CHM 151 Quiz 7a 25 Pts Fall 2008 Name: Key

$R = 62.4\ L\cdot torr/mol\cdot K$ $R = 0.0821\ L\cdot atm/mol\cdot K$ $PV = nRT$ $P_1V_1T_2 = P_2V_2T_1$

SHOW ALL WORK TO RECEIVE CREDIT.

1. A sample of a gas occupies 1.40×10^3 mL at 25 °C and 760 mmHg. What volume will it occupy at the same temperature and 380 mmHg?

$P_1 = 760\ mm\ Hg$ $P_2 = 380\ mm\ Hg$

$V_1 = 1.40 \times 10^3\ mL = 1.40\ L$ $V_2 = ?\ L$

$T_1 = 298K$ $T_2 = 298K$

$P_1V_1T_2 = P_2V_2T_1$

$V_2 = \frac{P_1V_1}{P_2} = \frac{(760\ torr)(1.40\ L)}{380\ torr}$

$V_2 = 2.8\ L$

2. A sample of N_2 gas occupies 2.40 L at 20°C. If the gas is in a container that can contract or expand at constant pressure, at what temperature will the N_2 occupy 4.80 L?

$P_1 = P_2$ $P_2 = P_1$

$V_1 = 2.40\ L$ $V_2 = 4.80\ L$

$T_1 = 273 + 20 = 293K$ $T_2 = ?$

$T_2 = \frac{P_2V_2T_1}{P_1V_1} = \frac{(4.80\ L)(293K)}{2.40\ L}$

$T_2 = 586K = 313\ ^\circ C$

3. Calculate the volume occupied by 35.2 g of methane gas (CH_4) at 25°C and 1.0 atm.

$35.2\ g \left| \frac{mol}{16.04\ g} \right. = 2.194\ mol$

$PV = nRT$

$V = \frac{nRT}{P} = \frac{(2.194\ mol)\left| \frac{0.0821\ L\cdot atm}{mol\cdot K} \right| 298K}{(1.0\ atm)}$

$V = 53.7\ L$

4. Calculate the density of $CO_2(g)$ at 100°C and 10.0 atm pressure.

$Density = \frac{g}{L}$ use $1\ mol\ CO_2\ (44.01\ g)$ in $PV = nRT$ to find V

$V = \frac{(1\ mol)\left| \frac{0.0821\ L\cdot atm}{mol\cdot K} \right| 373K}{(10.0\ atm)} = 3.062\ L$

$Density = \frac{44.01\ g}{3.062\ L} = 14.4\ g/L$

5. Determine the molar mass of chloroform gas if a sample weighing 0.389 g is collected in a flask with a volume of 102 cm^3 at 97°C. The pressure of the chloroform is 728 mmHg.

molar mass = g/mole use $PV = nRT$ to find moles (n)

$n = \frac{PV}{RT} = \frac{(728\ torr)(0.102\ L)\left(\frac{mol\cdot K}{62.4\ L\cdot torr} \right)}{(370K)}$

$n = 0.003216\ moles$ then $\frac{0.389\ g}{0.003216\ mol} = 121\ g/mol$

6. What volume of CO_2 gas at 645 torr and 800 K could be produced by the reaction of 45 g of $CaCO_3$ according to the equation?

$CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$

$45\ g$ $?\ mol \rightarrow L$

$45\ g\ CaCO_3 \left| \frac{1\ mol}{100.09\ g} \right| \frac{1\ mol\ CO_2}{1\ mol\ CaCO_3} = 0.4496\ mol$

$PV = nRT$

$V = \frac{nRT}{P}$

$V = \frac{(0.4496\ mol)\left(\frac{62.4\ L\cdot torr}{mol\cdot K} \right)(800K)}{(645\ torr)}$

$V = 34.8\ L$