Chem 1A

EXAM 1 STUDY GUIDE

Chemistry – Molecular Approach Nivaldo Tro, 4th ed

Chapter 1 – Matter, Measurement, and Problem Solving

The Scientific Approach, Classification of Matter, States of Matter, Physical and Chemical Changes, Physical and Chemical Properties.
Units of Measurements: System International (SI), Metric Units, English Units.
Scientific Notation and Significant Figures, Temperature Conversions and Scales;
Solving Chemical Problems: Dimensional Analysis (Factor-Label Method);
Calculations involving Density.

Suggested Exercises for Chapter 1: Self-Assessment Quiz (p. 33)
Problems: 33, 37, 39, 43, 45, 47, 51, 59, 67, 69, 73, 77, 81, 87, 93, 97, 103, 107, 115, 117, 124, 129, 130, 131.

Chapter 2 – Atoms and Elements

The Law of Conservation of Mass, Law of Definite Proportions and Multiple Proportions;
Atomic Theory (Know Contributions of Dalton, Thomson, Rutherford, Millikan);
Radioactivity, Atomic Structure, Subatomic Particles and Isotopes;
Periodic Table Organization and Ions and Periodic Table.
Atomic Mass, Moles, Avogadro's Number and Molar Mass,

Suggested Exercises for Chapter 2: Self-Assessment Quiz (p. 74-75)
Problems: 31, 37, 39, 41, 47, 53, 57, 61, 67, 69, 75, 78, 83, 87, 89, 95, 105, 108, 112, 115, 118, 123, 128, 131.

Chapter 3 – Molecules, Compounds and Chemical Equations [Omit Section 3.12 for Exam 1]

Ionic and Covalent bonds, Chemical Formulas, Naming Ionic Compounds, Molecular Compounds, Acids and Hydrated Ionic Compounds;
Formula Mass, Molar Mass, Mole Concept; Percent Composition;
Empirical and Molecular Formula; Writing Balanced Chemical Equations.

Suggested Exercises for Chapter 3: Self-Assessment Quiz (p. 127)
Problems: 23, 29, 33, 39, 43, 45, 47, 49, 51, 53, 55, 57, 63, 65, 67, 69, 73, 75, 77, 85, 87, 89, 93, 95, 99, 107, 111.

Chapter 4 – Chemical Quantities (Stoichiometry) and Aqueous Reactions [Omit Sections 4.7 and 4.9]

Stoichiometry (Mole-Mole and Mass-Mass problems), Limiting Reagents,
Yields of Reactions (Actual, Theoretical, Percent Yield);
Solution Concentration – Mass Percent, Molarity, Dilution Problems, Solution Stoichiometry.
Types of Chemical Reactions, Predicting Products of Chemical Reactions – Precipitation Reactions, Acid-Base Reactions. (Sections 4.7 and 4.9 will be covered before Exam 3)

Suggested Exercises for Chapter 4: Self-Assessment Quiz (p. 182: Q 1-8);
Problems: 25, 31, 33, 37, 39, 43, 47, 51, 53, 55, 59, 61, 67, 69, 75, 77, 89, 101, 103, 105, 107,113, 118, 123, 125, 129, 131.

Chapter 6 – Thermochemistry

Energy, Types of Energy and Energy Units (calories & Joules); Thermodynamics; Specific Heat Capacity; Calorimetry, Enthalpy, Standard Enthalpies, Heats of Reaction (ΔH_{rxn}) and Standard Enthalpies of Formation (ΔH°_f); Hess's Law, Heats of Solution,

Suggested Exercises for Chapter 6: Self-Assessment Quiz (p. 285)
Problems: 33, 37, 39, 47, 49, 57, 58, 59, 61, 63, 65, 67, 75, 79, 81, 82, 83, 87, 91.

Laboratory Experiments: Problem solving skills like those required by most problems in the Experiment Reports (2 & 3) and Study Assignments 1-3 will be needed for the exam.

Additional Practice Problems for Exam #1

1. An unknown organic compound is known to contain only the elements carbon, hydrogen, and oxygen. When 6.60 g of this organic were burned in an excess of oxygen gas, 9.90 g of carbon dioxide and 2.70 g of water vapor were produced. In a second experiment the molecular weight of this unknown compound was estimated to be 180 ± 20. What is the molecular formula of this organic compound?

2. 186 g of sodium oxide, a basic anhydride, are to be neutralized in a 2-step method. First, the solid is added to excess water to produce an aqueous solution of sodium hydroxide. Second, phosphoric acid is added to the basic solution to completely neutralize the base, leaving an aqueous solution of sodium phosphate. How many milliliters of 6.00 M phosphoric acid solution would be required to accomplish this neutralization?

3. 76.8 g of citric acid (MW = 192) are mixed in water with 31.4 g of calcium oxide (MW = 56.1). When the reaction reaches completion, how many grams of the "reagent in excess" will remain unreacted?

$$2\ H_3C_6H_5O_7 + 3\ CaO \longrightarrow Ca_3(C_6H_5O_7)_2 + 3\ H_2O$$

4. Nutrasweet is the brand name for the sweetener Aspartame. This molecule is the ester of a dipeptide that contains the amino acids phenylalanine and aspartic acid. If Aspartame is known to be 27.2 % oxygen, by weight, and it has a molecular weight of 292 g/mole, how many oxygen atoms must be found in each molecule of Aspartame?

5. Use standard heats of formation, ΔH_f°, to calculate the "fuel value" of table sugar, sucrose ($C_{12}H_{22}O_{11}$). The standard heat of formation of sucrose is -2221 kJ/mole. (Fuel value is the heat (kJ) produced when one gram of a fuel is burned.)

6.Nitrogen oxide is known to react with ozone: $NO + O_3 \longrightarrow NO_2 + O_2$. Given the information below, Calculate ΔH for this ozone destroying reaction.

$NO_2 \longrightarrow NO + O$ $\quad \Delta H = +304.1$ kJ

$2\ O \longrightarrow O_2$ $\quad \Delta H = -495.0$ kJ

$2\ O_3 \longrightarrow 3\ O_2$ $\quad \Delta H = -284.6$ kJ

7. If a 20 g piece of iron (S.H. = 0.45 J/g·°C) is heated to 250°C and then submerged in 100 mL of water at 18°C, what will be the final temperature of this heterogeneous mixture (assuming no heat is lost to the surroundings and no water is lost by evaporation)?

Answers to Additional Problems: 1) $C_6H_8O_6$ 2) 333mL 3) 5.1 g citric acid 4) 5 atoms of O per molecule 5) 16.49 kJ/g 6) –198.9 kJ 7) 23°C