

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

Revised March 4, 2014

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)
- 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 = 6.022×10^{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) Know solubility rules. 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	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
1A	2A	3B	4B	5B	6B	7B	8B	8B	8B	1B	2B	3A	4A	5A	6A	7A	
Li ⁺												Al ⁺³		N ⁻³	O ⁻²	F ⁻¹	
Na ⁺	Mg ⁺²													P ⁻³	S ⁻²	Cl ⁻¹	
K ⁺	Ca ⁺²										Zn ⁺²			As ⁻³	Se ⁻²	Br ⁻¹	
Rb ⁺	Sr ⁺²										Ag ⁺	Cd ⁺²			Te ⁻²	I ⁻¹	
Cs ⁺	Ba ⁺²																
Fr ⁺	Ra ⁺²																

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Northwest Florida
State College

TABLE 4.1 ■ Solubility Guidelines for Common Ionic Compounds in Water

Soluble Ionic Compounds	Important Exceptions
Compounds containing	
NO_3^-	None
CH_3COO^-	None
Cl^-	Compounds of Ag^+ , Hg_2^{2+} , and Pb^{2+}
Br^-	Compounds of Ag^+ , Hg_2^{2+} , and Pb^{2+}
I^-	Compounds of Ag^+ , Hg_2^{2+} , and Pb^{2+}
SO_4^{2-}	Compounds of Sr^{2+} , Ba^{2+} , Hg_2^{2+} , and Pb^{2+}
Insoluble Ionic Compounds	Important Exceptions
Compounds containing	
S^{2-}	Compounds of NH_4^+ , the alkali metal cations, and Ca^{2+} , Sr^{2+} , and Ba^{2+}
CO_3^{2-}	Compounds of NH_4^+ and the alkali metal cations
PO_4^{3-}	Compounds of NH_4^+ and the alkali metal cations
OH^-	Compounds of the alkali metal cations, and NH_4^+ , Ca^{2+} , Sr^{2+} , and Ba^{2+}

CHM1045 – Polyatomic Ions (you must know)

NH_4^+	ammonium ion
ClO^-	hypochlorite ion
ClO_2^-	chlorite ion
ClO_3^-	chlorate ion
ClO_4^-	perchlorate ion
NO_2^-	nitrite ion
NO_3^-	nitrate ion
HCO_3^-	bicarbonate ion
HSO_3^-	bisulfite ion
HSO_4^-	bisulfate ion
OH^-	hydroxide ion
CN^-	cyanide ion
MnO_4^-	permanganate ion
$\text{C}_2\text{H}_3\text{O}_2^-$	acetate ion
CO_3^{-2}	carbonate ion
SO_3^{-2}	sulfite ion
SO_4^{-2}	sulfate ion
PO_4^{-3}	phosphate ion