CHM151 Q5a 25 Pts FALL 2005 Name: _____

SHOW ALL WORK TO RECEIVE CREDIT. $P_1V_1T_2=P_2V_2T_1$ $PV = nRT$ Key

$R = 0.0821$ L·atm/mol·K = 62.4 L·torr/mol·K

1. (4 Pts) A sample of a gas occupies 1600 milliliters at 20.0°C and 600 torr. What volume will it occupy at the same temperature and 800 torr?

$P_1 = 600$ torr $P_2 = 800$ torr $V_2 = \frac{P_1 V_1 T_2}{P_2 T_1}$ ← same

$V_1 = 1600$ mL $V_2 = ?$

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

$V_2 = \frac{(600\ \text{torr})(1600\ \text{mL})}{800\ \text{torr}} = 1200\ \text{mL}$

2. (4 Pts) A sample of oxygen occupies 47.2 liters under a pressure of 1240 torr at 25°C. What volume would it occupy at 35°C if the pressure were decreased to 730 torr?

$P_1 = 1240$ torr $P_2 = 730$ torr $V_2 = \frac{P_1 V_1 T_2}{P_2 T_1} = \frac{(1240\ \text{torr})(47.2\ \text{L})(308\text{K})}{(730\ \text{torr})(298\text{K})}$

$V_1 = 47.2$ L $V_2 = ?$

$T_1 = 298$K $T_2 = 308$K $V_2 = 82.9$ L

3. (4 Pts) A given mass of xenon gas has a volume of 200 mL at 25.0°C and 760 torr. To what temperature must the xenon be heated to occupy 450 mL at 760 torr?

$P_1 = 760$ torr $P_2 = P_1$ $T_2 = \frac{P_2 V_2 T_1}{P_1 V_1} = \frac{(450\ \text{mL})(298\text{K})}{200\ \text{mL}}$

$V_1 = 200$ mL $V_2 = 450$ mL

$T_1 = 298$K $T_2 = ?$ $T_2 = 670.5$K $= 397.5$ °C

4. (4 Pts) What is the molecular weight of a gas if 0.104 gram of the gas occupies 48.7 mL at 0°C and 1 atm pressure (STP)? WANT g/mol

1 mole @ STP (22.4 L)

$48.7 \times 10^{-3}\ \text{L} \left| \frac{\text{mol}}{22.4\ \text{L}} \right. = 0.00217$ mol

then $\frac{0.104\ \text{g}}{0.00217\ \text{mol}} = 47.8$ g/mol

or $PV = nRT$

$n = \frac{PV}{RT} = \frac{(1\ \text{atm})(0.0487\ \text{L})}{(273)\ (0.0821\ \text{L·atm/mol·K})}$

$n = 0.00217$ mol

then $\frac{0.104\ \text{g}}{0.00217\ \text{mol}} = 48.7$ g/mol

5. (5 Pts) Calculate the density of $O_2$ in g/L, at STP (0°C and 760 torr). The atomic weight of oxygen is 16.0 amu. WANT g/L

$P = 760$ torr $PV = nRT$

$V =$

$n =$ use 1 mole (32 g)

$R = 62.4$ L·torr/mol·K

$T = 273$K

$V = \frac{nRT}{P} = \frac{(1\ \text{mol})(62.4\ \text{L·torr/mol·K})(273\text{K})}{(760\ \text{torr})}$

$V = 22.4$ L

$\frac{32.0\ \text{g}}{22.4\ \text{L}} = 1.427\ \text{g/L}$

or @ STP 1 mol occupies 22.4 L

so $\frac{32.0\ \text{g}}{22.4\ \text{L}} = 1.429\ \text{g/L}$

6. At 150°C and 1.00 atm, 500 mL of a vapor has a mass of 0.8365 g. What is the molecular weight of the compound? WANT g/mol

$P = 1.00$ atm $n = \frac{PV}{RT} = \frac{(1.00\ \text{atm})(0.500\ \text{L})}{(0.0821\ \text{L·atm/mol·K})(423\text{K})}$

$V = 0.500$ L

$n =$

$R = 0.0821$ L·atm/mol·K $n = 0.01439$ mol

$T = 423$K

then $\frac{0.8365\ \text{g}}{0.01439\ \text{mol}} = 58.1$ g/mol

CHM151 Q5b 25 Pts FALL 2005 Name:_____ Key

SHOW ALL WORK TO RECEIVE CREDIT. $P_1V_1T_2=P_2V_2T_1$ $PV = nRT$

$R = 0.0821\ L\cdot atm/mol\cdot K = 62.4\ L\cdot torr/mol\cdot K$

1. At 150°C and 1.00 atm, 500 mL of a vapor has a mass of 0.8365 g. What is the molecular weight of the compound?

#6 on Q 5a

2. (4 Pts) A given mass of xenon gas has a volume of 200 mL at 25.0°C and 760 torr. To what temperature must the xenon be heated to occupy 450 mL at 760 torr?

#3 on Q 5a

3. (5 Pts) Calculate the density of $O_2$ in g/L, at STP (0°C and 760 torr). The atomic weight of oxygen is 16.0 amu.

#5 on Q 5a

4. (4 Pts) A sample of oxygen occupies 47.2 liters under a pressure of 1240 torr at 25°C. What volume would it occupy at 35°C if the pressure were decreased to 730 torr?

#2 on Q 5a

5. (4 Pts) What is the molecular weight of a gas if 0.104 gram of the gas occupies 48.7 mL at 0°C and 1 atm pressure (STP)?

#4 on Q 5a

6. (4 Pts) A sample of a gas occupies 1600 milliliters at 20.0°C and 600 torr. What volume will it occupy at the same temperature and 800 torr?

#1 on Q 5a