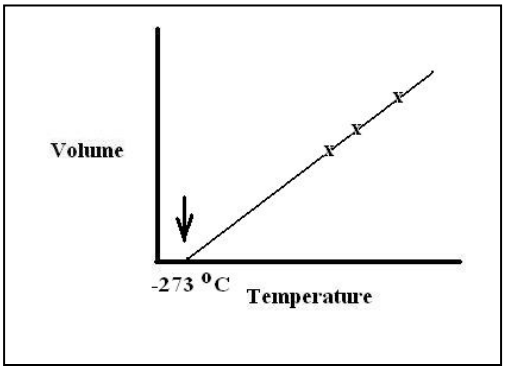


   Think of a Balloon:
   Drive to Mountains: P goes down, V goes up
   Drive back: P goes up, V goes down

   This is an **inversely proportional relationship!!!!**

   P V = k (see graph) or $P_1V_1 = P_2V_2$

   b. Charles' Law: Volume and Temperature at Constant Pressure

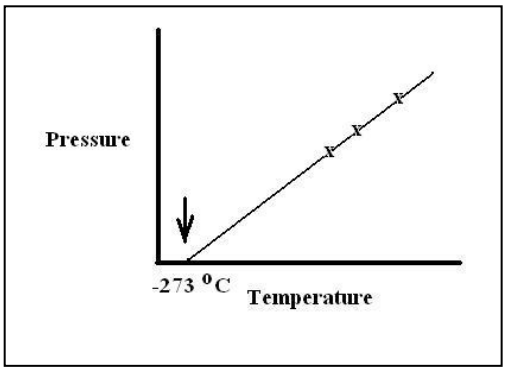


   Think of a Balloon:
   Heat it up (hot air balloon): T goes up, V goes up
   Cool it down (ice bath): T goes down, V goes donw

   This is a **directly proportional relationship!!!!! (straight line)**

   By cooling a balloon and extrapolating the line, the temperature that NO VOLUME would occur was found to be:
   -273 C

   c. Gay-Lussac's Law: Pressure and Temperature at Constant Pressure



   Think of a closed, empty can or bottle.
   Heat it up: T goes up, Pressure goes up
   Cool it down: T goes down, Pressure goes down

   This is a **directly proportional relationship!!!!! (straight line)**

   By cooling a container and extrapolating the line, the temperature that NO PRESSURE would occur was found to be:
   -273 C

5. The Combined Gas Law!!!

$$\frac{P\ V}{T} = K \qquad \text{Or} \qquad \frac{\mathbf{P_1\ V_1}}{\mathbf{T_1}} = \frac{\mathbf{P_2\ V_2}}{\mathbf{T_2}}$$

a. Units:

Pressure: Any units as long as they are the same on both sides

Volume: Any units as long as they are the same on both sides

Temperature: MUST BE KELVIN!!!!! (need a 0 pressure, 0 volume, 0 temperature origin)

b. Make a chart!!!! Just like Q = c m t

Ex 1: You have a 2.0 L balloon at 20. C and a pressure of 760. mm Hg. You drive to the mountains where the new pressure is 640. mm Hg and the new temperature is 10. C. What is the new volume of the balloon?

P_1 = 760. mm Hg
V_1 = 2.0 L
T_1 = 20 C = 293 K

P_2 = 640. mm Hg
V_2 = ???
T_2 = 10 C = 283 K

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

$$\frac{(760.\text{ mm Hg})(2.0\text{ L})}{293\text{ K}} = \frac{(640\text{ mm Hg})(V_2)}{283\text{ K}}$$

V_2 = 2.29 L

Ex 2: You have a 1000 L weather balloon that is at 20 C and 1.15 atm pressure. The balloon rises to a height where the pressure is 0.30 atm and the temperature is -50. C. What is the new volume of the balloon?

P_1 = 1.15 atm
V_1 = 1000 L
T_1 = 20 C = 293 K

P_2 = 0.30 atm
V_2 = ???
T_2 = -50 C = 223 K

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

$$\frac{(1.15\text{ atm})(1000\text{ L})}{293\text{ K}} = \frac{(0.30\text{ atm})\ V_2}{223\text{ K}}$$

V_2 = 291,752 L (292,000)