

Study Guide for Test 2: Chapters 3 & 4 (for Tro textbook)

*Revised October 19, 2016*

This is NOT a complete list of what will be on the Test. You must also study class notes, the homework, and the textbook. This is just a study guide to help you.

You still need to know everything on Test 1. ☹

- 1) Define, identify and/or give examples of: chemical bond, ionic bond, covalent bond, empirical formula, molecular formula, chemical formula, structural formula, atomic elements, diatomic molecules (know naturally occurring diatomics), ionic compounds, covalent compounds, polyatomic ions, fixed charged ions, systematic names, molecular compounds, acids, molar mass (formula mass, molecular mass, formula weight, molecular weight), mass percent composition, balanced equations, coefficient, reactants, products, organic compounds, hydrocarbons, alkanes, alkenes, alkynes, alcohols, ethers, aldehydes, ketones, carboxylic acid, esters, amines, mole-to-mole ratio (mole ratio), limiting reactant, excess reactant, actual yield, theoretical yield, percent yield, solute, solvent, solution, Molarity (M), concentrated solution, diluted solution, concentration, making a solution by dilution method, electrolyte, nonelectrolyte, strong electrolyte, strong acid, weak electrolyte, weak acid, soluble, insoluble, solubility rules, precipitate, precipitation reactions, molecular equation, chemical equation, complete ionic equation, net ionic equation, spectator ions, concentration of ions, neutralization reaction, gas forming reactions, Arrhenius acid, Arrhenius base, hydronium ions, monoprotic acid, diprotic acid, polyprotic acid, titration, color indicator, color endpoint, equivalence point, oxidation-reduction reactions, redox reactions, oxidation charges (or states or numbers), oxidizing agent, reducing agent, combustion reaction, greenhouse gas, greenhouse effect.
- 2) Know fixed charged ions, including their names and charges (see table below).
- 3) Know formulas and names of polyatomic ions (see table below).
- 4) Be able to name (with systematic name) and write chemical formulas of ionic compounds containing fixed charged ions, variable charged ions or polyatomic ions.
- 5) Be able to name (with systematic name) and write chemical formulas of hydrates.
- 6) Be able to name (with systematic name) and write chemical formulas of covalent compounds containing two elements (using covalent prefixes).
- 7) Be able to name (with systematic name) and write chemical formulas of acids.
- 8) Be able to name (with systematic name), to write chemical formulas, and to draw structural formulas of hydrocarbons with one to ten carbons (using organic prefixes).
- 9) Be able to classify organic compounds based on functional groups in compound given the structural formula. (i.e., organic compounds, hydrocarbons, alkanes, alkenes, alkynes, alcohols, ethers, aldehydes, ketones, carboxylic acid, esters, amines)  
{ skip this #9 for Fall 2016 classes }
- 10) Find molar mass of an atom or compound. Be able to convert between grams and moles using a molar mass.

- 11) Still know Avogadro's Number (Chapter 2) and be able to convert between number of items (atoms, molecules, ions, etc.) and moles of that item. Be able to combine this calculation with molar mass. (1 mole items =  $6.022 \times 10^{23}$  items)
- 12) Be able to convert between moles of a compound and moles of atoms in that compound using the chemical formula. (i.e., 1 mole  $C_6H_{12}O_6$  = 6 moles C)
- 13) Calculate the percent by mass composition.
- 14) Be able to determine the empirical formula from percent composition by mass.
- 15) Be able to determine the molecular formula given the empirical formula and molar mass.
- 16) Write and balance chemical equations.
- 17) Be able to write and use mole-to-mole ratios.
- 18) Be able to use both mole ratios and molar masses in a multistep calculation.
- 19) Find theoretical yield and percent yield; and identify actual yield.
- 20) Limiting Reactant problems: find limiting reactant, find excess reactant, find amount of product made, and find the amount of excess reactant remaining.
- 21) Definitions and calculations of Molarity. (Molarity =  $\frac{\text{moles}}{\text{liters}}$  ). Be able to solve for moles, liters, or Molarity.
- 22) Calculate Molarity or volumes of a diluted or concentrated solution. ( $M_1V_1 = M_2V_2$ )
- 23) Use Molarity and mole ratios in calculations with balanced reactions.
- 24) Using the given Solubility Guidelines (below), identify a compound as soluble or insoluble.
- 25) Be able to identify, predict, and write precipitation reactions.
- 26) Be able to write complete Ionic equations, net ionic equations, and identify spectator ions.
- 27) Identify, predict, and write Neutralization reactions.
- 28) Understand titration experiment including equivalence point, color indicator, and color endpoint. Be able to do titration calculations.
- 29) Identify, predict and write Gas Forming Reactions. See Table 4.3 in textbook. (Gas forming reaction with  $NH_4OH$  is not on test.)
- 30) Identify an Oxidation-Reduction reaction (also called Redox Rxn). Identify what is oxidized and what is reduced. Identify the oxidizing agent and the reducing agent.
- 31) Be able to find oxidation charges of atoms in compounds, ions, etc.
- 32) Be able to identify and write combustion reactions.
- 33) Know the 4 common names given in class. ( $H_2O$  = water,  $NH_3$  = ammonia,  $H_2O_2$  = hydrogen peroxide,  $CH_4$  = methane).
- 34) Find concentration of ions in solution.

		Fixed Charged Ions CHM1045																
1	1A	2											13	14	15	16	17	
2	3	2A											3A	4A	5A	6A	7A	
2	Li <sup>+</sup>														N <sup>-3</sup>	O <sup>-2</sup>	F <sup>-1</sup>	
3	11	12	3	4	5	6	7	8	9	10	11	12	13	15	16	17		
	Na <sup>+</sup>	Mg <sup>+2</sup>	3B	4B	5B	6B	7B	8B	8B	8B	1B	2B	Al <sup>+3</sup>	P <sup>-3</sup>	S <sup>-2</sup>	Cl <sup>-1</sup>		
4	19	20											30	33	34	35		
	K <sup>+</sup>	Ca <sup>+2</sup>											Zn <sup>+2</sup>	As <sup>-3</sup>	Se <sup>-2</sup>	Br <sup>-1</sup>		
5	37	38											47	48	52	53		
	Rb <sup>+</sup>	Sr <sup>+2</sup>											Ag <sup>+</sup>	Cd <sup>+2</sup>	Te <sup>-2</sup>	I <sup>-1</sup>		
6	55	56																
	Cs <sup>+</sup>	Ba <sup>+2</sup>																
7	87	88																
	Fr <sup>+</sup>	Ra <sup>+2</sup>																

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## Solubility Table Given for CHM1045 Test 2

### Solubility Guidelines for Ionic Compounds in Water

<u>Usually Soluble:</u> Cl <sup>-1</sup> , Br <sup>-1</sup> , I <sup>-1</sup>	<u>Exceptions:</u> Ag <sup>+1</sup> , Pb <sup>+2</sup> , Hg <sub>2</sub> <sup>+2</sup>
SO <sub>4</sub> <sup>-2</sup>	Ca <sup>+2</sup> , Sr <sup>+2</sup> , Ba <sup>+2</sup> , Pb <sup>+2</sup> , Hg <sub>2</sub> <sup>+2</sup>
<u>Usually Insoluble:</u> CO <sub>3</sub> <sup>-2</sup> , PO <sub>4</sub> <sup>-3</sup>	<u>Exceptions:</u> NH <sub>4</sub> <sup>+1</sup> , alkali metal ions
OH <sup>-1</sup> , S <sup>-2</sup>	NH <sub>4</sub> <sup>+1</sup> , alkali metal ions, Ca <sup>+2</sup> , Sr <sup>+2</sup> , Ba <sup>+2</sup>

## CHM1045 – Polyatomic Ions (you must know)

$\text{NH}_4^+$	ammonium ion
$\text{ClO}^-$	hypochlorite ion
$\text{ClO}_2^-$	chlorite ion
$\text{ClO}_3^-$	chlorate ion
$\text{ClO}_4^-$	perchlorate ion
$\text{NO}_2^-$	nitrite ion
$\text{NO}_3^-$	nitrate ion
$\text{HCO}_3^-$	bicarbonate ion
$\text{HSO}_3^-$	bisulfite ion
$\text{HSO}_4^-$	bisulfate ion
$\text{OH}^-$	hydroxide ion
$\text{CN}^-$	cyanide ion
$\text{MnO}_4^-$	permanganate ion
$\text{C}_2\text{H}_3\text{O}_2^-$	acetate ion
$\text{CO}_3^{-2}$	carbonate ion
$\text{SO}_3^{-2}$	sulfite ion
$\text{SO}_4^{-2}$	sulfate ion
$\text{PO}_4^{-3}$	phosphate ion