Common Assessment 3 Study Guide (Honors) Name_____

1. Aqueous solutions of silver nitrate and potassium chloride are mixed.

Chemical Equation	$AgNO_{3(aq)} + KCl_{(aq)} \rightarrow KNO_{3(aq)} + AgCl_{(s)}$
Net Ionic	$Ag^{+1}_{(aq)} + Cl^{-1}_{(aq)} \rightarrow AgCl_{(s)}$

2. Aqueous solutions of magnesium nitrate and sodium carbonate are mixed.

Chemical Equation	$Mg(NO_3)_{2(aq)} + Na_2CO_{3(aq)} \rightarrow 2NaNO_{3(aq)} + MgCO_{3(s)}$
Net Ionic	$Mg^{+2}_{(aq)} + CO_3^{-2}{}_{(aq)} \rightarrow MgCO_{3(s)}$

3. What two things are required to create a solution?

Solute and solvent

4. Describe the differences between dissolve, dissociate, ionize, and precipitate. Provide examples of substances that would undergo each type of chemical process.

Dissolve = breaking IMFs to separate molecules
Dissociate = breaking ionic bonds to separate ions
Ionize = breaking covalent bonds to form ions
precipitate = forming a solid product from aqueous solutions.

[dissolve ex: sugar | dissociate ex: NaCl | ionize ex: HCl | precipitate ex: AgCl]

5. Not all solutions are solids dissolved in liquids. Give two examples of different types of solutions that do not involve solids dissolving in water.

Air = N_2 gas (solvent) dissolves O_2 gas (solute)

Brass = Cu solid (solvent) dissolves Zinc solid (solute)

6. What are the differences in saturated, unsaturated, and supersaturated solutions?

unsaturated = less than the maximum amount of solute dissolved

saturated = the maximum amount of solute dissolved. * undissolved is on bottom!

supersaturated = more than the maximum amount of solute is dissolve due to heating the solution

7. How could you tell by looking at a solution if it was saturated or not?

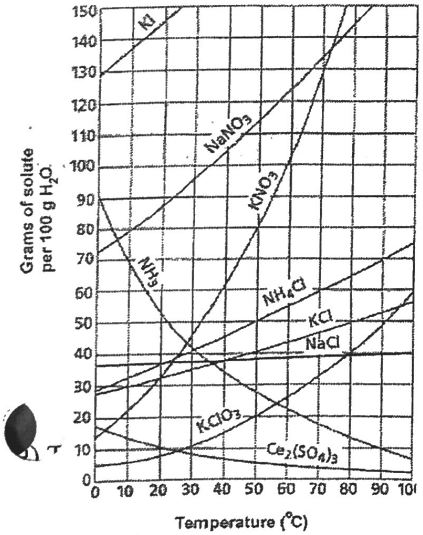
A saturated solution should have undissolved solid on the bottom of the container.

8. 0.450 moles of NaCl are dissolved in 95.0 mL of ~~water~~ solution. Calculate the molarity of the NaCl solution.

$M = \frac{x \text{ mol solute}}{X \text{ L solution}}$ $M = \frac{0.450 \text{ mol NaCl}}{0.0950 \text{ L soln}}$ $M = 4.73M$

9. 45.0 g of Calcium Nitrate was used to create a 1.30 M solution. What is the volume of the solution?

$45.0\text{g } Ca(NO_3)_2 \times \frac{1 \text{ mol } Ca(NO_3)_2}{164.1\text{g } Ca(NO_3)_2} \times \frac{1\text{L } Ca(NO_3)_2}{1.30 \text{ mol } Ca(NO_3)_2} = 0.210\text{ L } Ca(NO_3)_2 \text{ soln}$



10) How many grams of sodium nitrate can be dissolved in 100 ml of water at 20 °C?

87 grams

11) 50.0 grams of ammonium chloride dissolved in 100 ml of water at 50 °C, would create what type of solution? (saturated, unsaturated, supersaturated)

saturated

12) The solubility of NH_3 is decreasing over time. That suggests that NH_3 is?

NH_3 is a gas. Solids increase in solubility at higher temps.

13) How many grams of KI could dissolve in 50 ml of water at 20 °C?

72.5grams

14) What is the **least** soluble at 20 °C?

$KClO_3$

1g = 1mL

15) 3.65 grams of sodium chloride is dissolved in 50.0 mL of water. Determine the percent by mass of sodium chloride.

$\%\text{ by mass} = \frac{\text{mass of solute}}{\text{mass of solution}} \times 100$ $\quad \frac{3.65\text{g}}{53.65\text{g}} \times 100 = 6.80\%\ NaCl$

16) 3.75 moles of potassium nitrate is dissolved in 1.5 L of water. Determine the percent by mass of potassium nitrate.

$3.75\text{mol } KNO_3 \times \frac{101.11\text{g } KNO_3}{1\text{mol } KNO_3} = 379\text{g } KNO_3$ $\quad \frac{379\text{g } KNO_3}{1879\text{g soln}} \times 100 = 25.2\%\ KNO_3$

17) Balance the reaction: ___Na_2SO_4 + ___$BaCl_2$ → ___$BaSO_4$ + 2 NaCl

A) If 45.0 grams of barium chloride is used, how many moles of barium sulfate would be created?

$45.0\text{g } BaCl_2 \times \frac{1\text{mol } BaCl_2}{208.32\text{g } BaCl_2} \times \frac{1\text{mol } BaSO_4}{1\text{mol } BaCl_2} \times \frac{233.4\text{g } BaSO_4}{1\text{mol } BaSO_4} =$

B) How many grams of sodium sulfate are required to create 450 ml of a 2.0 M solution?

$0.450\text{L } Na_2SO_4 \times \frac{2.0\text{mol } Na_2SO_4}{1\text{L } Na_2SO_4} \times \frac{142.05\text{g } Na_2SO_4}{1\text{mol } Na_2SO_4} = 128\text{g } Na_2SO_4$

C) How many liters of solution will be needed to create a 2.45 M solution containing 60.0 grams of barium chloride?

$60.0\text{g } BaCl_2 \times \frac{1\text{mol } BaCl_2}{208.32\text{g } BaCl_2} \times \frac{1\text{L } BaCl_2}{2.45\text{mol } BaCl_2} = 0.118\text{L } BaCl_2$

D) If 5.3 grams of Barium Chloride and 6.4 grams of sodium sulfate are reacted, what is the theoretical yield of Barium Sulfate?

$5.3\text{g } BaCl_2 \times \frac{1\text{mol } BaCl_2}{208.32\text{g } BaCl_2} \times \frac{1\text{mol } BaSO_4}{1\text{mol } BaCl_2} \times \frac{233.40\text{g } BaSO_4}{1\text{mol } BaSO_4} = 5.9\text{g } BaSO_4$

$6.4\text{g } Na_2SO_4 \times \frac{1\text{mol } Na_2SO_4}{142.05\text{g } Na_2SO_4} \times \frac{1\text{mol } BaSO_4}{1\text{mol } Na_2SO_4} \times \frac{233.40\text{g } BaSO_4}{1\text{mol } BaSO_4} = 11\text{g } BaSO_4$

If a student carried out this experiment a produced 4.4 grams of Barium Sulfate, what would be the percent yield?

$\frac{4.4\text{g } BaSO_4}{5.9\text{g } BaSO_4} \times 100 = \%\text{ yield} = 74.6\%$

18) 3 H_2SO_4 + 2 $Al(OH)_3$ → ___$Al_2(SO_4)_3$ + 6 H_2O

A) In order to create 750.0 mL of 1.75 M sulfuric acid, how many grams would be required?

$0.750\text{L } H_2SO_4 \times \frac{1.75\text{mol } H_2SO_4}{1\text{L } H_2SO_4} \times \frac{97.089\text{g } H_2SO_4}{1\text{mol } H_2SO_4} = 127\text{g } H_2SO_4$

B) What is the theoretical yield of water when of 35.0 mL 2.50 M sulfuric acid reacts with 45.0 mL of 1.75 M aluminum hydroxide solution? (Limiting Reactant!)

$0.035\text{L } H_2SO_4 \times \frac{2.50\text{mol } H_2SO_4}{1\text{L } H_2SO_4} \times \frac{6\text{mol } H_2O}{3\text{mol } H_2SO_4} \times \frac{18.02\text{g } H_2O}{1\text{mol } H_2O} = 3.15\text{g } H_2O$

$0.045\text{L } Al(OH)_3 \times \frac{1.75\text{mol } Al(OH)_3}{1\text{L } Al(OH)_3} \times \frac{6\text{mol } H_2O}{2\text{mol } Al(OH)_3} \times \frac{18.02\text{g } H_2O}{1\text{mol } H_2O} = 4.25\text{g } H_2O$

19) Determine the percent composition of nitrogen in NO_2.

$\%N = \frac{\text{mass N}}{\text{mass } NO_2} \times 100$ $\quad \%N = \frac{14.01\text{g}}{46.01\text{g}} \times 100$ $\quad \%N = 30.4$

20) If a sample of ethyl butyrate is known to contain 0.620 g of carbon, 0.103 g of hydrogen and 0.276 g of oxygen, what is the empirical formula for ethyl butyrate?

$0.620\text{g C} \times \frac{1\text{mol C}}{12.01\text{g C}} = \frac{0.0516\text{ mol C}}{0.0173\text{mol}} = 3C$

$0.103\text{g H} \times \frac{1\text{mol H}}{1.01\text{g H}} = \frac{0.1019\text{ mol H}}{0.0173\text{ mol}} = 6H$

$0.276\text{g O} \times \frac{1\text{mol O}}{16.00\text{g O}} = \frac{0.0173\text{mol O}}{0.0173\text{mol}} = 1O$

C_3H_6O

21) A compound with an empirical formula of C_4H_4O and a molar mass of 136 grams per mole. What is the molecular formula of this compound?

Empirical molar mass (C_4H_4O) = 68.08 g/mol

$\frac{136\ g/mol}{68\ g/mol} = 2$

Molecular Formula = $C_8H_8O_2$

22) Determine the molecular formula of a compound that is 7.79 % Carbon and 92.21% Chlorine. The actual compound has a molar mass of 88 grams per mole.

$7.79\ g\ C \times \frac{1\ mol\ C}{12.01\ g\ C} = \frac{0.6486\ mol\ C}{0.6486\ mol} = 1C$

$92.21\ g\ Cl \times \frac{1\ mol\ Cl}{35.45\ g\ Cl} = \frac{2.601\ mol\ Cl}{0.6486\ mol} = 4Cl$

Empirical Formula = CCl_4

molar mass / E.F = $\frac{88\ g/mol}{88\ g/mol} = 1$

Molecular Formula = CCl_4

23) When do we use the units of atoms? Molecules? Formula Units?

atoms = Non-BrINClHOF Brothers

molecules = BrINClHOF Brothers and covalent molecules

Formula units = ionic compounds

24) Convert 2.55 grams of aluminum hydroxide to formula units.

$2.55\ g\ Al(OH)_3 \times \frac{1\ mol\ Al(OH)_3}{78.01\ g\ Al(OH)_3} \times \frac{6.02\times10^{23}\ f.u.n\ Al(OH)_3}{1\ mol\ Al(OH)_3} = 1.97\times10^{22}\ f.u.n\ Al(OH)_3$

(formula unit #s.)

25) 4.5×10^{23} atoms of zinc would be equal to how many moles?

$4.5\times10^{23}\ atoms\ Zn \times \frac{1\ mol\ Zn}{6.02\times10^{23}\ atoms\ Zn} = 0.75\ mol\ Zn$

26) 2.5 moles of sodium phosphide would have what mass?

$2.5\ mol\ Na_3P \times \frac{99.94\ g\ Na_3P}{1\ mol\ Na_3P} = 250\ g\ Na_3P$

) Write the balanced equation for the reaction between sulfuric acid and aluminum hydroxide.

$3\ H_2SO_4\ (aq) + 2\ Al(OH)_3\ (aq) \longrightarrow 6\ H_2O\ (l) + Al_2(SO_4)_3\ (aq)$

A) If you have 4.6 mol of sulfuric acid and 4.6 mol of aluminum hydroxide, how many grams of water would form?

$4.6\ mol\ H_2SO_4 \times \frac{6\ mol\ H_2O}{3\ mol\ H_2SO_4} \times \frac{18.02\ g\ H_2O}{1\ mol\ H_2O} = 170\ g\ H_2O$

$4.6\ mol\ Al(OH)_3 \times \frac{6\ mol\ H_2O}{2\ mol\ Al(OH)_3} \times \frac{18.02\ g\ H_2O}{1\ mol\ H_2O} = 250\ g\ H_2O$

B) If I only had 175.0 mL of aluminum hydroxide solution, what molarity of that solution would be required to produce exactly 85.0 grams/mL of water?

$85.0\ g\ H_2O \times \frac{1\ mol\ H_2O}{18.02\ g\ H_2O} \times \frac{2\ mol\ Al(OH)_3}{6\ mol\ H_2O} = \frac{1.57\ mol\ Al(OH)_3}{0.175\ L\ Al(OH)_3}$

$M = 8.97\ \frac{mol}{L}$

C) 45.0 mL of water is added to 1.20 L of an 8.0 M sulfuric acid solution. Determine the molarity of the new solution.

$M_1V_1 = M_2V_2$

$(8.0M)(1.20L) = M_2(1.245L)$

$M_2 = 7.1\ M$

28) An example of dissociation is when an covalent compound is added to water and breaks apart into separate molecules.

29) The limiting reactant determines when a reaction will stop and how much product can theoretically be produced.