PURDUE UNIVERSITY

# STUDY GUIDE AND SAMPLE EXAMINATION FOR CHEMISTRY 11200
# (Revised July 2016)

This Study Guide describes topics to be mastered prior to attempting the examination to establish credit in Purdue's Chemistry 11200. The material can be studied from many of the textbooks on the market. A list of several of these is given below.

## SUBJECT MATTER - A Brief Outline

The subject matter of any General Chemistry course is varied. Chemistry 112 deals with gases and their properties, solids and their properties, solutions, reaction rates and chemical equilibrium, oxidation reduction reactions, nuclear chemistry, organic chemistry with an emphasis on nomenclature and functional groups, and biochemistry.

The course is taken primarily by students in the School of Agriculture and the School of Health and Human Sciences and is designed to meet their needs. It is also taken by smaller numbers of students in the School of Humanities and the School of Technology. A knowledge of high-school chemistry is presumed and the course goes far beyond the high school level.

A weekly three-hour laboratory is an integral part of the course and includes measurement techniques, the use of the analytical balance, titration techniques and experiments with various elements and compounds.

The topics presented in the outline should be studied prior to attempting the sample examination included with this study guide. These topics are broken down under several headings according to those found in the texts currently in use at Purdue. In preparing for the examination it is important to work many problems. However, the problems should not only be used to test your recall of equations, but also should be used to measure your understanding of the concepts and principles involved.

## SPECIAL NOTE

Words of advice concerning the taking of the actual examination for credit are warranted. No one does well on an examination when he or she is excessively fatigued. Therefore, you are urged to provide yourself an adequate rest period before taking the actual examination. If your trip to the campus necessitates travel into the late hours of the night or an extremely early departure from your home, you may be well advised to allow for a one night's rest in the Lafayette area before taking the examination. Many students who are unsuccessful with the examination tell us that failing to take the above precautions contributed strongly to this result. Most such students find that their first year was somewhat less rewarding than it might have been because of the time spent retracing materials studied in high school. Please consult your advanced credit schedule for the actual time and place of the examination. It is usually given both morning and afternoon.

**TEXTS**
The texts referred to below may be ordered from any of the local book stores:
Local Book Stores:

Local Book Stores:

University Book Store, 360 State Street, W. Lafayette, IN 47906.

Follett's Purdue Book Store, Purdue Service Center, W. Lafayette, IN 47906.

Texts:

Chemistry; BURDGE 4e, McGraw-Hill.

**STUDY GUIDE FOR CHEMISTRY 11200**

1. Properties of liquids and solids

You should be able to describe heating and cooling curves and connect it to temperature changes and a molecular scale mode to describe changes.

You should be able to describe intramolecular forces (bonding and bonding types), as well as intermolecular forces such as van der Waals, hydrogen bonding, dispersion forces, and dipole forces.

Be familiar with the definitions of vaporization, condensation, boiling point, heat of vaporization, heat of fusion.

2. Solutions

Know the following terms and how they apply to solutions: homogeneous, heterogeneous, solute, solvent, miscible, immiscible, soluble, insoluble, concentrated, dilute, saturated, unsaturated, hydration and solvation.

You should be able to describe the processes that must occur in order for a substance to dissolve in a solvent at the molecular level. You should be able to decide whether the energy associated with that process favors dissolution.

Know how to express solution concentration as molarity, ppm, ppb, and molality

You should know how to prepare a specified volume of a solution of known concentration, e.g., 200 mL of 0.100 M NaCl. You should be able to calculate the number of moles or the mass of solute dissolved in a given volume of solution of known concentration, e.g., how many grams of NaCl are present in 50.0 mL of a 1.50 M solution? You should be able to use a solution of

known concentration to prepare a solution of a lower concentration by dilution, e.g., prepare 100 mL of 0.22 M HCl starting with a solution that is 2.50 M HCl.

Be able to identify and describe the colligative properties: osmotic pressure, vapor pressure lowering, boiling point elevation, freezing point depression.

Given the boiling point of a pure solvent, its molal boiling point elevation constant, and the molality of the solution, you should be able to calculate the boiling point of the solution. Conversely, you should be able to find the molality of a solution from the boiling point of that solution. You should be able to find the molecular weight of a solute from the molality of the solution, the boiling point of the solution, the boiling point of the pure solvent, and the molal boiling point elevation constant.

You should be able to calculate the freezing point of a solution from the freezing point of the pure solvent, its molal freezing point depression constant, and the molality of the solution. You should be able to find the molecular weight of a solute from the molality of the solution, the freezing point of the solution, the freezing point of the pure solvent, and the molal freezing point depression constant.

Describe what a colloid is, how they can be used, and what stabilizes them.

3. Reaction rates

Understand rate of appearance and disappearance. Be able to write rates of appearance and disappearance based upon a chemical reaction.

Determine reaction order from experiental data.

Determine the order of a reaction. Use integrated rate laws and recognize the order of reaction from plots made using integrated rate laws.

Calculate half-life for a first order reaction.

Know the conditions that can affect the rate of a chemical reaction. You should be able to describe reaction rates using collision frequency, orientation, activation energy, and potential energy reaction pathways.

Know how to use a reaction progress diagram to identify the activation energy and whether a reaction is exothermic or endothermic.

4. Chemical Equilibrium

You should be able to define chemical equilibrium. Given a chemical reaction you should be able to write the equilibrium constant. Given data, you should be able to calculate the equilibrium constant.

Use Le Chatelier's Principle to predict how changes in concentration, temperature, and pressure affect equilibrium.

5. Acids and bases

You should be able to use the Arrhenius theory and the Bronsted Lowry definition to describe acids and bases.

Know what a hydronium ion is.

Be able to identify monoprotic, diprotic, and triprotic acids. Be able to give definitions and examples of strong and week acids.

You should know how to write a neutralization reaction between an acid and a base.

You should thoroughly understand the pH scale and how to calculate pH and pOH and identify if a substance is acidic, basic or neutral.

Know how to interconvert between pH, pOH, $[H_3O^+]$ and $[OH^-]$.

Understand the autoionization of water and the connection between $[H_3O^+]$ and $[OH^-]$ in solutions.

Understand the meaning of $K_a$ and $K_b$ and the chemical equations they represent.

Use $K_a$ and $K_b$ in equilibrium calculations (with and without ICE tables).

Understand the relationship between $K_a$, $K_b$ and $K_w$.

Use the pH of a weak acid or base to calculate $K_a$ or $K_b$.

Be able to define a buffer, how it responds to the addition of acids or bases, its importance in regulating pH.

Calculate the pH of a buffer using an ICE table or the Henderson-Hasselbalch equation.

You should be able to carry out acid-base titration calculations

6. Oxidation and Reduction.

You should be able to calculate or assign oxidation numbers for atoms, molecules, and ions.

Know the definition of oxidation and reduction, and oxidizing and reducing agents.

You should be able to balance (and identify) oxidation and reduction reactions. From that balanced chemical equation you should be able to identify the species which are oxidized and reduced, as well as the oxidizing and reducing agents.

Be able to describe electrolytic and voltaic cells.

Be able to determine which half-reaction will occur at the cathode and which will occur at the anode of a voltaic cell using the half-cell potentials.

## 7. Organic Chemistry

Know how to use IUPAC names and structures so that you can name straight chain alkanes, alkenes, and alkynes.

You should be able to identify alcohols, ethers, aldehydes, ketones, carboxylic acids, esters, amines, and amides by their functional group.

## 8. Biochemistry

Know the basic structural components of carbohydrates, lipids, fatty acids, amino acids, proteins, nucleic acids, DNA, RNA, monosaccharides, disaccharides, and polysaccharides.

You should be able to identify and describe a peptide (amide) bond and the reaction that forms it (amine + carboxylic acid).

You should be able to identify and describe primary, secondary, tertiary, and quaternary protein structure.