Chapter 1 Summary

Main Concepts (Big Ideas):

Law of Constant Composition, Definite Proportion- *The elemental composition of a compound is always the same regardless of its origin. First stated by Joseph Louis Proust.*

Intensive Properties: *Do not depend on the amount of the substance. Melting and boiling point, density, voltage are independent of amounts.*

Significant figures: *When measuring a substance, the last value has uncertainty. When adding or subtracting, the measurement with the least number of sig. figs to the right of the decimals indicates the sig. figs. reported in answer. When multiplying and dividing, the measurement with the least total sig. figs. indicates the total sig. figs. in answer. In regards to zeros, they are recorded if there is a decimal point and they trail a nonzero number, ex.: 0.0030, two sig. figs.*

Precision: *How closely together a group of measurements are to each other, regardless of what the correct value should be.*

Accuracy: *How close a measurement is to the accepted value. Does not indicate anything about the grouping of other measurements.*

Some important Formulas:

Density = Mass/ Volume

Practice Problems:

#21: Suggest a method of separating each of the following mixtures into two components: a) sugar and sand, b) oil and vinegar.

#17: In the process of attempting to characterize a substance, a chemist makes the following observations: The substance is a silvery white, lustrous metal. It melts at 649°C and boils at 1105°C. Its density at 20°C is 1.738g/cm^3. The substance burns in air, producing an intense white light. It reacts with chlorine to give a brittle white solid. The substance can be pounded into thin sheets or drawn into wires. It is a good conductor of electricity. Which of these characteristics are physical properties, and which are chemical properties?

#25: Make the following conversions: a) 72°F to °C, b) 216.7°C to °F, c) 233°C to K, d) 315K to °F, e) 2500°F to K, f) 0 K to °F.

#47: Perform the following conversions: a) 5.00 days to s, b) 0.550 mi to m, c) $1.89/gal to dollars per liter, f) 0.02500 ft^3 to cm^3.

#51: The density of air at ordinary atmospheric pressure and 25°C is 1.19g/L. What is the mass, in kilograms, of the air in a room that measures 14.5ft x 16.5ft x 8.0ft?

All assigned problems for the chapter: #7,8,9,17,19,22,25,33,35,37,39,43,47,49,51,65

Chapter 2 Summary

Main Concepts (Big Ideas):

Empirical Formula- *The ratio of atoms within a compound in their simplest, smallest number.*

Molecular Formula: *Provide the actual number of atoms in a molecule.*

Structural Formulas: *Describes how atoms are connected to each other within a molecule.*

Nomenclature: *The system used in naming chemical compounds. Ex.: ionic compounds vs. molecular compounds.*

Some important scientist and their contributions:

Thompson- *discovered the charge of the electron through cathode ray tube experiment.*

Milikan-*related the charge of the electron to the mass through the oil drop experiment.*

Rutherford-*provided the nuclear model of the atom through the gold foil experiment. Also discovered the charge and characteristics of the nucleus in the lead block experiment.*

Dalton-*Provided the five theories on atom (matter is made of atoms, atoms cannot be created or destroyed, atoms of the same element are identical, chemical reactions are the rearrangement of atoms, compounds are formed from a definite ratio of atoms combining.)*

Practice Problems:

#9: How does Dalton's atomic theory account for the fact that when 1.000g of water is decomposed into its elements, 0.111g of hydrogen and 0.889g of oxygen are obtained regardless of the source of the water?

#11: A chemist finds that 30.82g of nitrogen will react with 17.60g, 35.20g, 70.40g, or 88.00g of oxygen to form four different compounds. a) Calculate the mass of oxygen per gram of nitrogen in each compound. b) How do the numbers in part (a) support Dalton's atomic theory?

#31: Only two isotopes of copper occur naturally, Cu-63 (62.9296 amu, abundance 69.17%) and Cu-65 (64.9278 amu, abundance 30.83%). Calculate the atomic weight (average atomic mass) of copper.

#61: Give the chemical formula for a) chlorite ion, b) chloride ion, c) chlorate ion, d) perchlorate ion, e) hypochlorite ion.

#67: White the chemical formulas for the following compounds: a) aluminum hydroxide, b) potassium sulfate, c) copper (I) oxide, d) zinc nitrate, e) mercury (II) bromide, f) iron (III) carbonate, g) sodium hypobromite.

#71: Give the name or chemical formula, as appropriate for each of the following binary molecular substances: a) SF_6, b)IF_5, c)XeO_3, d) dinitrogen tetroxide, e) hydrogen cyanide, f) tetraphosphorus hexasulfide.

All assigned problems for the chapter: #1,8,9,11,13,17,21,29-35odd,39,41,51,53,60,61,67,69,71

Chapter 3 Summary

Main Concepts (Big Ideas):

Stoichiometry- *Converting a compound to another compound with mole ratios.*

Balancing Equations: *Shows relationship between reactants and products in regards to atoms.*

Types of reactions: *Synthesis (combination), decomposition, single replacement, double replacement, combustion, oxidation-reduction (redox).*

Limiting reactants: *Completely consumed in a reaction and determines the amount of products that can be formed.*

Some important scientist and other side notes:

Lavoisier- *Used quantitative approach to chemistry, developed stoichiometry, setting up Dalton's theories.*

Molar Mass-*The mass of one mole of any substance. Varies based on the substance but always contains 6.022 x 10^{23} atoms or molecules.*

Some important Formulas:

mass percentage within a compound = $\frac{(\#\text{ of atoms of that element})(\text{atomic weight of element})}{(\text{formula weight of compound})} \times 100\%$

percent yield= $\frac{(\text{actual yield})}{(\text{theoretical yield})} \times 100\%$

Practice Problems:

#13: Write balanced chemical equations to correspond to each of the following descriptions:

a) solid calcium carbide, CaC_2, reacts with water to form an aqueous solution of calcium hydroxide and acetylene gas, C_2H_2.

b) When solid potassium chlorate is heated, it decomposes to form solid potassium chloride and oxygen gas.

c) Solid zinc metal reacts with sulfuric acid to form hydrogen and an aqueous solution of zinc sulfate. (finish the rest in HW.)

#23: Calculate the percentage by mass of oxygen in the following compounds:

a)morphine, $C_{17}H_{19}NO_3$,

b)codeine, $C_{18}H_{21}NO_3$,

c) cocaine, $C_{17}H_{21}NO_4$,

d)tetracycline, $C_{22}H_{24}N_2O_8$

#33: Calculate the following quantities:

a) mass, in grams, of 0.105 mole of sucrose ($C_{12}H_{22}O_{11}$)

b) moles of $Zn(NO_3)_2$ in 143.50g of this substance

c) number of molecules in 1.0×10^{-6} mol CH_3CH_2OH

#43: Give the empirical formula of each of the following compounds if a sample contains:

a) 0.0130 molC, 0.0390 mol H, and 0.0065 mol O

b) 11.66 g iron and 5.01 g oxygen

c) 40.0% C, 6.7% H, and 53.3% O by mass.

#49: What is the molecular formula of each of the following compounds?

a) empirical formula CH_2, molar mass = 84g/mol

b) empirical formula NH_2Cl, molar mass = 51.5g/mol

#75: Sodium hydroxide reacts with carbon dioxide as follows:

$2NaOH(s) + CO_2(g) \rightarrow Na_2CO_3(s) + H_2O(l)$

Which is the limiting reactant when 1.85 mol NaOH and 1.00 mol CO_2 are allowed to react? How many moles of Na_2CO_3 can be produced? How many moles of the excess reactant remain after the completion of the reaction?

#81: When benzene (C_6H_6) reacts with bromine (Br_2), bormobenzene (C_6H_5Br) is obtained:

$C_6H_6 + Br_2 \rightarrow C_6H_5Br + HBr$

a)When 30.0 g of benzene reacts with 65.0g of bromine, what is the theoretical yield of bromobenzene?

b) If the actual yield of bromobenzene is 43.3g, what is the percentage yield?

All assigned problems for the chapter: #1,9,13,17-23 odd, 27,33,35,39,43,49,51,57,61,65,75,77,81

Chapter 4 Summary

Main Concepts (Big Ideas):

Strong Acids- *Acids that completely dissociate in solution. (HCl, HBr, HI, H_2SO_4, HNO_3, $HClO_3$, $HClO_4$*

Oxidation-Reduction: *Reactions are driven by the exchange of electrons. Elements that gain electrons are reduced, elements that lose electrons are oxidized. (LEO the lion says GER or OIL RIG).*

Activity Series: *Experimentally developed chart that helps chemists understand the likelihood of a reaction taking place. The higher an element is on the activity series chart, the more reactive it is.*

Solubility Guidelines: *General rules that can help chemists if a reaction will take place in solution, if a precipitate or gas will form.*

Solution concentration: *How chemists describes parts within a whole. Ex.: percentage, ppm, ppb, molarity, molality.*

Titrations-*Using known information (volume and concentration) and a balanced equation to determine unknown information (concentration) of another substance.*

Some important Formulas:

Molarity = (Moles of solute/ Volume of solution in liters)

$M_1V_1 = M_2V_2$ *This equation is very useful in making dilutions of solutions.*

Practice Problems:

#21: Will precipitation occur when the following solutions are mixed? If so, write a balanced chemical equation for the reaction. a)Na_2CO_3 and $AgNO_3$, b) $NaNO_3$ and $NiSO_4$, c) $FeSO_4$ and $Pb(NO_3)_2$

#49: Determine the oxidation number for the indicated element in each of the following substances: a) S in SO_2, b) C in $COCl_2$, c) Mn in $KMnO_4$, d) Br in HBrO, e) As in As_4,

f) O in K_2O_2

#51: Which element is oxidized and which is reduced in the following reactions?

a) $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$

b) $3Fe(NO_3)_2(aq) + 2Al(s) \rightarrow 3Fe(s) + 2Al(NO_3)_3(aq)$

c) $Cl_2(aq) + 2NaI(aq) \rightarrow I_2(aq) + 2NaCl(aq)$

d) $PbS(s) + 4H_2O_2(aq) \rightarrow PbSO_4(s) + 4H_2O(l)$

#67: Calculate a) the number of grams of solute in 0.250L of 0.175 M KBr,

b) the molar concentration of a solution containing 14.75g of $Ca(NO_3)_2$ in 1.375L,

c) the volume of 1.50M Na_3PO_4 in milliliters that contains 2.50g of solute.

#73: a) You have a stock solution of 14.8M NH_3. How many milliliters of this solution should you dilute to make 1000.0mL of 0.250 M NH_3?

b) If you take a 10.0 mL portion of the stock solution and dilute it to a total volume of 0.500 L, what will be the concentration of the final solution?

#75 a) Starting with solid sucrose, $C_{12}H_{22}O_{11}$, describe how you would prepare 250 mL of a 0.250 M sucrose solution.

b) Describe how you would prepare 350.0 mL of 0.100M $C_{12}H_{22}O_{11}$ starting with 3.00 L of 1.50 M $C_{12}H_{22}O_{11}$.

#86 An 8.65g sample of an unknown group 2A metal hydroxide is dissolved in 85.0 mL of water. An acid-base indicator is added and the resulting solution is titrated with 2.50 M HCl(aq) solution. The indicator changes color signaling that the equivalence point has been reached after 56.9 mL of the hydrochloric acid solution has been added. a) What is the molar mass of the metal hydroxide?

b) What is the identity of the metal cation: Ca^{2+}, Sr^{2+}, Ba^{2+}?

All assigned problems for the chapter: #12, 19, 21, 24, 31,37, 39, 45, 47, 49, 51, 59, 63, 67, 73, 75, 79, 83