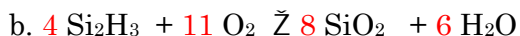


Chemistry 60 - Exam II
24 January 2018

Name _____

Show all work for credit. State any assumptions made to solve a problem. Give all numerical answers with the correct number of significant figures. All answers in scientific notation must be in correct scientific notation (i.e., 6.022×10^{23} not 6.022E23 or 6.022e23). All instances of incorrect scientific notation will result in the loss of 3 points each. All numbers that require units should have the units written. All instances of numbers without units will result in the loss of 3 points each.

1. (4 points) **Balance** the following chemical equations:



2. (18 points) 254.33 g of chromium(II) acetate reacts with sodium sulfide to produce chromium(II) sulfide and sodium acetate. Write **the chemical, ionic and net ionic equation** for the reaction including phase labels. Calculate the number of **grams of chromium(II) sulfide** produced if there is a 85.23 % yield.



$$\begin{aligned} ? \text{ g CrS} &= 254.33 \text{ g Cr}(\text{C}_2\text{H}_3\text{O}_2)_2 \times \frac{1 \text{ mol Cr}(\text{C}_2\text{H}_3\text{O}_2)_2}{170.084 \text{ g Cr}(\text{C}_2\text{H}_3\text{O}_2)_2} \times \frac{1 \text{ mol CrS}}{1 \text{ mol Cr}(\text{C}_2\text{H}_3\text{O}_2)_2} \times \frac{84.06 \text{ g CrS, theor.}}{1 \text{ mol CrS}} \times \frac{85.23 \text{ g CrS, act.}}{100.00 \text{ g CrS, theor.}} \\ &= 107.1 \text{ g CrS, actual} \end{aligned}$$

3. (13 points) Calculate the **mass of carbon dioxide produced** when 41.327 g of pentanoic acid ($C_5H_{10}COOH$) reacts with 36.873 g of oxygen gas.

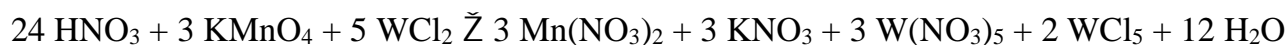


$$? \text{ g } CO_2 = 41.327 \text{ g } C_5H_{10}COOH \times \frac{1 \text{ mol } C_5H_{10}COOH}{115.152 \text{ g } C_5H_{10}COOH} \times \frac{24 \text{ mol } CO_2}{4 \text{ mol } C_5H_{10}COOH} \times \frac{44.010 \text{ g } CO_2}{1 \text{ mol } CO_2} = 94.769 \text{ g } CO_2$$

$$? \text{ g } CO_2 = 36.873 \text{ g } O_2 \times \frac{1 \text{ mol } O_2}{31.998 \text{ g } O_2} \times \frac{24 \text{ mol } CO_2}{31 \text{ mol } O_2} \times \frac{44.010 \text{ g } CO_2}{1 \text{ mol } CO_2} = 39.263 \text{ g } CO_2$$

39.263 g of carbon dioxide are produced.

4. (15 points) 135.2 mL of a 0.436 M solution of tungsten(II) chloride reacts with an excess of a potassium permanganate solution. The balanced chemical equation is:



Calculate the **number of grams of the tungsten(V) chloride** produced.

$$? \text{ g } WCl_5 = 135.2 \text{ mL } WCl_2 \text{ sol'n} \times \frac{0.436 \text{ mol } WCl_2}{1000 \text{ mL } WCl_2 \text{ sol'n}} \times \frac{2 \text{ mol } WCl_5}{5 \text{ mol } WCl_2} \times \frac{361.11 \text{ g } WCl_5}{1 \text{ mol } WCl_5} = 8.51 \text{ g } WCl_5$$

5. (12 points) Calculate the *molarity of a sodium carbonate solution* that is 32.6%(m/m) and has a density of 1.457 g/mL.

$$\begin{aligned} ? \frac{\text{mol Na}_2\text{CO}_3}{\text{L Na}_2\text{CO}_3 \text{ sol'n}} &= \frac{36.2 \text{ g Na}_2\text{CO}_3}{100.0 \text{ g Na}_2\text{CO}_3 \text{ sol'n}} \times \frac{1 \text{ mol Na}_2\text{CO}_3}{105.988 \text{ g Na}_2\text{CO}_3} \times \frac{1.457 \text{ g Na}_2\text{CO}_3 \text{ sol'n}}{1 \text{ mL Na}_2\text{CO}_3 \text{ sol'n}} \times \frac{1 \text{ mL Na}_2\text{CO}_3 \text{ sol'n}}{10^{-3} \text{ L Na}_2\text{CO}_3 \text{ sol'n}} \\ &= 4.98 \text{ M Na}_2\text{CO}_3 \end{aligned}$$

6. (12 points) How many *mL of a 0.563 M solution* are needed to make 500.0 mL of a 0.100 M solution?

$$\begin{aligned} M_1V_1 &= M_2V_2 \\ V_1 &= \frac{M_2V_2}{M_1} = \frac{(0.100 \text{ M})(500.0 \text{ mL})}{(0.563 \text{ M})} = 88.8 \text{ mL} \end{aligned}$$

7. (12 points) 254.3 mL of water are added to 436.2 mL of a 0.853 M solution. What is the *new molarity*?

$$\begin{aligned} M_1V_1 &= M_2V_2 \\ M_2 &= \frac{M_1V_1}{V_2} = \frac{(0.853 \text{ M})(436.2 \text{ mL})}{(690.5 \text{ mL})} = 0.539 \text{ M} \end{aligned}$$

8. (14 points) 25.00 mL of a potassium hydroxide solution is titrated with 35.23 mL of a 0.1532 M sulfuric acid solution. What is the *molarity of the potassium hydroxide solution*?



$$? \frac{\text{mol KOH}}{\text{L KOH sol'n}} = \frac{35.23 \text{ mL H}_2\text{SO}_4 \text{ sol'n}}{25.00 \text{ mL KOH sol'n}} \times \frac{0.1532 \text{ mol H}_2\text{SO}_4}{1 \text{ L H}_2\text{SO}_4 \text{ sol'n}} \times \frac{2 \text{ mol KOH}}{1 \text{ mol H}_2\text{SO}_4} = 0.4318 \text{ M KOH}$$