Name _____**Chem 161, Section**: _____**Group Number:** _____

ALE 19. Acid-Base & Redox Reactions and an Introduction to Chemical Equilibrium

(Reference: Chapter 4 – *Silberberg 5h edition*)

Important!! For answers that involve a calculation you must show your work neatly using dimensional analysis with correct significant figures and units to receive full credit. No work, no credit. Report numerical answers to the correct number of significant figures. **CIRCLE ALL NUMERICAL RESPONSES**.

Section 4.4 Acid-Base Reactions (Read section 4.4 before answering questions 1 – 4.)

1. The net ionic equation for the aqueous neutralization reaction between acetic acid and sodium hydroxide is different from that for the reaction between hydrochloric acid and sodium hydroxide. Explain by writing the molecular and net ionic equation for each reaction.

   a. Acetic Acid + Sodium hydroxide

   Molecular Equation: _____

   Net Ionic Equation: _____

   b. Hydrochloric Acid + Sodium Hydroxide

   Molecular Equation: _____

   Net Ionic Equation: _____

2. Complete the following acid-base reactions with balanced molecular, total ionic and net ionic equations:

   a. Cesium hydroxide *(aq)* + nitric acid *(aq)*

   Molecular Equation: _____

   Total Ionic Equation: _____

   Net Ionic Equation: _____

   b. Calcium hydroxide *(aq)* + acetic acid *(aq)*

   Molecular Equation: _____

   Total Ionic Equation: _____

   Net Ionic Equation: _____

3. If 26.35 mL of a standard 0.1650 *M* KOH solution is required to neutralize 35.00 mL of H_2SO_4, what is the molarity of the sulfuric acid?

   Balanced Molecular Equation: _____

   Calculation:

4. A sodium hydroxide solution was standardized by titrating 25.00mL of 0.1528 *M* standard hydrochloric acid. The initial burette reading of the sodium hydroxide was 2.24 mL, and the final reading upon reaching the endpoint was 39.21 mL. What is the molarity of the sodium hydroxide solution?

   Balanced Molecular Equation: _____

   Calculation:

Section 4.5 Oxidation-Reduction (Redox) Reactions (Read section 4.5 before answering questions 5 – 8.)

5. Explain why an oxidizing agent undergoes reduction in a redox reaction.

6. Give the oxidation number of each element in the following compounds or ions.
   a.) KBr: K = Br =

   b.) BrF_3 Br = F =

   c.) $HBrO_3$ H = Br = O =

   d.) CBr_4 C = Br =

e.) MnO_4^{1-}: Mn = O =

f.) Mn_2O_3 Mn = O =

g.) $KMnO_4$: K = Mn = O =

7. Identify the oxidizing agent and the reducing agent in each of the following:

a.) $8\ H^+_{(aq)} + Cr_2O_7^{2-}{}_{(aq)} + 3\ SO_3^{2-}{}_{(aq)} \rightarrow 2\ Cr^{3+}_{(aq)} + 3\ SO_4^{2-}{}_{(aq)} + 4\ H_2O_{(l)}$

Oxidizing agent: _____ Reducing agent: _____

b.) $NO_3^{1-}{}_{(aq)} + 4\ Zn_{(s)} + 7\ OH^{1-}{}_{(aq)} + 6\ H_2O_{(l)} \rightarrow 4\ Zn(OH)_4^{2-}{}_{(aq)} + NH_3{}_{(aq)}$

Oxidizing agent: _____ Reducing agent: _____

8. A person's blood alcohol (ethanol: C_2H_5OH) level can be determined by titrating a sample of blood plasma (blood minus the red blood cells and the white blood cells) with a potassium dichromate solution. The balanced net ionic equation is:

$$16\ H^+_{(aq)} + 2\ Cr_2O_7^{2-}{}_{(aq)} + C_2H_5OH_{(aq)} \rightarrow 4\ Cr^{3+}_{(aq)} + 2\ CO_{2(g)} + 11\ H_2O_{(l)}$$

If 35.46 mL of 0.05961 *M* $Cr_2O_7^{2-}$ is required to titrate 28.00 g of blood plasma, what is the mass percent of alcohol in the blood?

Section 4.6 Elemental Substances in Redox Reactions (Read section 4.6 before answering questions 9–12.)

9. What is the name of the kind of reaction that leads to each of the following?

a.) An increase in the number of substances: _____

b.) A decrease in the number of substances: _____

c.) No change in the number of substances: _____

10. Predict the product(s) and write the balanced equation for each of the following redox reactions. (*Hint for part b*: Think of water as HOH

    a.) $N_{2(g)}$ + $H_{2(g)}$ →

    b.) $Ba_{(s)}$ + $H_2O_{(l)}$ →

11. Predict the product(s) and write the balanced equation for combustion reaction between pentane, C_5H_{12}, and an excess of oxygen gas.

    Is a combustion reaction a redox reaction? *Explain.*

12. In a combination reaction, 2.22 g magnesium metal is heated with 3.75 g of nitrogen gas.
    a.) Write the balanced chemical equation for the reaction:

    b.) Which reactant is in excess? *Show your work with correct units and sig figs*.

    c.) How many moles of product are formed? *Show your work with correct units and sig figs*.

    d.) After reaction, how many grams of each reactant and product are present? *Show your work with correct units and sig figs*.

Section 4.7 Reversible Reactions: An Introduction to Chemical Equilibrium

Read section 4.7 before answering questions 13 – 14.

13. Why is the equilibrium state called "dynamic"?

14 Describe what happens at the molecular level when acetic acid (a weak acid) dissolves in water.

Comprehensive Problems

15. Sodium peroxide, Na_2O_2, is often used in self-contained breathing devices, such as those used in fire emergencies, because it reacts with exhaled CO_2 to form Na_2CO_3 and O_2. How many liters of exhaled air can react with 80.0 g of Na_2O_2 if each liter of exhaled air contains 0.0702 g if CO_2?

    Balanced Equation: _____

    Calculation: