(#4-3b)
CHEMISTRY
THE IDEAL GAS (c)

PV = nRT R = .0821	Combined Gas Law $P_1V_1/T_1 = P_2V_2/T_2$ T = Kelvin

1. What are the two forms of measuring gas pressure and what is the conversion between the two.

mm Hg (torr) 760 = 1 Atm

2. Sulfur dioxide, a gas that plays a central role in the formation of acid rain, is found in the exhaust of automobiles and power plants. Consider a 1.53 L sample of gaseous SO_2 at a pressure of 5.6×10^3 mmHg. If the pressure is changed to 1.5×10^4 mmHg at a constant temperature, what will be the new volume of the gas? Which law will be used in this question?

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ $\frac{P_1V_1T_2}{T_1P_2} = V_2$ $\frac{(5.6e3)(1.53)(T)}{T\ 1.5e4} = 0.57L$

3. A sample of gas at 15°C and 1 atm has a volume of 2.58L. What volume will this gas occupy at 38°C and 1 atm? Which law will be used in this question?

15+273 = 288K

38+273 = 311

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ $\frac{P_1V_1T_2}{T_1P_2} = V_2$ P-constant $\frac{1(2.58)311}{288} = 2.78atm$

4. A sample of hydrogen gas has a volume of 8.56L at a temperature of 0°C and a pressure of 1.5 atm. Calculate the moles of H_2 molecules present in this gas sample.

$PV=nRT$ $\frac{PV}{RT}=n$ $\frac{1.5 \cdot 8.56L}{.0821 \cdot 273} = 0.57mol$ 273

5. Suppose we have a sample of ammonia gas with a volume of 3.5 L at a pressure of 1.68 atm. The gas is compressed to a volume of 1.35L at a constant temperature. Which gas law will be used in this example and what is the final pressure?

Combined T=constant

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ $\frac{P_1V_1T_2}{T_1V_2} = P_2$ $\frac{(3.5)(1.68)T}{(1.35)(T} = 4.35\ atm$

6. A 5 g sample of Methane (CH_4) gas that has a volume of 3.8 L at 5° C is heated to 86°C at constant pressure of 2 atm. Calculate its new volume.

$5g \cdot \frac{1\ mol}{16\ g} = 0.312\ mol$ $PV=nRT$ $V=\frac{nRT}{P}$ $\frac{0.312 \cdot (0.0821)(359)}{2\ atm} = 4.5 atm$

7. A sample containing .35 mol argon gas at a temperature of 13°C and a pressure of 897mmHg. Calculate the change in volume that occurs when the temperature increases to 23°C.

897/760 → 1.18

23 +273 = 296

$PV=nRT$ $V=\frac{nRT}{P}$ $\frac{0.35 \cdot 0.0821 \cdot 296}{1.18}$

8. A steel reaction vessel of a bomb calorimeter, which has a volume of 75.0mL, is charged with oxygen gas to a pressure of 145 atm at 22°C. Calculate the moles of oxygen in the reaction vessel.

22 +273 = (295)

$PV=nRT$ $\frac{PV}{RT}=n$ $\frac{145 \cdot 0.075}{.0821 \cdot 295K} = 0.45mol$