Name ____Mr. Perfect_____ Date _____F09_____

1. Classify each of the following compounds as ionic, covalent, or polar covalent. (10 pts)
(Electronegativity values: N = 3.0, K = 0.8, Cl = 3.0, Br = 2.8, C = 2.5)

a. N_2

3.0 – 3.0 = 0
Covalent

b. KBr

2.8 – 0.8 = 2.0
Ionic

c. CN

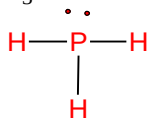
3.0 - 2.5 = 0.5
Polar Covalent

d. Br_2

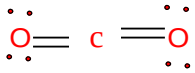
2.8 – 2.8 = 0
Covalent

2. Draw the Lewis structures for each of the following: (10 pts)

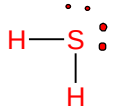
a. PH_3



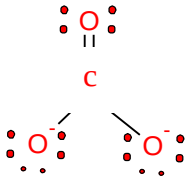
b. CO_2



c. H_2S

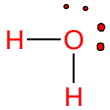


d. CO_3^{2-}



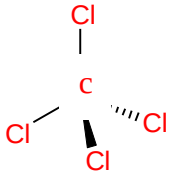
3. Draw the structures for the following compounds and clearly indicate the electron geometry and molecular shape of each. Include expected bond angles for full credit. (10 pts)

a. H_2O



electron geometry = tetrahedral
Molecular shape = bent

b. CCl_4



electron geometry = tetrahedral
Molecular shape = tetrahedral

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4. Calculate the percentage of water in the following hydrate. (10 pts)

$Na_2S_2O_3 \cdot 5H_2O$ H_20 x 5

MW = 248 g/mol MW = 18 g/mol x 5 = 90 g/mol

$$\%H_2O = \frac{90}{248} \times 100 = 36\%$$

5. Determine the water of crystallization for the following hydrate. The compound was found to contain 26.2% water. (10 pts)

$CuF_2 \cdot \mathbf{X}H_2O$ Assume a 100 g sample: 100 g – 26.2 g = 73.8 g of CuF_2

$$26.2\ g\ H_2O \times \frac{mol}{18\ g} = 1.46\ mol\ \div 0.72\ mol = 2$$

$$73.8\ g\ CuF_2 \times \frac{mol}{102\ g} = 0.72\ mol\ \div 0.72\ mol = 1$$

$CuF_2 \cdot \mathbf{2}H_2O$

6. If 24.0 mL of a 0.170 M NaI solution reacts with 0.209 M of a $Hg(NO_3)_2$ solution, what volume of $Hg(NO_3)_2$ is required for complete precipitation of HgI_2? (10 pts)

Balance Equation

$$Hg(NO_3)_{2(aq)} + \underline{2}NaI_{(aq)} \rightarrow HgI_{2(s)} + \underline{2}NaNO_{3(aq)}$$

Solve Stoichiometry:

$$0.170\frac{mol}{L}NaI \times 0.024\ L\ \times \frac{1\ mol\ Hg(NO_3)_2}{2\ mol\ NaI} \times \frac{L}{0.209\ mol} = 0.00976\ L\ Hg(NO_3)_2$$

9.76 mL $Hg(NO_3)_2$

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7. Calculate the following concentrations if you dissolve 0.24 g of Na_2CO_3 into 250 mL of water. (Report the answer to 3 significant figures in scientific notation) (10 pts)

a. Molarity =

$$M = \frac{0.24\ g\ Na_2CO_3 \times \frac{mol}{106\ g}}{0.250\ L} = 9.60x10^{-3}\ \frac{mol}{L}$$

b. Osmolarity =

$Na_2CO_3 \rightarrow 2Na^+ + CO_3^{2-}$

Forms 3 particles $3 \times 9.60x10^{-3}$ M = $2.72x10^{-2}$ osmol

8. If the total pressure of a gas mixture of N_2 and O_2 is 1.5 atm, what is the partial pressure of N_2 if there are 0.371 g of O_2 at a volume of 0.90 L and 5.00 °C? (15 pts) (R = 0.0821 L atm/mol K) PV= nRT

T = 5 + 273 = 278 K

$$P_{O2} = \frac{n_{O2}RT}{V} = \frac{\left(0.371g \times \frac{mol}{32g}\right)\left(0.0821\frac{L\ atm}{mol\ K}\right)(278K)}{0.09L} = 0.29\ atm$$

$P_{N2} = P_{Total} - P_{O2}$ = 1.5 atm – 0.29 atm = 1.2 atm

What is the % N in the gas mixture? (5 pts)

$$\%N = \frac{P_{N2}}{P_T} \times 100 = \frac{1.2\ atm}{1.5\ atm} \times 100 = 80\%$$

9. If the solubility of chlorine gas is 0.63g/100mL of water at 25 °C and 760 mmHg. What is the solubility of chlorine gas in water at 25 °C and 1200 mmHg? (10 pts)

$$\frac{0.63\ g}{100\ mL} \times \frac{1200\ mmHg}{760\ mmHg} = \frac{0.99\ g}{100\ mL}$$

10. (Extra Credit) Which of the following would you expect to have a higher boiling point? Circle the one with the higher boiling point. (5 pts)

CH_3-O-CH_3 or CH_3CH_2-OH

H-bonding (polar molecule containing a H atom directly bonded to O, F, N.)