Exam 3 Review: Chapters 7 & 8

Chapter 7

1. What is a chemical reaction? List some examples.

2. What are the main indications of a chemical reaction occurring? List all proof.

3. What is a chemical equation? Identify all important parts.

4. Define all types of chemical equations and provide a simplified (skeletal) version of each.

5. What does each abbreviation, often used in chemical equations, represent?

(g) (l) (s) (aq)

6. Which observation is consistent with a chemical reaction occurring? Why?
   a) Solid copper deposits on a piece of aluminum foil when the foil is blacked in a blue copper nitrate solution. The blue color of the solution fades.

   b) Liquid ethyl alcohol turns into a sold when placed in a low temperature freeze.

   c) A white precipitate forms when solutions of barium nitrate and sodium sulfate are mixed.

   d) A mixture of sugar and water bubbles when yeast is added. After several days, the sugar is gone and ethyl alcohol is found in the water.

7. Balance the following equations:

$$Pb(NO_3)_2\,(aq) + \quad NaCl\,(aq) \rightarrow \quad PbCl_2(s) + \quad NaNO_3(aq)$$

$$C_3H_8\,(g) + \quad O_2\,(g) \rightarrow \quad CO_2(g) + \quad H_2O(l)$$

8. Consider the unbalanced chemical equation.

$$H_2O\,(l) \rightarrow \quad H_2\,(g) + \quad O_2(g)$$

A chemistry student tries to balance the equation by placing the subscript 2 after the oxygen atom in H_2O. Explain why this is not correct. What is the correct balanced equation?

9. Is each compound soluble or insoluble? Use abbreviations.

$$CuS \qquad CaCl_2 \qquad Pb(NO_3)_2 \qquad PbSO_4$$

10. Write a molecular equation for the reaction between aqueous HNO_3 and aqueous $Ca(OH)_2$

11. Which of these are redox reactions?

$$2\ Mg\ (s) + \ O_2(g) \rightarrow 2MgO\ (s)$$

$$2HBr\ (aq) + Ca(OH)_2(aq) \rightarrow 2H_2O\ (l) + CaBr_2\ (aq)$$

$$Ca\ (s) + Cl_2(g) \rightarrow CaCl_2\ (s)$$

$$Zn\ (s) + Fe^{2+}(aq) \rightarrow Zn^{2+} + Fe\ (s)$$

12. Write a balanced chemical equation for the combustion of liquid methyl alcohol (CH_3OH).

13. Write a balanced chemical equation for each chemical reaction.
    a. Solid magnesium reaction with aqueous copper (I) nitrate to from aqueous magnesium nitrate and solid copper.

    b. Gaseous dinitrogen pentoxide decomposes to form nitrogen dioxide and oxygen gas.

    c. Solid calcium reacts with aqueous nitric acid to form aqueous calcium nitrate and hydrogen gas.

    d. Liquid methanol (CH_3OH) reacts with oxygen gas to form aqueous carbon dioxide gas and gaseous water.

14. Determine whether the following reactions are redox. If so, identify what is oxidized and what is reduced.
    a) $4Fe(s)+3O_2(g)\rightarrow 2Fe_2O_3(s)$

    b) $H_2SO_4(aq)+NaOH(aq)\rightarrow Na_2SO_4(aq)+H_2O(l)$

    c) $2K(s)+Cl_2(g)\rightarrow 2KCl(s)$

    d) $Cu(s)+2AgNO_3(aq)\rightarrow Cu(NO_3)_2(aq)+2Ag(s)$

15. Determine the oxidation numbers of each element in the following compounds:
    a) SO_2

    b) H_2O_2

    c) NaH

    d) H_2S

16. For each of the following redox reactions, determine:
    - The oxidation number of each element
    - The element that is oxidized
    - The element that is reduced

    a) $2Al(s)+3Br_2(l)\rightarrow 2AlBr_3(s)$

    b) $Zn(s)+CuSO_4(aq)\rightarrow ZnSO_4(aq)+Cu(s)$

17. For each reaction below, determine the spectator ions.

a) $Na_2SO_4(aq)+BaCl_2(aq)\rightarrow BaSO_4(s)+2NaCl(aq)$

b) $KOH(aq)+HNO_3(aq)\rightarrow KNO_3(aq)+H_2O(l)$

c) $AgNO_3(aq)+NaCl(aq)\rightarrow AgCl(s)+NaNO_3(aq)$

d) $Pb(NO_3)_2(aq)+2KI(aq)\rightarrow PbI_2(s)+2KNO_3(aq)$

Chapter Eight

1. Why is stoichiometry important?

2. In photosynthesis, plants convert carbon dioxide and water into glucose ($C_6H_{12}O_6$) according to the reaction:

$$6\,CO_2(g) + 6\,H_2O\,(l) \rightarrow 6\,O_2(g) + C_6\,H_{12}\,O_6(aq)$$

How many grams of glucose can be synthesized from 58.5 grams of CO_2? Assume that there is more than enough water present to react with all of the CO_2.

3. How many mol of sodium oxide can be synthesized from 4.8 mol of sodium? Assume that more than enough oxygen is present:

$$4\ \mathrm{Na}\ (\mathrm{s}) + \mathrm{O_2}\ (\mathrm{g}) \rightarrow 2\mathrm{Na_2O}\quad (\mathrm{s})$$

4. Propane (C_3H_8) burns in oxygen to form carbon dioxide and water:

$$C_3H_8+5O_2 \rightarrow 3CO_2+4H_2O$$

If you start with 44.1 g of propane, how many grams of water (H_2O) will be produced?

5. Potassium chlorate ($KClO_3$) decomposes into potassium chloride and oxygen gas:

$$2KClO_3 \rightarrow 2KCl+3O_2$$

If you decompose 75.0 g of $KClO_3$, how many grams of oxygen gas (O_2) are produced?

6. Consider the following synthesis reaction:

$$2\ \mathrm{Na}\ (\mathrm{s}) + \mathrm{Cl_2}\ (\mathrm{g}) \rightarrow 2\mathrm{NaCl_2}\ (\mathrm{s})$$

If we have 53.2 g of Na, what is the theoretical yield?

7. A student performs a reaction to produce water and calculates the theoretical yield to be 75.0 g. However, when they collect and measure the actual yield, they find they only produced 52.5 g of water. What is the percent yield of the reaction? Show your work.

$2H_2(g) + O_2(g) \rightarrow 2H_2O(l) = -2044\ kJ$

8. An LP gas tank in a home barbecue contains 1.18 x 10^4 g of propane (C_3H_8). Calculate the heat (in kJ) associated with the complete combustion of all the propane in the tank.

$$C_3H_8 + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(l)$$

9. What is a limiting reactant?