CHM151 Quiz 5a 25 Pts Spring 2011 Name: Key

Molar Masses: C 12.011, H 1.01, O 16.00

Formulas and Constants: $PV = nrt$, $P_1V_1T_2 = P_2V_2T_1$ $R = 0.0821 L \cdot atm/mol \cdot K = 62.4 L \cdot torr/mol \cdot K$

SHOW WORK TO RECEIVE CREDIT.

1. (5Pts) A 4.92-L cylinder contains 7.42 g of methane, CH_4, at 2780 mmHg. What is the temperature of the gas in °C?

$P = 2780$ torr
$V = 4.92$ L
$n = \frac{7.42 g \mid mol}{16.05 g} = 0.462 mol$
$R = 62.4$ L·torr/mol·K
$T = ?$

$PV = nRT$

$T = \frac{PV}{nR} = \frac{(2780 torr)(4.92 L)}{(0.462 mol)\left(62.4 \frac{L \cdot torr}{mol \cdot K}\right)}$

$T = 474$ K

$474 - 273 = 201$ °C

2. (5Pts) The partial pressures of CH_4, N_2, and O_2 in a sample of gas were found to be 111 mmHg, 503 mmHg, and 629 mmHg, respectively. What is the mole fraction of nitrogen?

$\frac{P_{N_2}}{P_{CH_4} + P_{N_2} + P_{O_2}}$ = mol fraction of N_2 $\frac{503}{111 + 503 + 629} = 0.405$

3. (5Pts) The volume of a sample of gas measured at 95.0°C and 1.00 atm pressure is 2.00 L. What must the final temperature (**in °C**) be in order for the gas to have a final volume of 7.00 L at 1.00 atm pressure?

P_1 V_1 T_1 P_2 V_2 T_2

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

$\frac{(1.00 atm)(2.00 L)}{(95.0 + 273 K)} = \frac{(1.00 atm)(7.00 L)}{T_2}$

$T_2 = 1288$ K

$1288 - 273 = 1015$ °C

4.(5Pts) A 2.00-L glass soda bottle filled only with air is tightly capped at 21°C and 730.0 mmHg. If the bottle is placed in water at 75°C, what is the pressure in the bottle?

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

$(730 mmHg)(75 + 273 K) = P_2 (21 + 273 K)$

$P_2 = 864$ mm Hg

5.(5Pts) Determine the density of O_2 gas at 2°C and 1.91 atm.

$D = g/L$
$P = 1.91$ atm
$V = ?$
$n =$ use $1 mol\ O_2\ (32.0 g)$
$R = 0.0821$ L·atm/mol·K
$T = 2 + 273 = 275$ K

$PV = nRT$

$V = \frac{nRT}{P} = \frac{(1 mol)\left(0.0821 \frac{L \cdot atm}{mol \cdot K}\right)(275 K)}{(1.91 atm)}$

$V = 11.8$ L

$Density = \frac{32.0 g}{11.8 L} = 2.71 g/L$

CHM151 Quiz 5b 25 Pts Spring 2011 Name: Key

Molar Masses: C 12.011, H 1.01, O 16.00

Formulas and Constants: $PV = nrt$, $P_1V_1T_2 = P_2V_2T_1$ $R = 0.0821 L \cdot atm/mol \cdot K = 62.4 L \cdot torr/mol \cdot K$

SHOW WORK TO RECEIVE CREDIT.

1.(5Pts) The volume of a sample of gas measured at 75.0°C and 1.00 atm pressure is 4.00 L. What must the final temperature (in °C) be in order for the gas to have a final volume of 9.00 L at 1.00 atm pressure?

$P_1 \quad V_1 \quad T_2 = P_2 \quad V_1 \quad T_1$

$(1.00\,atm)(4.00L)\,T_2 = (1.00\,atm)(9.00L)(75+273K)$

$T_2 = \frac{(9.00L)(75+273K)}{4.00L} = 783\,K$

$783 - 273 = 510\,^\circ C$

2.(5Pts) A 2.00-L glass soda bottle filled only with air is tightly capped at 20°C and 728.0 mmHg. If the bottle is placed in water at 71°C, what is the pressure in the bottle?

$P_1 V_1 T_2 = P_2 V_2 T_1$

$(728.0\,mm\,Hg)(71+273K) = P_2(20+273K)$

$P_2 = \frac{(728.0\,mm\,Hg)(71+273K)}{(20+273K)} = 855\,mm\,Hg$

3.(5Pts) The partial pressures of CH_4, N_2, and O_2 in a sample of gas were found to be 179 mmHg, 473 mmHg, and 629 mmHg, respectively. What is the mole fraction of nitrogen?

$\frac{473}{(179+473+629)} = 0.369$

4.(5Pts) What is the density of O_2 gas at 25°C and 1.41 atm?

$P = 1.41\,atm$

$V = ?$

$n = use\ 1\ mole\ (32.0g)$

$R = 0.0821 \frac{L \cdot atm}{mol \cdot K}$

$T = 298\,K$

$V = \frac{nRT}{P} = \frac{(1\,mol)(0.0821 L \cdot atm/mol \cdot K)(298K)}{1.41\,atm}$

$V = 17.35\,L$

$density = \frac{32.0g}{17.35L} = 1.84\,g/L$

5.(5Pts) A 6.84-L cylinder contains 3.45 g of methane, CH_4, at 2570 mmHg. What is the temperature of the gas in °C?

$P = 2570\,mm\,Hg$

$V = 6.84L$

$n = \frac{3.45g}{16.05 g/mol} = 0.215\,mol$

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

$T = ?\,K$

$T = \frac{PV}{nR} = \frac{(2570\,torr)(6.84L)}{(0.215\,mol)(62.4 L \cdot torr/mol \cdot K)}$

$T = 1310\,K$

$1310 - 273 = 1040\,^\circ C$