Chem 11 finals review #3 balancing and moles

Part 1: Balance and classify the following equations (you may have to predict the products.)

*** No net ionic equations at this level. If you don't know what that is, don't worry about it. ***

1) Solid magnesium reacts with gaseous oxygen to form solid magnesium oxide.

$2Mg_{(s)} + O_{2(g)} \rightarrow 2MgO_{(s)}$ synth

2) Liquid nitroglycerine ($C_3H_5N_3O_9$) breaks down into carbon dioxide gas, water vapor, nitrogen gas and oxygen gas.

$4C_3H_5N_3O_{9(l)} \rightarrow 12CO_{2(g)} + 10H_2O_{(g)} + 6N_{2(g)} + O_{2(g)}$ decomp

3) Solid lead is mixed with potassium chloride powder.

no reaction (activity series)

4) Solid potassium is mixed with table salt.

$K_{(s)} + NaCl_{(s)} \rightarrow KCl_{(s)} + Na$ single replacement

5) solid potassium chloride is mixed with fluorine gas

$2KCl_{(s)} + F_{2(g)} \rightarrow 2KF_{(s)} + Cl_{2(g)}$ single rep

6) A solution of copper (II) chloride is mixed with a solution of sodium phosphate

$3CuCl_{2(aq)} + 2Na_3PO_{4(aq)} \rightarrow Cu_3(PO_4)_{2(aq)} + 6NaCl_{(aq)}$ double repl.

7) Phosphoric acid is mixed with aqueous sodium hydroxide

$H_3PO_{4(aq)} + 3NaOH_{(aq)} \rightarrow Na_3PO_{4(aq)} + 3H_2O_{(l)}$ acid base

8) Liquid nitroglycerin is ignited.

$4C_3H_5N_3O_{9(l)} + 11O_{2(g)} \rightarrow 12CO_{2(g)} + 10H_2O_{(g)} + 12NO_{2(g)}$

comb.

Part 2: Percent composition, empirical and molecular formula

1) What is the percent composition of each element in Nitroglycerine?

$C_3H_5N_3O_9$ molar mass → 227.0 $\frac{g}{mol}$

C → 3 × 12.0 g = 36.0 g $\frac{36.0}{227.0} \times 100\% = 15.8\%$

H → 5 × 1.0 g = 5.0 g $\frac{5.0}{227.0} \times 100\% = 2.2\%$

N → 3 × 14.0 g = 42.0 g $\frac{42.0}{227.0} \times 100\% = 18.5\%$

O → 9 × 16.0 g = 144.0 g $\frac{144.0}{227.0} \times 100\% = 63.4\%$

2) An imaginary compound consists of 15.96% C, 2.33% H, 21.28% O and 26.367% Br. What is its empirical formula?

Assume 100 g so % = g

C 15.96 g × $\frac{1 \text{ mol}}{12.0 \text{ g}}$ = 1.33

H 2.33 × $\frac{1 \text{ mol}}{1.0 \text{ g}}$ = 2.33

O 21.28 g × $\frac{1 \text{ mol}}{16.0 \text{ g}}$ = 1.33

Br 26.367 g × $\frac{1 \text{ mol}}{79.9 \text{ g}}$ = 0.33

$C_{1.33}H_{2.33}O_{1.33}Br_{0.33}$ $0.33 \approx \frac{1}{3}$ so × 3

$C_4H_7O_4Br_1$ empirical formula

empirical mass = 198.9 $\frac{g}{mol}$

3) If the compound from #2 has a molecular mass of 397.8 $\frac{g}{mol}$, what is its molecular formula?

$\frac{397.8 \frac{g}{mol}}{198.9 \frac{g}{mol}} = 2$

so $(C_4H_7O_4Br_1) \times 2$

$C_8H_{14}O_8Br_2$ molecular formula

Part 2: Basic mole calculations

1) What is the mass of 12.2 moles of naturally occurring Bromine?

12.2 mol Br_2 × $\frac{159.8 \text{ g}}{1 \text{ mol}}$ = 1.95×10^3 g

2) How many moles of iron are there in a 1.24 g pure iron nail?

$$1.24 g \times \frac{1 mol}{55.8 g} = 0.0222 mol$$

3) How many molecules of Iodine are there in an 8.1 mole sample?

$$8.1 mol \times \frac{6.022 \times 10^{23} molecules}{1 mol} = 4.9 \times 10^{24} molecules$$

4) How many moles of copper are there in a 3.10 g pure copper penny?

$$3.10 g \times \frac{1 mol}{63.5 g} = 0.0488 mol$$

5) How many moles of oxygen gas are there in a 61.2 L sample at STP?

$$61.2 L \times \frac{1 mol}{22.4 L} = 2.73 mol$$

6) How many liters of volume does a 12.1 mole sample of gas take up at STP?

$$12.1 mol \times \frac{22.4 L}{1 mol} = 271 L$$

7) What is the molarity of the solution if 2.7 moles of solute is dissolved in 1.3 L of solvent?

$$M = \frac{n}{V} = \frac{2.7 mol}{1.3 L} = 2.1 M$$

or $2.1 \frac{mol}{L}$

8) How many moles of solute must you dissolve in 0.76 L of solvent to get a 1.7 M solution?

$$M = \frac{n}{V} \rightarrow 1.7 M = \frac{n}{0.76} \rightarrow n = 1.3 mol$$

9) How many liters of solvent must you dissolve 1.88 moles of solute in to get a 1.41 $\frac{mol}{L}$ solution?

$$M = \frac{n}{V} \rightarrow 1.41 \frac{mol}{L} = \frac{1.88 mol}{V} \rightarrow V = \frac{1.88 mol}{1.41 \frac{mol}{L}} \rightarrow V = 1.33 L$$

Part 3: Multistep mole calculations:

1) How many liters of volume does 8.21 g of nitrogen gas take up at STP?

$$8.21 g \times \frac{1 mol N_2}{28.0 g} \times \frac{22.4 L}{1 mol} = 6.56 L$$

2) What is the mass of 1.74×10^{12} molecules of Rhenium (IV) oxide?

ReO_2

$$1.74\times10^{12}\text{ molecules} \times \frac{1\text{ mol}}{6.022\times10^{23}\text{ molecules}} \times \frac{218.2\text{ g}}{1\text{ mol}} = 6.30\times10^{-10}\text{ g}$$

3) 11.0 L of Hydrogen Chloride gas is at STP is bubbled through 500.0 mL of water. Assuming all of the Hydrogen Chloride is absorbed, what is the molarity of Hydrochloric acid that is made?

$$11.0\text{ L} \times \frac{1\text{ mol}}{22.4\text{ L}} = 0.491071428\text{ mol}$$

$$M = \frac{n}{V} \Rightarrow \frac{0.491071428\text{ mol}}{0.5000\text{ L}} = 0.982\text{ M}$$

4) 350.0 mL of water (density = 1.00 $\frac{g}{mL}$) is decomposed into its elements:

a. How many grams of oxygen gas are created?

$$D = \frac{m}{V}$$

$$2\,H_2O \rightarrow 2H_2 + O_2$$

$$1.00\,\frac{g}{mL} = \frac{m}{350.0\text{ mL}}$$

$$350\text{ g } H_2O \times \frac{\quad}{\quad} = 19.44444\text{ mol } H_2O$$

$$350\text{ g} = m$$

$$19.44444\text{ mol } H_2O \times \frac{1\text{ mol } O_2}{2\text{ mol } H_2O} \times \frac{32.0\text{ g}}{1\text{ mol } O_2} = 311\text{ g } O_2$$

b. How many L of volume would the Hydrogen gas take up at STP?

$$19.44444\text{ mol } H_2O \times \frac{2\text{ mol } H_2}{2\text{ mol } H_2O} \times \frac{22.4\text{ L}}{1\text{ mol}} = 436\text{ L}$$

Remember the fives rounding rule

435.55 → 435.6

round to even #