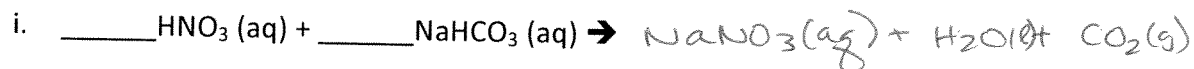
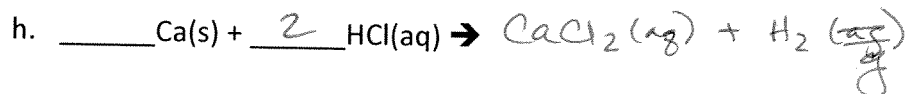
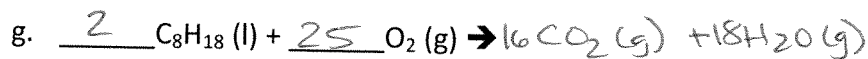
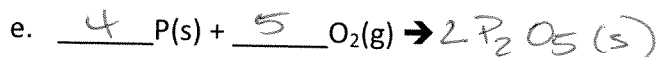
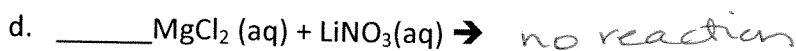
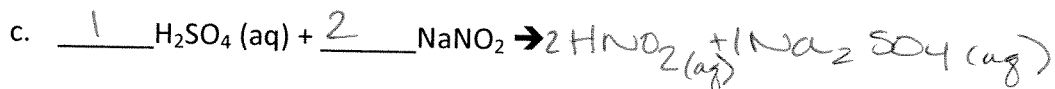
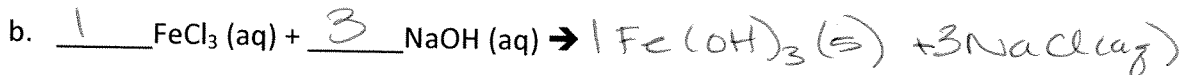
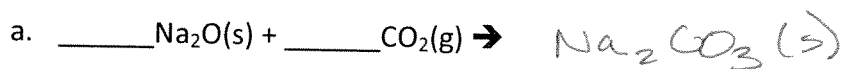


Name Key

Exam #1 – 100 points

Directions: Answer each question below to the best of your ability. Show all work where calculations are required. An information sheet with a periodic table is attached to the back of the exam; you may remove it if you wish.

1. (27) Fill in the product(s) of each chemical reaction below, then balance the chemical equation. Write 'no reaction' if you do not expect a reaction to occur.



2. (12) Write balanced chemical equations for each of the following reactions. Indicate all states. A reaction does occur in each case; do not write 'no reaction'.

a. Ethyl butyrate is a liquid that smells like pineapples and has a molecular formula of $C_6H_{12}O_2$. It is burned in air.



b. Potassium chlorate is strongly heated



c. Aqueous solution of sodium chloride and fluorine gas are combined



3. (10) For the reaction below, (i) complete and balance the chemical equation, (ii) provide a complete ionic equation, and (iii) write the net ionic equation. A reaction does occur in each case; do not write 'no reaction'.

a. Balanced equation: Aqueous beryllium iodide mixes with copper (I) sulfate



b. Complete ionic equation:



c. Net ionic equation:



a. Balanced equation: $Ni(NO_3)_2(aq) + 3 KBr(aq) \rightarrow$



b. Complete ionic equation:



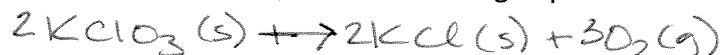
c. Net ionic equation:



4. (2) Provide the formula of two weak acids.



5. (6) Pure oxygen gas can be prepared in the laboratory by the decomposition of solid potassium chlorate to form potassium chloride and oxygen gas. How much oxygen in grams can be prepared from 45.8 g of potassium chlorate?



$$45.8\text{g KClO}_3 \times \frac{1\text{mol KClO}_3}{122.55\text{g}} \times \frac{3\text{mol O}_2}{2\text{mol KClO}_3} \times \frac{32.00\text{g}}{1\text{mol O}_2} = 17.9\text{g O}_2$$

6. When phosphine gas combines with oxygen gas, tetraphosphorus decoxide and water are produced:



- a. (10) How many grams of P_4O_{10} will be produced when 35.0 g of PH_3 reacts with 76.5 g of oxygen gas in a closed container?

LR $35.0\text{g PH}_3 \times \frac{1\text{mol PH}_3}{34.00\text{g}} \times \frac{1\text{mol P}_4\text{O}_{10}}{4\text{mol PH}_3} = 0.2573529\text{ moles P}_4\text{O}_{10}$

XS $76.5\text{g O}_2 \times \frac{1\text{mol O}_2}{32.00\text{g}} \times \frac{1\text{mol P}_4\text{O}_{10}}{8\text{mol O}_2} = 0.2988281\text{ moles P}_4\text{O}_{10}$

$$0.2573529\text{ mole P}_4\text{O}_{10} \times \frac{283.88\text{g}}{1\text{mol P}_4\text{O}_{10}} = 73.1\text{g P}_4\text{O}_{10}$$

- b. (6) Which reagent was in excess, and how many grams of it remain unreacted at the end of part (a)?

O_2 is in excess

$$0.2988281\text{ mol P}_4\text{O}_{10} \\ - 0.2573529\text{ mol P}_4\text{O}_{10} \\ \hline 0.0414752\text{ mol P}_4\text{O}_{10}$$

$$0.0414752\text{ mol P}_4\text{O}_{10} \times \frac{8\text{mol O}_2}{1\text{mol P}_4\text{O}_{10}} \times \frac{32.00\text{g}}{1\text{mol O}_2} = 10.6\text{g O}_2$$

7. (5) A laboratory procedure calls for making 500.0 mL of a 1.4 M KNO_3 solution. How much KNO_3 in μg is needed?

$$500.0 \text{ mL} \times \frac{1 \text{ L}}{1000 \text{ mL}} \times \frac{1.4 \text{ mol KNO}_3}{\text{L}} \times \frac{101.10 \text{ g}}{1 \text{ mol KNO}_3} = 70.77 \text{ g KNO}_3$$

$$70.77 \text{ g} \times \frac{10^6 \mu\text{g}}{1 \text{ g}} = 7.077 \times 10^7 \mu\text{g KNO}_3$$

$$7.1 \times 10^7 \mu\text{g KNO}_3$$

8. (5) How much of a 12.0 M HNO_3 solution should you use to make 850.0 mL of a 0.250 M HNO_3 solution?

$$m_1 V_1 = m_2 V_2$$

$V_1 = ?$

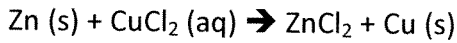
$$V_1 = \frac{m_2 V_2}{m_1}$$

$$= \frac{(0.250 \text{ M})(850.0 \text{ mL})}{(12.0 \text{ M})}$$

$$= 17.7 \text{ mL of the } 12.0 \text{ M } \text{HNO}_3 \text{ solution.}$$

9. (5) What is the molarity of ZnCl_2 (aq) that forms when 15.0 g of zinc completely reacts with CuCl_2 (aq) according to the following reaction? (Assume a final volume of 175 mL)

$$175 \text{ mL} \times \frac{1 \text{ L}}{1000 \text{ mL}} = 0.175 \text{ L}$$



$$15.0 \text{ g Zn (s)} \times \frac{1 \text{ mol Zn}}{65.39 \text{ g}} \times \frac{1 \text{ mol ZnCl}_2}{1 \text{ mol Zn}} = \frac{0.22939287 \text{ mol ZnCl}_2}{0.175 \text{ L}}$$

$$= 1.31 \text{ M ZnCl}_2$$

10. (12) The titration of a 20.0 mL sample of an H_2SO_4 solution of unknown concentration requires 22.87 mL of a 0.158 M KOH solution to reach the equivalence point. What is the concentration of the unknown H_2SO_4 solution?



$$\begin{aligned}
 & 22.87 \text{ mL} \times \frac{1 \text{ L}}{1000 \text{ mL}} \times \frac{0.158 \text{ mol KOH}}{1 \text{ L}} \times \frac{1 \text{ mol H}_2\text{SO}_4}{2 \text{ mol KOH}} \\
 &= \frac{0.00180673 \text{ mol H}_2\text{SO}_4}{20.0 \text{ mL} \times \frac{1 \text{ L}}{1000 \text{ mL}}} \\
 &= 0.090 \text{ M H}_2\text{SO}_4
 \end{aligned}$$

Extra Credit: (5) Draw an example of how water solvates Mg^{2+} and SO_4^{2-}

