CHM 151 Quiz 5a 25 Pts Spring 2009 Name: Key

SHOW ALL WORK TO RECEIVE CREDIT

$PV = nRT$ $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ $P_1V_1T_2 = P_2V_2T_1$ $R = \frac{0.0821 L \cdot atm}{mol \cdot K} = \frac{62.4 L \cdot torr}{mol \cdot K}$

1. (4 Pts) A balloon containing 3.0 L of CO_2 at 22 °C and a pressure of 725 torr is placed in a freezer at -7 °C. Assume the pressure does not change and calculate the new volume of the balloon.

~~$P_1 = 725$ torr $P_2 =$ SAME~~

$V_1 = 3.0\,L$ $V_2 = ?$

$T_1 = 295\,K$ $T_2 = 267\,K$

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

$V_2 = \frac{(3.0\,L)(267\,K)}{295\,K} = 2.7\,L$

2. (5 Pts) Determine the temperature in K of 95.0 g of N_2 gas if the volume of the container is 8.00 L and the pressure is 850 mmHg.

$PV = nRT$

$P = 850$ mm Hg

$V = 8.00\,L$

$n = \frac{95.0\,g}{28.02\,g/mol} = 3.39\,mol$

$R = 62.4 \frac{L \cdot torr}{mol \cdot K}$

$T = \frac{PV}{nR} = \frac{(850\,torr)(8.00\,L)}{(62.4\,L \cdot torr/mol \cdot K)(3.39\,mol)}$

$T = 32.1\,K$

3. (6 Pts) Complete the following reactions, then write the total ionic and the net ionic equations for each.

a. $HClO_4(aq) + NaOH(aq) \rightarrow H_2O(l) + NaClO_4(aq)$ strong acid + Strong Base

total ionic eq.: $H^+ + ClO_4^- + Na^+ + OH^- \rightarrow H_2O(l) + Na^+ + ClO_4^-$

net ionic eq.: $H^+ + OH^- \rightarrow H_2O(l)$

b. $KOH(aq) + HF(aq) \rightarrow H_2O(l) + KF(aq)$

Strong Base weak acid

total ionic eq.: $K^+ + OH^- + HF(aq) \rightarrow H_2O(l) + K^+ + F^-$

net ionic eq.: $OH^- + HF(aq) \rightarrow H_2O + F^-$

4. (5 Pts) Determine the density of O_2 gas at 25 °C and 725 mmHg. (Atomic mass of O is 16.00).

Density = g/mL or g/L (for gases)

$P = 725$ mm Hg

$V = ?$

$n =$ assume 1 mol O_2 (32.0 g)

$R = 62.4 \frac{L \cdot torr}{mol \cdot K}$

$T = 298\,K$

$PV = nRT$

$V = \frac{nRT}{P} = \frac{(1\,mol)(62.4\,L \cdot torr/mol \cdot K)(298\,K)}{(725\,torr)} = 25.65\,L$

$D = \frac{32.00\,g}{25.65\,L} = 1.25\,g/L$

5. (5 Pts) A 0.540 g sample of air at 25 °C and a pressure of 710 mmHg, occupies a volume of 500 mL. Determine the average molar mass of the air.

molar mass = g/mol

$P = 710$ mm Hg

$V = 500\,mL = 0.500\,L$

$n = ?$

$R = 62.4 \frac{L \cdot torr}{mol \cdot K}$

$T = 298\,K$

$PV = nRT$

$n = \frac{PV}{RT} = \frac{(710\,torr)(0.500\,L)}{(62.4\,L \cdot torr/mol \cdot K)(298\,K)} = 0.0191\,mol$

$\text{molar mass} = \frac{0.540\,g}{0.0191\,mol} = 28.3\,g/mol$