

Ch 60. Exam 2. Sample key

Info: 6.022×10^{23} atoms = 1 mole also $1 \text{ g} = 6.022 \times 10^{23}$

1. The molar mass of an oxygenated hydrocarbon substance is 192.12 g / mole . Its composition is as follows: **C** : 37.5 % , **H** : 4.2 % , **O** : 58.29 % Calculate the empirical formula **and** molecular formula. (use atomic masses C = 12.0 , H = 1.0 , O = 16.0)

$$37.5 \text{ g C} / 12.0 = 3.125 \text{ mole} / 3.125 = 1.00 \times 6 = 6$$

$$4.2 \text{ g H} / 1.008 = 4.17 \text{ mole} / 3.125 = 1.33 \times 6 = 8 \quad \text{so: } \text{C}_6\text{H}_8\text{O}_7 \text{ m mass} = 192 \text{ same as empirical}$$

$$58.29 \text{ g O} / 16.00 = 3.64 \text{ mole} / 3.125 = 1.16 \times 6 = 7$$

2. How many grams of bromine are contained in 7.50 g of ammonium bromide ?

$$\text{M mass} = 79.9 + 14.0 + 4.03 = 97.93 \quad 7.50 \text{ g NH}_4\text{Br} \times \frac{79.9}{97.93} = 6.12 \text{ g}$$

3. Calculate the mass, in grams of 2.06×10^{24} boron atoms / $6.02 \times 10^{23} = \underline{3.42 \text{ mole}}$ x 10.8 g/mole = 37.3 g

4. Name the following compounds according to the IUPAC system

a) $\text{Pb}(\text{IO}_3)_4$ lead(IV) iodate b) $\text{HCN}(\text{aq})$ hydrocyanic acid c) K_3Sb potassium antimonide

d) CsH cesium hydride e) H_3PO_3 phosphorous acid f) C_4H_{10} butane g) AsCl_5 arsenic pentachloride

h) $\text{Sn}(\text{C}_2\text{H}_3\text{O}_2)_2$ tin(II)acetate

5. Write formulas for the following named compounds:

a) copper(I) carbonate Cu_2CO_3 b) xenon hexafluoride XeF_6 c) heptane C_7H_{16}

d) cobalt(III)perbromate $\text{Co}(\text{BrO}_4)_3$ e) calcium peroxide CaO_2 f) silicic acid H_2SiO_3

g) lithium cyanide LiCN h) potassium hydrogen carbonate KHCO_3

8. Write balanced equations for the following reactions . Assume they do give products.

- a) calcium metal reacts with water to produce a gas and a compound in solution



- b) barium hydroxide reacts with bromic acid $\text{Ba}(\text{OH})_2 + 2 \text{HBrO}_3 \rightarrow \text{Ba}(\text{BrO}_3)_2 + 2 \text{H}_2\text{O}$

- c) manganese (III) oxide combines with water to form one substance $\text{Mn}_2\text{O}_3 + 3 \text{H}_2\text{O} \rightarrow 2 \text{Mn}(\text{OH})_3$

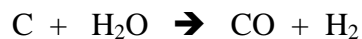
- d) dinitrogen trioxide reacts with water to produce one substance (an acid) $\text{N}_2\text{O}_3 + \text{H}_2\text{O} \rightarrow 2 \text{HNO}_2$

- e) pentane combusts $\text{C}_5\text{H}_{12} + 8 \text{O}_2 \rightarrow 5 \text{CO}_2 + 6 \text{H}_2\text{O}$

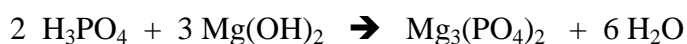
- f) sulfuric acid decomposes $\text{H}_2\text{SO}_4 \rightarrow \text{SO}_3 + \text{H}_2\text{O}$

- g) H_2 reacts with Fe_3O_4 to produce an element and a compound $4 \text{H}_2 + \text{Fe}_3\text{O}_4 \rightarrow 3 \text{Fe} + 4 \text{H}_2\text{O}$

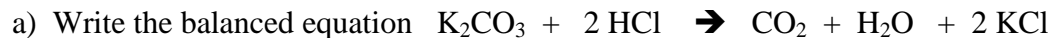
- h) hydrogen and carbon monoxide can be produced by reacting coal with steam



- i). phosphoric acid reacts with magnesium hydroxide, forming two products



9. 10.0 grams of potassium carbonate is mixed with 10.0 grams of hydrochloric acid . 1.25 L of a gaseous product was collected at STP



b) Calculate the moles of the two reactants and determine which is the limiting reactant.

$$10.0 \text{ g K}_2\text{CO}_3 / 138.2 \text{ g/mole} = 0.0724 \text{ mole} \quad 10.0 \text{ g HCl} / 36.5 \text{ g/mole} = 0.274 \text{ mole}$$

$$\begin{aligned} & \times 2 \text{ HCl} = 0.1448 \text{ moles HCl needed to react with } 0.0724 \text{ moles K}_2\text{CO}_3 \\ & 0.274 \text{ moles HCl given} - \text{ so too much HCl} \\ & \text{K}_2\text{CO}_3 \text{ is the limiting reactant} \end{aligned}$$

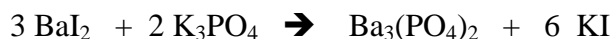
c) Calculate the theoretical yield and the percent yield in the reaction

$$0.0724 \text{ mole K}_2\text{CO}_3 \times 1 \text{ mole CO}_2 / 1 \text{ mole K}_2\text{CO}_3 \times 22.4 \text{ L CO}_2 / \text{mole CO}_2 = 1.62 \text{ L CO}_2 \quad (\text{theo yield})$$

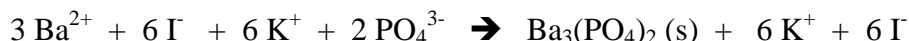
$$\text{Actual yield} (1.25 / \text{theo } 1.62) \times 100 = 77.2 \%$$

16. For the reaction between barium iodide (aq) and potassium phosphate (aq) ,

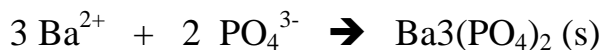
a) write the total balanced equation . indicate which product precipitates (s)



b) write a total ionic equation, and indicate which are the spectator ions (SI)



c) write the net ionic equation



17. Using the reaction in problem 16, predict how many grams of product would precipitate after mixing two ... solutions of reactants.

Solution 1 contained 10.0 g of barium iodide.

Solution 2 contained 8.00 grams of potassium phosphate.

Show all work – and indicate which reactant is the limiting reactant.

lim. reactant 5 pts
mol. mass calcs 5 pts
mole calcs 10 pts incl 2 pts sig figs
product 15 pts incl 2 pts sig figs

