JOHN JAY COLLEGE OF CRIMINAL JUSTICE / CUNY

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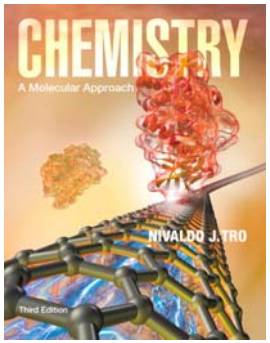
GENERAL CHEMISTRY II (CHE 104) SUMMER 2014 SYLLABUS

	Classroom/Lab	Time	Instructor	Email Address	Office	Phone#	Office Hours
Lecture – 01	L2.82 / L2.85	M,W – 8:00-10:40 AM	Francis X. Sheehan	FSheehan@jjay.cuny.edu	05.66.16	212-237-8951	M,W–by appt
Recitation – 01R1	3.80 / L2.85	M,W – 10:50-12:05 PM	Francis X. Sheehan	FSheehan@jjay.cuny.edu	05.66.16	212-237-8951	M,W–by appt
Laboratory – 01L1	3.66	M,W – 1:15- 3:45 PM	Lauren Gunderson	LGunderson@jjay.cuny.edu	04.70.07	212-237-8894	M,W–by appt
Recitation – 01R2	1.66 / L2.85	M,W – 10:50-12:05 PM	Pia Austria	PAustria@jjay.cuny.edu	04.70.07	212-237-8894	M,W–by appt
Laboratory – 01L2	3.70	M,W – 1:15- 3:45 PM	Pia Austria	PAustria@jjay.cuny.edu	04.70.07	212-237-8894	M,W–by appt
Recitation – 01R5	3.78 / L2.85	M,W – 10:50-12:05 PM	Lauren Gunderson	LGunderson@jjay.cuny.edu	04.70.07	212-237-8894	M,W–by appt
Laboratory – 01L5	3.66	T,Th – 9:00-11:30 AM	Helen Chan	HChan@jjay.cuny.edu	04.70.07	646-781-5686	T,Th–by appt



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COURSE DESCRIPTION AND OBJECTIVES: This is the second of a two-semester course primarily intended for Forensic Science and Fire Science majors, as well as others interested in developing a fundamental knowledge base of chemistry. It provides students with a better understanding of the chemical world around us and is a prerequisite for more advanced chemistry courses. The learning objectives of this course, as more fully described below, are to: (1) build on the basic properties and reactions of elements and compounds learned in the first semester, ending with two socially relevant topics, an introduction to nuclear chemistry, a topic with renewed interest following the March 2011 nuclear powerplant accident in Fukushima, Japan following an earthquake and tsunami and an introduction to coordination compounds which form the basic for theurapuetic drugs, chemical sensors and coloring agents; (2) stress principles of qualitative and semi-qualitative analysis through hands-on experimentation; and (3) foster competence and develop skills needed to safely and effectively work in a scientific laboratory. Students who successfully complete this course and maintain a math/science GPA of at least 2.0 will be eligible to take Organic Chemistry and advance as a forensic science major. 3 hours lecture,1.5 hours recitation, 3 hours laboratory. 4 credits.

REQUIRED LECTURE AND RECITATION READING/MISC MATERIAL:

Lecture Text Bundle (Books a la Carte is an unbound, three-hole punch version of the textbook that is less expensive than the hardcover book and comes bundled with the required online homework software and eText. The textbook chapter under discussion must be brought to class: (It is important ordering is done by ISBN#. Order ISBN- 13:9780321813619.)

Tro, Chemistry, A Molecular Approach (3rd ed.), Books a la Carte Plus MasteringChemistry with eText – Access Card Package, Boston: Pearson Education Inc., 2014.

Scientific Calculator

One of the TI-30 scientific calculators shown in this syllabus, available at most electronic and department stores, is required to be brought to class each day. (TI-34 and TI-36 calculators are not TI-30 calculators and, therefore, are prohibited.) The calculator must be in the TI-30 group, such as TI-30XA, TI-30XS, TI-30X IIS.

Turning Technologies Response Card NXT (RCXR-03), if required by professor

Note: You need not purchase this "clicker." You may borrow one from the college through the Science Department (they are distributed in class or lab, not in the department) at no charge provided you agree in writing to return it on or before Department Exam Day (or within 10 days of dropping the course, whichever occurs first) and agree to replace it with an identical model if it is lost, stolen or damaged. Its estimate cost is $40.00. Failure to timely return either the borrowed clicker in good condition or a purchased replacement clicker will result in an SC "Science Stop" on your registration, financial aid, ability to obtain a transcript, etc. The stop can be removed by returning the clicker to Chemistry Courses Coordinator Francis Sheehan (05.66.16) or his specified designee and having the Loan Agreement you signed to obtain the device canceled in your presence. Allow at least one week for the stop to be removed.

LEARNING OUTCOMES – COURSE

Reasoning	• Apply critical thinking skills to more advanced problem solving exercises in chemistry. • Use analytical reasoning skills in course exercises of increasing complexity/difficulty. • Understand and employ the creative aspects of historical discoveries in chemistry to identify and solve chemical problems and explore new areas of research. • Perform basic statistical analysis and validate analyzed data. • Construct sound and accurate conclusions based on statistical analysis of data.
Knowledge	• Apply modern library searching and retrieval methods to obtain information about a topic, chemical, chemical technique, or an issue relating to chemistry. • Understand the history of scientific investigation related to core chemical concepts. • Demonstrate an understanding of chemical reactions including kinetics; equilibrium; and bonding theory.
Practical skills	• Illustrate an advanced understanding of laboratory safety; scientific measurement; chemical reactions and formulas; chemical identification; solutions and dilutions. • Manipulate modern instruments and techniques to conduct intermediate chemistry experiments. • Appreciate the basic safety rules that apply to work done in a chemistry laboratory. • Demonstrate scientific conduct reflecting ethical and moral principles consistent with professional integrity.
Communication	• Summarize scientific results and demonstrate competence with logic in written and oral formats.

LEARNING OUTCOMES – DETAILED BY CHAPTER SECTION

CHAPTER 11 Learning Outcomes: Students will be able to:

11.1 Climbing Geckos and Intermolecular Forces

- Know that intermolecular forces are attractive forces between individual molecules.
- Know that the gecko's ability to climb smooth surfaces is due to intermolecular forces.

11.2 Solids, Liquids, and Gases: A Molecular Comparison

- Know the properties that differentiate the phases of matter: density, molar volume, molecular shape, and strength of intermolecular forces.
- Define crystalline and amorphous and recognize the difference in solids.
- Know that both temperature and pressure can affect phase changes.

11.3 Intermolecular Forces: The Forces That Hold Condensed States Together

- Know and understand that intermolecular forces originate from the interactions between charges, partial charges, and temporary charges on molecules, atoms, and ions.
- Know how Coulomb's law describes the mathematical relationship between energy of attraction, magnitude of charge, and distance.
- Know and understand that dispersion (London) forces result from fluctuations of electron distribution within molecules and atoms.
- Identify and predict how the shape and sizes of molecules or atoms affects the magnitude of dispersion forces the particles exhibit as well as macroscopic physical properties like boiling point.
- Know and understand that polar molecules have permanent dipoles that attract each other through dipole-dipole interactions.
- Know and understand the phenomenon of hydrogen bonding.
- Predict the ability of molecules to exhibit hydrogen bonding.
- Recognize hydrogen bonding as the force that holds double-stranded DNA together.
- Rank a series of molecular compounds with respect to boiling point.
- Know and understand that the interaction of ions and dipoles leads to the dissolution and solvation of ions by water and other polar liquids.

11.4 Intermolecular Forces in Action: Surface Tension, Viscosity, and Capillary Action

- Know and understand that surface tension is due to intermolecular forces.
- Describe examples of surface tension.
- Know and understand that viscosity is due to intermolecular forces, mass, shape, and length.
- Know and understand that capillary action is the result of both cohesive and adhesive forces.

11.5 Vaporization and Vapor Pressure

- Understand the process of vaporization and how it changes with temperature, surface area, and the degree of intermolecular forces.
- Understand that molecules or atoms have a distribution of thermal energies that changes as a function of temperature.
- Know that the heat of vaporization, ΔH_{vap}, is a quantitative measure for the process of vaporization.
- Calculate and interconvert mass, moles, and energy using the heat of vaporization.
- Know and understand how vapor pressure and dynamic equilibrium dictate vaporization and condensation.
- Know that the vapor pressure of a liquid depends on temperature and that the boiling point of a liquid depends on the external pressure.
- Use the Clausius-Clapeyron equation to relate temperature and vapor pressure.
- Define critical temperature and critical pressure.

11.6 Sublimation and Fusion

- Define and understand sublimation and deposition.
- Define and understand fusion in the context of phase changes.
- Use the heat of fusion, ΔH_{fus} in calculations involving energy, masses, and moles.

11.7 Heating Curve for Water

- Understand the different segments in the heating curve for H_2O that ranges from below the melting point to above the boiling point.
- Calculate the energy changes associated with heating a substance (like H_2O) through a series of temperature changes and phase changes.

11.8 Phase Diagrams

- Know that a phase diagram relates the states of matter for a substance to temperature and pressure.
- Identify the main regions and significant points in a phase diagram.
- Understand the effect of changes in temperature and changes in pressure on the phase of a substance as shown by its phase diagram.

11.9 Water: An Extraordinary Substance

- Know that water has unique properties compared with similar molecules based on size, constituent atoms, and molar mass.
- Know that the unique properties of water are attributable to hydrogen bonding.

11.10 Crystalline Solids: Determining Their Structure by X-Ray Crystallography

- Recall that waves can interfere constructively and destructively.
- Know that X-rays diffract when interacting with the atoms in crystalline solids, forming diffraction patterns.
- Know that diffraction patterns can be analyzed and used to identify the three-dimensional structure of the atoms or molecules in a crystalline solid.
- Use Bragg's law to calculate the relationship between the distance between crystalline layers, the wavelength of electromagnetic radiation, and the angle of reflection.

11.11 Crystalline Solids: Unit Cells and Basic Structures

- Define and identify unit cells.
- Know and identify the cubic crystalline lattice types: simple, body-centered, and face-centered.
- Identify the kind of unit cell, the coordination number, and the edge length for the three cubic crystalline lattice types.
- Use the kind of unit cell and the radius of an atom to calculate the density of a metal.
- Identify the hexagonal and cubic closest-packing structures, and know their unit cells and component layers.

11.12 Crystalline Solids: The Fundamental Types

- Know the organization of crystalline solids—molecular, ionic, and atomic—including basic properties and examples.
- Know and identify constituent atoms, lattice types, and unit cells for some common ionic solids: CsCl, NaCl, ZnS, and CaF_2.
- Know and identify atomic solid types—nonbonding, metallic, and network covalent—and some of their properties and examples.

11.13 Crystalline Solids: Band Theory

- Know that the organization of conduction and valence bands of molecular orbitals forms the basis for conductors, semiconductors, and insulators.

<u>Impediments to avoid to achieve CHAPTER 11 Learning Outcomes:</u>

- confusing intermolecular and intramolecular forces
- not appreciating how important information from earlier chapters is for the understanding of concepts in this chapter
- having difficulty predicting the relative strength of intermolecular forces involved in different materials
- being unaware that there can be intramolecular hydrogen bonding
- confusing cohesion and adhesion
- not realizing that, under the right set of conditions, water also sublimes
- thinking that more viscous necessarily means more dense
- thinking that the "liquid" in liquid crystals refers to these materials being pliable rather than actually being liquid

CHAPTER 12 Learning Outcomes: Students will be able to:

12.1 Thirsty Solutions: Why You Shouldn't Drink Seawater

- Define solution, solute, and solvent.
- Understand that water in tissue will combine with saltwater in order to dilute it, causing dehydration.

12.2 Types of Solutions and Solubility

- Know and understand that common solutions can have a gas, liquid, or solid as either the solvent or solute.
- Define entropy and know that it causes the mixing that results in solution formation.
- Know that the common types of intermolecular forces determine whether solutions will form when components are mixed.
- Identify some common laboratory solvents.
- Identify organic substances as water soluble or fat soluble.

12.3 Energetics of Solution Formation

- Know and understand the components of solution formation and the energy changes associated with them.
- Define and understand heat of hydration and heat of solution.

12.4 Solution Equilibrium and Factors Affecting Solubility

- Know and understand the differences among the states that describe solution equilibrium and dissolution: unsaturated, saturated and supersaturated.
- Know the temperature dependence of the solubility of solids.
- Know that the solubility of gases is a function of both temperature and pressure.
- Use Henry's law to calculate molar concentrations of gases in solution.

12.5 Expressing Solution Concentration

- Define the different expressions of solution concentration: molarity, molality, parts by mass, parts by volume, mole fraction, and mole percent.
- Know how to prepare a solution of known concentration.
- Convert between the different units of concentration.

12.6 Colligative Properties: Vapor Pressure Lowering, Freezing Point Depression, Boiling Point Elevation, and Osmotic Pressure

- Define colligative property.
- Understand dynamic equilibrium with respect to vapor pressure in solutions and the effect of a solute on the rate of vaporization.
- Use Raoult's law to calculate the vapor pressure of a solution.
- Understand vapor pressure for solutions containing two volatile components, and understand deviations from Raoult's law for nonideal solutions.
- Calculate the vapor pressure of a solution containing two volatile components.
- Understand the basis for freezing point depression.
- Calculate the freezing point depression of a solution from its molality and vice versa.
- Understand the basis for boiling point elevation.
- Calculate the boiling point elevation of a solution from its molality and vice versa.
- Understand osmosis and osmotic pressure.
- Calculate the osmotic presure of a solution.
- Use colligative properties to calculate the molar mass of an unidentified solute.

12.7 Colligative Properties of Strong Electrolyte Solutions

- Understand the difference between colligative properties of nonelectrolytes and electrolytes.
- Calculate the van't Hoff factor from deviations in freezing point depression, boiling point elevation, and osmotic pressure.
- Define hyperosmotic, hyposmotic, and isosmotic in relation to biological cells.

12.8 Colloids

- Define colloidal dispersion or colloid.
- Know the differences between the different kinds of colloid: aerosol, solid aerosol, foam, emulsion, and solid emulsion.
- Understand Brownian motion in solutions.
- Know the structure of a soap molecule and a micelle.
- Know and understand the Tyndall effect.

CHAPTER 13 Learning Outcomes: Students will be able to:

13.1 Catching Lizards

- Know that physiological processes (like a lizard's metabolism) depend on temperature.
- Know that the rate of chemical reactions generally depends on the concentration of the reactants and the temperature of the reaction.

13.2 The Rate of a Chemical Reaction

- Know that a rate is the change of a particular property with respect to time.
- Know and understand that the rate of a chemical reaction is a change in concentration measured during a change in time.
- Know the difference between average and instantaneous rates, and understand how each can be measured or estimated from a plot of concentration vs. time (or from a table of data used to produce such a plot).
- Calculate an average rate of reaction and predict a change in concentration from a plot of concentration vs. time (or from a table of data used to produce such a plot).
- Know that the rate of a reaction is measured experimentally and that instruments like a spectrometer or gas chromatograph are used to measure concentrations.

13.3 The Rate Law: The Effect of Concentration on Reaction Rate

- Know the general definition of a rate law and the meaning and significance of the rate order and rate constant.
- Know that order of the reaction predicts the dependence of concentration on time.
- Understand that the order of a reaction must be determined experimentally and not from a balanced reaction.
- Know that the plot of rate (often in units of M/s) vs. concentration produces a straight horizontal line for zero-order reactions, a straight line with a positive slope for first-order reactions, and a curved line with a positive slope for higher-order reactions.
- Use the method of initial rates to determine the order of a reaction from a table of concentration and initial rates.
- Determine and identify the order of a reaction with multiple reactants by observing the effect of a concentration change on the rate of reaction for each independent reactant.

13.4 The Integrated Rate Law: The Dependence of Concentration on Time

- Understand the difference between rate law and integrated rate law.
- Know and understand the first-order integrated rate law and that a plot of the natural logarithm of the reactant concentration versus time is linear.
- Determine the rate constant from the slope of a plot of natural logarithm of reactant concentration versus time for a first-order reaction.
- Use the first-order integrated rate law to find the reactant concentration at a given time or the time elapsed for a given concentration change.
- Know and understand the second-order integrated rate law and that a plot of the inverse reactant concentration versus time is linear.
- Determine the rate constant from the slope of a plot inverse reactant concentration versus time for a second-order reaction.
- Use the second-order integrated rate law to find the reactant concentration at a given time or the time elapsed for a given concentration change.
- Know and understand the zero-order integrated rate law and that a plot of the reactant concentration versus time is linear.
- Determine the rate constant from the slope of a plot of reactant concentration versus time for a zero-order reaction.
- Use the zero-order integrated rate law to find the reactant concentration at a given time or the time elapsed for a given concentration change.
- Define half-life and understand how it can be identified from a plot of reactant concentration versus time.
- Calculate the half-life or predict the concentration of a reactant using the mathematical expressions for first- and second-order reactions.

13.5 The Effect of Temperature on Reaction Rate

- Know that the temperature dependence of reaction rate is modeled by the Arrhenius equation, an equation that describes the rate constant k in terms of temperature, a frequency factor, and an activation energy.
- Define activation energy and frequency factor.
- Know that a transition state or activated complex represent a transient arrangement of atoms that occurs as reactants form products.
- Draw and interpret a potential energy diagram, a plot of energy vs. reaction progress, including the energy levels of the reactants, transition state, and products.
- Know that atoms and molecules contain a distribution of energy that depends on temperature and that those exceeding the activation energy can undergo reaction.
- Calculate the activation energy from a plot of the natural logarithm of the rate constant versus inverse temperature, ln k vs. 1/T.
- Know and understand the collision model: atoms or molecules need to come in contact or collide in order to react.
- Know that the collision model accounts for the frequency factor in the Arrhenius equation and that effective collisions require the proper orientation between two reacting molecules.

13.6 Reaction Mechanisms

- Know that most reactions do not occur in a single step on a molecular level and that the series of steps is called the reaction mechanism.
- Know that the sum of the elementary steps must be equal to the overall chemical reaction.
- Know that reaction intermediates are species formed by one elementary step and consumed by another.
- Recognize unimolecular and bimolecular reactions.

- Know that the rate-determining step of a mechanism determines the rate law for the overall reaction.
- Draw and interpret a potential energy diagram, a plot of energy versus reaction progress, for a reaction that involves multiple steps.
- Understand the rate law resulting from a mechanism in which an intermediate is formed in a fast initial step.
- Show that a given mechanism is consistent with an observed rate law.

13.7 Catalysis

- Know that a catalyst increases the rate of a reaction without being consumed by the reaction.
- Know that catalysts lower the activation energy of a reaction, often by changing the mechanism or the nature of the transition state.
- Know that an automobile's catalytic converter modifies exhaust molecules by catalyzing reactions to produce less harmful emissions.
- Know the definitions of homogeneous and heterogeneous catalysis and understand how they differ.
- Know that catalysts are involved in important atmospheric reactions including the depletion of the ozone layer and the interconversion of other pollutants.
- Know the general model for the behavior of enzymes and understand their role as biological catalysts.

CHAPTER 14 Learning Outcomes: Students will be able to:

14.1 Fetal Hemoglobin and Equilibrium

- Know that hemoglobin is the bloodstream's carrier for oxygen and that the binding of oxygen to hemoglobin is an equilibrium reaction.
- Know that the fetal–maternal oxygen equilibrium is maintained via the placenta where oxygen is exchanged.

14.2 The Concept of Dynamic Equilibrium

- Know and understand that in a dynamic equilibrium, the rate of the forward reaction equals the rate of the reverse reaction.
- Understand the concept of dynamic equilibrium through the population analogy.

14.3 The Equilibrium Constant (*K*)

- Define and understand the law of mass action.
- Write and interpret equilibrium expressions using concentrations.
- Understand the significance of numerical values of the equilibrium constant, especially very large and very small values.
- Know and understand the mathematical relationships between chemical equations and equilibrium constants.

14.4 Expressing the Equilibrium Constant in Terms of Pressure

- Know and understand the relationship between equilibrium expressions written in terms of pressure or concentration.
- Write and interpret the equilibrium expressions given by K_p and K_c for a chemical reaction.
- Show the relationship between K_p and K_c for a gas-phase reaction.

14.5 Heterogeneous Equilibria: Reactions Involving Solids and Liquids

- Know and understand that the concentrations of solids and liquids in a reaction do not change over the course of a reaction and do not appear in the equilibrium expression.
- Write and interpret an equilibrium expression for a reaction involving a solid or liquid.

14.6 Calculating the Equilibrium Constant from Measured Equilibrium Concentrations

- Know and understand that the equilibrium constant will be identical for a given reaction at a given temperature; the equilibrium can be established at an infinite combination of concentrations.
- Write and compute the table of values for an equilibrium reaction at the initial, change in, and equilibrium concentrations. Know that this is often called the ICE table.

14.7 The Reaction Quotient: Predicting the Direction of Change

- Know that the reaction quotient *Q* is defined in the same way as the equilibrium constant *K* except that *Q* can be defined for a state other than equilibrium.
- Know and understand how *Q* can be compared with *K* and used to determine in which direction a reaction will proceed in order to establish equilibrium.
- Predict the direction of a reaction by comparing the values of *Q* and *K*.

14.8 Finding Equilibrium Concentrations

- Calculate equilibrium concentrations from the equilibrium constant K and all but one of the equilibrium concentrations or pressures of the reactants and products.
- Calculate equilibrium concentrations from the equilibrium constant K and initial concentrations or pressures of the reactants and products.
- Calculate equilibrium concentrations from initial concentrations or pressures in cases in which the equilibrium constant is small.

14.9 Le Châtelier's Principle: How a System at Equilibrium Responds to Disturbances

- Define Le Châtelier's Principle.
- Know and understand the effect of changing concentration on a system at equilibrium.
- Know and understand the effect of changing volume or pressure of a system at equilibrium that involves gases.
- Know and understand the effect of a temperature change on a system at equilibrium.

- Predict the effect of temperature change on a reaction for which the heat flow is known.

CHAPTER 15 Learning Outcomes: Students will be able to:

15.1 Heartburn
- Know that acid reflux or heartburn is due to irritation of the esophagus by stomach acid, a strong mineral acid.
- Know that the potency of an acid (or base) is measured by the concentration of H^+ (or H_3O^+) ions, an equilibrium phenomenon.

15.2 The Nature of Acids and Bases
- Know the names and uses of some common acids.
- Know that some organic acids are responsible for the sour taste of some foods, including fruits.
- Know the names and uses of some common bases.

15.3 Definitions of Acids and Bases
- Define Arrhenius acid and Arrhenius base.
- Know and understand that a proton in water is solvated and is often represented as H_3O^+.
- Define Brønsted-Lowry acid and Brønsted-Lowry base.
- Understand and identify conjugate acid–base pairs.

15.4 Acid Strength and the Acid Dissociation Constant (K_a)
- Know and understand that strong acids dissociate completely to protons and the conjugate base.
- Know and understand that weak acids dissociate to a small extent, leaving the molecular form of the acid the predominant species.
- Understand that the degree of dissociation of an acid is related to the attraction between the proton and the conjugate base.
- Know and understand that the acid ionization constant, K_a, is the equilibrium constant for the dissociation of an acid to a proton and the conjugate base.

15.5 Autoionization of Water and pH
- Know and understand that water itself can act as an acid, producing H+ and OH^- in a process called autoionization.
- Know that the ion product constant for water (also called the dissociation constant for water) is
- 1×10^{-14} at 25 °C and can be expressed as the product of $[H^+]$ and $[OH^-]$.
- Know that the acidity or basicity of a solution is defined by the balance between proton and hydroxide concentrations.
- Define pH in terms of $[H_3O^+]$.
- Calculate and interconvert pH and proton concentration.
- Define pOH in terms of $[OH^-]$.
- Define pK_a in terms of K_a.

15.6 Finding the $[H_3O^+]$ and pH of Strong and Weak Acid Solutions
- Calculate the pH of a strong acid solution from $[H_3O^+]$.
- Calculate the pH of a weak acid solution using the K_a and the initial acid concentration.
- Calculate the percent ionization of a weak acid using the K_a and the initial acid concentration.
- Calculate the pH of a mixture of weak acids by comparing the sources of proton.

15.7 Base Solutions
- Know and understand that strong bases dissociate completely in solution and that many strong bases are the soluble metal hydroxides.
- Know and understand that weak bases dissociate water to a small extent to form OH^-.
- Identify amines as weak bases.
- Know and understand that the base ionization constant, K_b, is the equilibrium constant for the reaction of a weak base with water to form OH^- and the conjugate acid.
- Calculate and interconvert among $[OH^-]$, $[H_3O^+]$, and pH in solutions of strong and weak bases.

15.8 The Acid–Base Properties of Ions and Salts
- Know the active ingredients of common antacids.
- Know and understand how the scales of acid and base strength complement each other for a series of conjugate acid–base pairs.
- Know the mathematical relationship between K_a, K_b, and K_w.
- Calculate the pH of a solution containing an anion acting as a base.
- Determine whether an anion, cation, or salt is basic, acidic, or pH-neutral.

15.9 Polyprotic Acids
- Know the structures of some polyprotic acids and understand that each proton is governed by its own dissociation constant.

- Calculate the pH of a polyprotic acid solution using acid dissociation data and an ICE table.
- Calculate the pH of a dilute sulfuric acid solution.
- Calculate the concentration of the anions from weak diprotic acids in solution.

15.10 Acid Strength and Molecular Structure

- Know and understand that both bond polarity and bond strength influence the acidity of binary acids.
- Know that the strength of oxyacids depends on the electronegativity of the central atom (Y) and the number of oxygens attached to that atom.

15.11 Lewis Acids and Bases

- Define Lewis acid and Lewis base.
- Know that molecules with an incomplete octet of electrons can act as Lewis acids and that molecules with lone electron pairs can act as Lewis bases.
- Know that small cations can act as Lewis acids.

15.12 Acid Rain

- Know that SO_2 and NO_2, byproducts of fuel combustion reactions, combine with water and oxygen to form sulfuric acid and nitric acid, the components of acid rain.
- Know that normal rainfall is not neutral (i.e., pH = 7) since it combines with CO_2 to form carbonic acid.
- Know that acid rain adversely affects statues, buildings, trees, and forests.

CHAPTER 16 Learning Outcomes: Students will be able to:

16.1 The Danger of Antifreeze

- Know that the pH of blood is regulated by carbonic acid (H_2CO_3) and its anion, bicarbonate (HCO_3^-), both of which are derived from carbon dioxide and water.
- Know that ethylene glycol (antifreeze) is metabolized to glycolic acid, which lowers the blood pH and lowers to ability of hemoglobin to transport oxygen.

16.2 Buffers: Solutions That Resist pH Change

- Define buffer and know that a buffer typically consists of a weak acid and its conjugate base.
- Know that the common ion effect is an example of Le Châtelier's principle.
- Calculate the pH of a buffer solution starting with initial concentrations of weak acid and its conjugate base.
- Use the Henderson-Hasselbalch equation to calculate the pH of a buffer solution from the pK_a of the weak acid and the initial concentrations of the weak acid and conjugate base.
- Know and understand that a buffer has limits; the buffering action is related to a stoichiometric consumption of either the weak acid or the conjugate base.
- Calculate the pH change in a buffer after the addition of a small amount of strong acid or base.
- Know that buffers can also be made from a weak base and its conjugate acid, and calculate the pH of such a buffer using the Henderson-Hasselbalch equation and the pK_a of the conjugate acid.

16.3 Buffer Effectiveness: Buffer Range and Buffer Capacity

- Know and understand that the buffer capacity is optimal when the ratio of acid and conjugate base differs by less than or equal to a factor of 10.
- Know and understand that a buffer is more resistant to pH changes when the concentrations of acid and base are relatively large.
- Know and understand that an effective buffer covers a pH range one unit above and one unit below the pK_a of the weak acid.
- Use the pK_a and the buffer range to choose appropriate buffer systems for specific applications.

16.4 Titrations and pH Curves

- Calculate the pH of a solution at various points along a titration of a strong acid with a strong base.
- Calculate the pH of a solution at various points along a titration of a weak acid with a strong base.
- Recognize the titration curve for the titration of a weak base with a strong acid.
- Recognize the titration curve for the titration of a polyprotic acid with a strong base.
- Define equivalence point for an acid–base titration.
- Know that the equivalence point of an acid–base titration can be determined using a pH meter.
- Define endpoint for an acid–base indicator.
- Know that the equivalence point of an acid–base titration can be approximated by observing the endpoint of an acid–base indicator.
- Know that indicators can only be used for the specific pH ranges in which the indicator changes color.

16.5 Solubility Equilibria and the Solubility Product Constant

- Know that the solubility product constant, K_{sp}, defines the equilibrium constant for the dissolution of an ionic compound into its constituent ions.
- Calculate the molar solubility of an ionic compound in pure water using the Ksp expression and an ICE table.
- Know that the solubility of an ionic compound is lower in a solution containing a common ion than in pure water.
- Calculate the molar solubility of an ionic compound in the presence of a common ion using the K_{sp} expression and an ICE table.
- Know that the solubility of an ionic compound containing a basic anion increases with decreasing pH.

16.6 Precipitation

- Know that the precipitation of an ionic compound upon mixing aqueous solutions can be predicted using the *Q* expression and comparing *Q* to K_{sp}.
- Define selective precipitation, and know and understand how cations can be selectively precipitated based on their differential solubility with various anions.

16.7 Qualitative Chemical Analysis

- Know and understand that differential precipitation is the basis of the qualitative analysis of cations in solution.
- Know that the qualitative analysis scheme is based on, sequentially, insoluble chlorides, acid-insoluble sulfides, base-insoluble sulfides and hydroxides, insoluble phosphates, and alkali metals and ammonium.
- Know that alkali metals give a characteristic color upon heating in an open flame.

16.8 Complex Ion Equilibria

- Define complex ion and ligand.
- Know that metal cations form complex ions with a series of anionic and neutral ligands.
- Calculate complex ion equilibria using formation constants, K_f, and cation and ligand concentrations.
- Know that amphoteric metal hydroxides, like $Al(OH)_3$, are more soluble in acidic and in basic solution than in pure water.

CHAPTER 17 Learning Outcomes: Students will be able to:

17.1 Nature's Heat Tax: You Can't Win and You Can't Break Even

- Know that the energy released from gasoline combustion is used in part to move a car forward, but most of the energy is dissipated as heat.
- Know that energy is lost as heat in charging rechargeable batteries and also in the normal operation (discharge) of the batteries.
- Know that heating with natural gas is more efficient than heating with electricity because there are fewer places for the energy to be lost.
- Know that the reference made to "heat tax" is due to heat loss to the surroundings as well as the inefficiency of real-world processes.

17.2 Spontaneous and Nonspontaneous Processes

- Define spontaneous and understand the difference between spontaneous and nonspontaneous processes.
- Know and understand that spontaneity and speed are not the same. Spontaneity is dictated by thermodynamics, while speed is dictated by kinetics.

17.3 Entropy and the Second Law of Thermodynamics

- Know that spontaneity is not solely dependent on the enthalpy change for a reaction or process. Some endothermic processes, like ice melting, are spontaneous under certain conditions.
- Know that when ice melts, liquid water evaporates, or NaCl dissolves in water, the arrangement of molecules or ions becomes more disordered.
- Define entropy in words and know Boltzmann's equation for entropy.
- Know and understand the difference between a macrostate and a microstate.
- Define and understand the second law of thermodynamics.
- Understand the example of gas particles in connected flasks as an illustration of entropy change and number of microstates.
- Know and rationalize the entropy changes associated with state changes.
- Predict the sign of ΔS for common processes.

17.4 Heat Transfer and Changes in the Entropy of the Surroundings

- Know and understand that the entropy change for the universe is defined in terms of the entropy change for the system and the entropy change for the surroundings.
- Know that a process in which the system's entropy decreases can still be spontaneous depending on the degree to which the surroundings' entropy changes.
- Know and understand that an exothermic process increases the entropy of the surroundings, and an endothermic process decreases the entropy of the surroundings.
- Calculate the entropy change for the surroundings in terms of the enthalpy change for the system and the temperature.

17.5 Gibbs Free Energy

- Define Gibbs free energy and express it mathematically in terms of the temperature, enthalpy change, and entropy change of the system.
- Understand the meaning of the mathematical sign of the change in Gibbs free energy with respect to spontaneity.
- Compute the change in Gibbs free energy and predict spontaneity from T, ΔH, and ΔS.

17.6 Entropy Changes in Chemical Reactions: Calculating $\Delta S°_{rxn}$

- Define and understand standard conditions.
- Use standard molar entropies to calculate the standard entropy change for a chemical reaction or physical process.
- Define and understand the third law of thermodynamics.
- Understand the dependence of standard molar entropy on physical state, molar mass, atomic arrangement, and molecular complexity.

17.7 Free Energy Changes in Chemical Reactions: Calculating $\Delta G°_{rxn}$

- Calculate the standard free energy change for a reaction using the temperature, the standard enthalpy change, and the standard entropy change.
- Interpret the meaning of the mathematical sign for the standard free energy change.
- Calculate the standard free energy change for a reaction using the standard free energies of formation of products and reactants.
- Calculate the standard free energy change for a stepwise reaction.
- Define reversible and irreversible reactions and processes.
- Understand what is meant by "free" energy.

17.8 Free Energy Changes for Nonstandard States: The Relationship between $\Delta G°_{rxn}$ and ΔG_{rxn}

- Calculate the free energy change for a reaction or process under nonstandard conditions.
- Understand that the free energy change for a reaction or process at equilibrium is exactly zero, indicating nonspontaneity for the reaction or process in either direction.

17.9 Free Energy and Equilibrium: Relating $\Delta G°_{rxn}$ to the Equilibrium Constant (K)

- Calculate and interconvert between the standard free energy change and the equilibrium constant.
- Use a two-point equation to calculate the equilibrium constant for a reaction or process at two different temperatures.

CHAPTER 18 Learning Outcomes: Students will be able to:

18.1 Pulling the Plug on the Power Grid

- Know that electrical power comes from a power grid, a distribution system for electricity.
- Know that fuel cell technology can replace the power source for an automobile or a home.
- Know that the oxidation and reduction reactions for the combination of hydrogen and oxygen to make water can power a fuel cell.

18.2 Balancing Oxidation–Reduction Equations

- Define oxidation and reduction.
- Balance aqueous redox reactions in acidic solution by using the half-reaction method.
- Balance aqueous redox reactions in basic solution by using the half-reaction method.

18.3 Voltaic (or Galvanic) Cells: Generating Electricity from Spontaneous Chemical Reactions

- Understand that the components in redox reactions can be separated into two compartments or cells and that the energy released by these reactions can be used to do electrical work.
- Define electrochemical cell, voltaic (galvanic) cell, electrolytic cell, half-cell, and electrode.
- Understand the rate of flowing electrons as current, and know the unit for current.
- Define potential difference and know its unit.
- Define electromotive force, cell potential, and standard cell potential.
- Know and understand that electrochemical reactions are a combination of half-cell reactions, oxidation occurring at the anode and reduction occurring at the cathode.
- Know and understand the components of an electrochemical cell, including the half-cells, electrodes, and salt bridge.
- Understand the direction of electron flow and the potential of a voltaic cell.
- Use cell notation to represent electrochemical cells.

18.4 Standard Electrode Potentials

- Know that the standard hydrogen electrode has an electrochemical potential of 0.00 V.
- Understand standard potentials and use them to generate potentials for electrochemical cells.
- Calculate standard potentials for electrochemical cells from standard electrode potentials of the half reactions.
- Calculate standard potentials and predict the direction of spontaneity for redox reactions.
- Use standard potentials to predict whether metals will dissolve in acid.

18.5 Cell Potential, Free Energy, and the Equilibrium Constant

- Calculate and interconvert between the standard change in free energy, $\Delta G°$, the standard potential for an electrochemical cell, $E°$, and the equilibrium constant, K.

18.6 Cell Potential and Concentration

- Use the Nernst equation to calculate the cell potential under nonstandard conditions.
- Define concentration cell and understand how a concentration cell works.
- Know and understand nerve cells as a biological example of a concentration cell.

18.7 Batteries: Using Chemistry to Generate Electricity

- Know some characteristics of dry-cell, lead-storage, nickel–cadmium, nickel–metal hydride, and lithium ion batteries.

- Know the primary difference between batteries and fuel cells.
- Know and understand how the hydrogen–oxygen fuel cell and the fuel-cell breathalyzer work.

18.8 Electrolysis: Driving Nonspontaneous Chemical Reactions with Electricity
- Know and understand how an electrolytic cell works.
- Predict the products of some common electrolysis reactions.
- Calculate and interconvert between current, time, and amount for electrolysis reactions.

18.9 Corrosion: Undesirable Redox Reactions
- Know that corrosion generally refers to the oxidation reactions of metals.
- Know the steps by which iron rusts.
- Know some strategies for preventing corrosion.

CHAPTER 19 Learning Outcomes: Students will be able to:

19.1 Diagnosing Appendicitis
- Know that radioactivity, the natural emission of subatomic particles from atoms, can be used in medical applications like radiology, the practice of diagnostic imaging.
- Define radioactivity.

19.2 The Discovery of Radioactivity
- Know that radioactive elements emit energy that is capable of penetrating some types of matter, including tissues of the body.
- Know that radioactive substances can expose photographic plates, a phenomenon that was discovered by Becquerel and further studied by Marie and Pierre Curie.

19.3 Types of Radioactivity
- Define nuclide and recall the conventions for writing nuclear symbols.
- Know that an alpha particle is the same as a helium-4 nucleus.
- Define ionizing power and penetrating power.
- Know that a beta particle is the same as an electron and is emitted when a neutron changes to a proton.
- Know that in beta decay, the mass number of the radioactive nucleus stays the same.
- Know that a gamma particle is a high-energy photon and is often emitted in conjunction with the other types of radiation.
- Know that a positron is the antiparticle of an electron and that it is emitted when a proton changes to a neutron.
- Know that electron capture occurs when an electron from an inner orbital is combined with a nuclear proton to form a nuclear neutron.
- Write nuclear symbols for all the subatomic particles, and write balanced reactions for all the types of radioactive decay.

19.4 The Valley of Stability: Predicting the Type of Radioactivity
- Know that atomic nuclei are held together by the strong force.
- Predict the relative stability and type of radioactive decay of isotopes based on their atomic number and N/Z ratio.
- Know that the stability of an isotope depends on its absolute number of protons and neutrons.
- Know that a radioactive decay series characterizes the steps by which an isotope transforms into other smaller and lighter atoms.

19.5 Detecting Radioactivity
- Know that radioactivity exposure in humans is often measured with film-badge dosimeters, photographic film in a light-proof case that responds to other forms of radiation besides light.
- Know that the Geiger-Müller counter is a device that can count particles emitted by radioactive nuclei.
- Know that a scintillation counter is another device that detects low levels of radiation.

19.6 The Kinetics of Radioactive Decay and Radiometric Dating
- Know that natural radioactivity is a part of our environment, unrelated to human activity, and understand that it is a consequence of the instability of all nuclei beyond atomic number 83.
- Know and understand that all radioactive nuclei decay via first-order kinetics and that the half-life of a radioactive substance is independent of the amount of the substance.
- Know that the natural, radioactive isotope carbon-14 decays with a known half-life and that its concentration in dead organic material can be used to measure the age of the material through radiocarbon dating.
- Calculate and predict the age of a sample based on its concentration of carbon-14.
- Know and understand that the ratio of uranium-238 to lead-206 within igneous rocks can be used to measure the age of the rocks.
- Calculate and predict the age of a rock based on its ratio of uranium-238 to lead-206.

19.7 The Discovery of Fission: The Atomic Bomb and Nuclear Power
- Define nuclear fission.

- Understand how the fission of an isotope like uranium-235 can lead to a self-amplifying chain reaction.
- Know that the first nuclear weapons, developed by the United States in the 1940s, were fission weapons.
- Know and understand that nuclear reactors take the energy from a small, controlled fission reaction and convert the energy to heat to produce electrical power through conventional methods, e.g. steam-driven turbines.

19.8 Converting Mass to Energy: Mass Defect and Nuclear Binding Energy
- Know and understand why nuclear reactions release far more energy than chemical reactions.
- Define mass defect and nuclear binding energy.
- Calculate the mass defect and nuclear binding energy for a radioactive isotope.

19.9 Nuclear Fusion: The Power of the Sun
- Define nuclear fusion.
- Know that attempts at man-made nuclear fusion are still at experimental stages and are being pursued because fusion does not involve radioactivity or radioactive byproducts.

19.10 Nuclear Transmutation and Transuranium Elements
- Define transmutation.
- Know and understand that linear accelerators and cyclotrons are devices used to transmutate elements for experimentation and to produce medically important isotopes for diagnosis and treatment of disease.

19.11 The Effects of Radiation on Life
- Know that radioactivity in the body can do damage and is classified into three groups: acute radiation damage, increased cancer risk, and genetic effects.
- Know that exposure to radioactivity can come from several sources including natural radiation, diagnostic medical procedures, and consumer products.
- Know and understand that the dose and time extent of a radiation exposure give rise to a variety of adverse effects, including death.

19.12 Radioactivity in Medicine and Other Applications
- Define radiotracer and recognize some examples.
- Know that radioactive isotopes are used for radiotherapy in medicine.
- Know that radioactivity is used in a variety of applications, including the sterilization of implanted medical devices, the destruction of bacteria and parasites that spoil foods, and the sterilization of insects that carry disease.

CHAPTER 24 Learning Outcomes: Students will be able to:

24.1 The Colors of Rubies and Emeralds
- Know that the colors of gemstones are attributable to electronic transitions between the d-orbitals of transition elements.

24.2 Properties of Transition Metals
- Recall that the transition metals occupy the d block of the periodic table.
- Recall how to write electron configurations and determine oxidation states for d-block elements.
- Recall trends in radius, ionization energy, and electronegativity for d-block elements.

24.3 Coordination Compounds
- Define complex ion, ligand, coordination compound, and coordinate covalent bond.
- Recognize monodentate, bidentate, and polydentate ligands.
- Define chelate and chelating agent.
- Recognize the common geometries of complex ions.
- Write names and formulas for coordination compounds.

24.4 Structure and Isomerization
- Differentiate between structural isomers and stereoisomers.
- Recognize and identify coordination isomers and linkage isomers.
- Identify and draw geometric isomers.
- Recognize and draw optical isomers.

24.5 Bonding in Coordination Compounds
- State the hybridization of the metal center using valence bond theory for particular geometries.
- Explain the crystal field theory of d-orbital splitting in octahedral and tetrahedral complexes.
- Understand the relationship between crystal field splitting and the colors of transition metal complexes.
- Know the difference between weak-field, moderate-field, and strong-field ligands.

- Know the relationship between crystal field splitting and the magnetic properties of transition metal complexes.
- Understand the difference between high-spin and low-spin in transition metal complexes.
- Predict the number of unpaired electrons in an octahedral complex.

24.6 Applications of Coordination Compounds

- Know that EDTA is used as a chelating agent to bind toxic heavy metals.
- Know the role of transition metals in biomolecules such as hemoglobin, cytochrome c, chlorophyll, and carbonic anhydrase.

WORTH MENTIONING AGAIN!

Make sure you have a valid JJ email address listed on Blackboard. Otherwise you will not receive email announcements from your professors. Even if the email address listed for you on Blackboard is not correct you are responsible for all emails sent to the class via Blackboard. Check and, if necessary, update your profile on Blackboard today.

When emailing your professor,

- **use a meaningful subject line starting with the course and section, such as "Che 104-04 Question about MasteringChemistry password."**
- **include your full name in the body of EVERY email you write related to this course.**

Attendance and punctuality counts.

Keep up with the MasteringChemistry homework.

Yes, the homework is graded and can make a significant difference in your course grade.

Bring the chapter under discussion and your approved calculator with you to class every day.

Take care of the clicker assigned you. You will have to replace it if it is damaged, lost or stolen.

The provisions of this syllabus will be strictly enforced. Keep a copy of this syllabus with you when at the college and refer to it often.

If you don't have safety glasses for labwork or arrive after safety instructions have been discussed, you will be marked absent for the lab.

Help us help you succeed. Study each chapter by reading it at least twice before class, do as much online homework as you can, show up on time prepared, participate in class, ask questions as needed, and then re-read each chapter at least two more times after the lecture and finish the homework.

Study, study and then study some more. The more you study the "luckier" you will be on the next exam.

Prerequisites

Mat 103, 104, 105 or equivalent, and Che 101/102 or Che 103 or equivalent.

GRADING POLICY: This four credit course has three components-- lecture, recitation, and laboratory. Each component has a separate grading policy which contributes a percentage to the overall course grade. In general, the course grade is the sum of the grades earned in the lecture (70%), recitation (5%) and lab (25%) sessions, plus, if applicable, 10% of an American Chemical Society (ACS) exam grade. However, since the lab sessions are an integrated component of the course, where lab safety skills and dexterity are taught for use in subsequent science courses, for safety reasons, a minimum lab grade of 60.00% is required to pass the course. Unethical/unprofessional conduct will result in a failing course grade and referral for additional action. Deviation from this syllabus, which represents a contract, are not permitted except in extraordinary circumstances applicable to all sections. A TI-30 model calculator is required for this course. See calculator details in this syllabus. Students not seated along a wall may use a tablet or laptop in the classroom but only to view their e-book, class PowerPoints, or take notes. Students using a computer along a wall or viewing social media or non-chemistry related data during class time even for a short period of time will be marked absent and may be subject to other sanctions.

Lecture: Four lecture exams will be given. The lowest grade on the first three exams is dropped and each of the grades on the remaining two exams constitute 20% of the course grade (40% for both). There are no make-up exams. The policy of dropping one exam was instituted to accommodate absence and extraneous circumstances resulting in an uncharacteristically poor performance. During final exam week a fourth lecture exam is given that counts as 30% percent of the course grade. The grade on the fourth exam cannot be "dropped." A 5% performance factor penalty will be imposed on the overall lecture grade for each 5% increment below 50.00% earned on clicker questions, if given. After week one, students who do not bring a required clicker to a class and use it when requested will be marked absent. Each excessive absence (more than four) or failure to meaningfully participate in lecture sessions will result in a 5% reduction per occurrence in the overall lecture grade.

Recitation: Recitation constitutes 5% of the course grade, based on successfully completing twelve of fourteen online homework assignments by their due dates, as well as attendance and meaningful participation in the recitation sessions. Active participation during the recitation sessions by all students benefits all students, providing varying approaches to mastering the subject material, incentive for success, and progress evaluation. Consequently, attendance and participation are NOT optional. Each excessive absence (more than two) or failure to meaningfully participate in recitation sessions will result in a 10% reduction per occurrence of the grade total earned on the assigned online homeworks. After week one, students who do not bring a required clicker to a class and use it when requested will be marked absent.

Laboratory: The final lab grade is based on three factors: (1) the cumulative lab examination, (2) the five unknowns (labeled "U" on the lab syllabus), and (3) a "performance" factor (0.00 - 1.00). The overall lab grade (which is 25% of the course grade) is calculated by adding the lab exam score (0-80.00 points) to the four highest grades on the five unknowns (0-5.00 points each), and multiplying the sum by the performance factor. To be objective, the performance factor will be 1.00 unless a safety rule is violated, there are excessive absences (more than two), laboratory equipment is lost or broken, a completed ASA or other assignment is not submitted when requested, an unapproved calculator is used, or participation in lab is not meaningful. There is a severe (10%) performance factor penalty for each excessive absence, or for each Advance Study Assignment (ASA) or handout that is not satisfactorily completed on time. The clarity of any written explanations needed to answer questions on ASAs or handouts will be graded. Any lab keys issued must be personally returned to the Lab Technician by the last day of classes to avoid a significant performance factor penalty and "IN" grade. Before a letter grade is issued, missing, lost or stolen lab keys must be replaced. "IN" grades automatically convert permanently to "F" if not timely resolved.

Overall Grade: The lab grade (25.00 pts max) is added to the lecture (70.00 pts max) and recitation (5.00 pts max) grades. If the total is a passing grade, 10% of the ACS grade is added, producing the final course grade.

American Chemical Society (ACS) Exam: A national ACS exam will be administered on Department Exam Day only. There are no make-ups. 10% of the grade earned on the exam will be added to the course grade if it is a passing course grade. The ACS exam grade cannot be used to raise a failing course grade to a passing course grade, but it can be used to increase a passing grade to a higher passing grade. Letter grades for the course will then be assigned based on the letter grade criteria in JJ Policy Reg.008, modified 6/18/12. The letter grade criteria may also be posted on the course's Blackboard Web site.

ATTENDANCE POLICY: Students enrolled in this course are *required* to attend all lecture, recitation and laboratory sessions of the section for which they registered. In general, there are two one period lecture sessions, a one period recitation session and a two period laboratory session each week. (During summer session, two weeks of classes are covered each calendar week.) Excessive absences (defined above) will result in a reduction in the grade. Attendance is taken solely from roll sheets circulated at the beginning and/or end of each session. Lateness or early departure (resulting in missing no more than 15 minutes of a session) counts as ½ absence. Students missing more than 15 minutes of a session will be counted as absent. Students missing safety instructions in lab will be marked absence and prohibited from doing the exercise for their own safety and the safety of the other students in the lab. If the college is officially closed, thereby canceling all classes, an announcement will be found on 237-8000, and broadcast on AM stations WINS (1010), WOR (710), WCBS (880), WADD (1280), WMCA (570), WLIB (1190), and WFAS (1230), as well as FM stations WCBS (101.1) and WBLS (107.5). If a class will be cancelled for extraordinary circumstances, the instructor will email an announcement using Blackboard to enrolled students as soon as practicable. This has not happened in recent memory.

ACTIVE COLLEGE E-MAIL/BLACKBOARD ACCOUNT REQUIRED: Students are expected to maintain active and accessible college email and Blackboard accounts. Blackboard will be used to send emails and may be used to post announcements, handouts, additional study materials, text supplements, grades, etc. Use the CUNY Portal Login page help features for a forgotten username or password, or contact DoIT, 212-237-8200 for other help. Verify your CUNY email address is correctly listed on Blackboard and keep the mailbox from filling up and refusing delivery, because you will be responsible for the contents of any email sent to that account. When emailing instructors for this course, start the email's subject line with the course and section number (e.g., Che 104-01) followed by a brief description. Include your full name in the body of every email. Emails that do not contain these descriptive details may be considered spam, and remain unopened and unanswered. Students are expected to check email regularly.

TUTORING: Although a considerable amount of remediation is done during the course, when necessary students are encouraged to attend-- on a first come, first served basis—free tutoring offered to students requesting such help. Scheduled weekly or biweekly appointments are encouraged. "Crash" sessions immediately before an exam are discouraged. A student who fails an exam (less than 60.00%) is required to sign into and attend at least one hour of tutoring weekly until the next exam. An additional hour of tutoring is required for every seven days, or part thereof, homework is past due. (The homework must still be completed.) Failure to sign in and attend required tutoring and provide attendance documentation counts as a recitation absence per occurrence. Attendance at tutoring is automatically forwarded to the instructor by the Math and Science Resource Center.

HOMEWORK: Graded online MasteringChemistry® (**MC**) assignments must be successfully completed by their due dates to receive full credit. Some credit will be awarded for late assignments. Frankly, the knowledge you gain by doing the assignments, even if late, justifies the effort even if no credit were awarded. You will be emailed (using Blackboard) your MasteringChemistry course code which you will use to register for your specific course and section on MasteringChemistry. You may switch sections on MasteringChemistry later but all your homework data and grades up to that point will be lost, so register correctly the first time. Use your JJ email address as your Login ID. Although more information will be sent to you in an email, for now please do not use your SSN anywhere on the site. Homework is also shown on this syllabus. The exercises at the back of each chapter in the text are grouped by topic. Do as many blue numbered textbook problems in each group as possible. The answers at the back of the book should only be used after a thorough attempt at answering each problem has been made. Much is learned from the struggle to derive the correct answer. Much is lost by simply seeing "how the book does it." You may do the MasteringChemistry problems before or after the textbook problems. Be prepared to provide answers in recitation to exercises similar to those listed as homework in this syllabus. We have made great effort to ensure that ample tools are available to help students succeed in this course, if the tools are used diligently.

WRITING ACROSS THE CURRICULUM (WATC): Reports written by Forensic Scientists must be clear, concise, and unambiguous. Consequently, where a homework assignment requires a written explanation, spelling, grammar, and clarity of expression will be considered in determining the "correctness" of the answer proffered. It is important that careful attention is directed to writing what you mean and meaning what you write.

STUDENTS WITH DISABILITIES: Qualified students with disabilities will be provided reasonable academic accommodations if determined appropriate by the Office of Accessibility Services (OAS), 212-237-8031, located in room L.66.00. Prior to granting disability accommodations, verification of a student's eligibility must be timely received from OAS by the chemistry course coordinator, Professor Francis Sheehan (FSheehan@jjay.cuny.edu), and the instructor, from the OAS. It is the student's responsibility to initiate contact with the OAS and to follow the established procedures for having the accommodation notice sent to both the course coordinator and the instructor.

ACADEMIC INTEGRITY: Students who succeed in this course and graduate with a degree in Forensic Science may be hired by government or private agencies to analyze evidence and testify in a court of law, placing in jeopardy another person's reputation and/or liberty. Dishonesty of any kind cannot and will not be tolerated. Students are expected to become thoroughly aware of the "John Jay College Policy on Academic Integrity" (and other college policies), available on the college's Web site. Sanctions to the extent permitted by the policy will be imposed and any written material submitted may be transmitted by the instructor to Turnitin.com (or equivalent service) to help analyze its originality. See the Undergraduate Bulletin for the College's Policy on Plagiarism and Cheating, which will be strictly enforced. Plagiarism includes copying ASA or homework answers from others. A handout will be provided you so that there will be no misunderstanding of what constitutes plagiarism. You are required to do your own work to avoid severe grade and disciplinary penalties. Use of a headset at any time is prohibited. The College subscribes to Turnitin.com and Blackboard has a similar module called SafeAssign. Any written assignments submitted may be subject to evaluation by these or similar programs.

Statement of the College Policy on Plagiarism

Plagiarism is the presentation of someone else's ideas, words, or artistic, scientific, or technical work as one's own creation. Using the ideas or work of another is permissible only when the original author is identified. Paraphrasing and summarizing, as well as direct quotations require citations to the original source. Plagiarism may be intentional or unintentional. Lack of dishonest intent does not necessarily absolve a student of responsibility for plagiarism. It is the student's responsibility to recognize the difference between statements that are common knowledge (which do not require documentation) and restatements of the ideas of others. Paraphrase, summary, and direct quotation are acceptable forms of restatement, as long as the source is cited. Students who are unsure how and when to provide documentation are advised to consult with their instructors. The Library has free guides designed to help students with problems of documentation. (John Jay College of Criminal Justice Undergraduate Bulletin, http://www.jjay.cuny.edu/academics/654.php, see Chapter IV Academic Standards.)

Note: You will be presented with a handout called "The Perils of Plagiarism" that you will be required to read and return signed to your professor on the next meeting date.

Extra Work:

Extra work (more studying, more practice exercises) is encouraged to help you improve your performance on an *upcoming* exam or lab. The grade for the course is strictly computed as defined in this syllabus. Students must focus on doing well on the standardized assessments (exams, online homework, lab work, class participation, attendance, etc.) on the assessment date stated on this syllabus. The time to do the extra work is before the exam is given and/or the lab is performed, as extra work after-the-fact is not provided. The grading policy stated herein sufficiently accommodates an unexpected absence and uncharacteristic poor performance during the semester.

Grade of Incomplete:

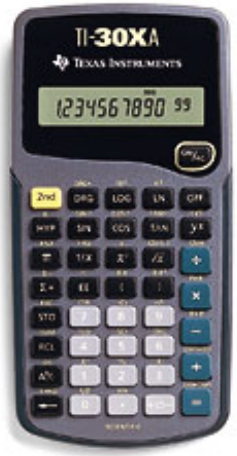
A grade of incomplete will only be issued if the student is absent from Exam 4 and/or the Lab Exam and the average of the best two of the first three exam grades applied to the missed Exam 4 and/or Lab Exam results in a passing grade. If a grade of Incomplete is assigned, it is the student's responsibility to resolve it during the following semester on the specific date published on the Undergraduate Academic Calendar on www.jjay.cuny.edu. The exam(s) must be scheduled at least two weeks in advance via email with the Chemistry Courses Coordinator (FSheehan@jjay.cuny.edu), who will administer the exam(s). The exam(s) will only be administered on the published date, except in extraordinary documented circumstances . Incompletes must be avoided because they will prevent advancement to more advanced chemistry courses the following semester since successful completion of this course is a pre-requistite for more advanced chemistry courses. Incompletes that remain unresolved after the published make-up date are automatically changed to FIN.

"SC" Science Equipment/Key Registration Stop:

If equipment is issued to you, timely return it. Did you know that an "SC" Science Equipment/Key Stop (also known as Hold) restricts students from registering, receiving financial aid, requesting transcripts, receiving certification letter of attendance, receiving the diploma, etc.? JJC Policy Reg.017 12/15/12

COME TO LECTURE/RECITATION PREPARED:

Do your homework. Stay up with the course material. Stay slightly ahead of the professor with your studying. You will need a blue or black ink pen to sign the attendance sheet, a TI-30 calculator, safety glasses on lab days, your notebook and any book/manual required. Although a TI-30XA is the preferred calculator for the course, any TI-30 calculator is acceptable (e.g., TI-30XA, TI-30XS, TI-30XIIS, etc.).



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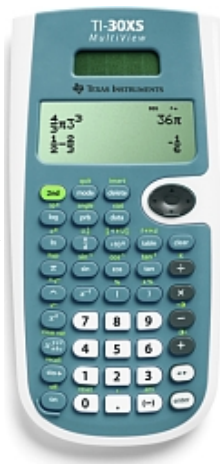

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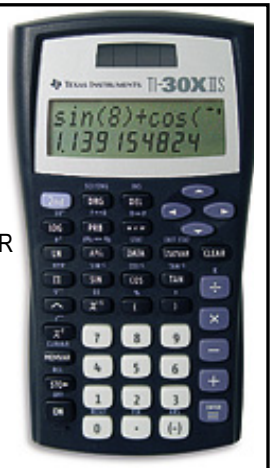

TI-30X IIS

AND

Turning Technologies NXT (RCXR-03)
(if required)

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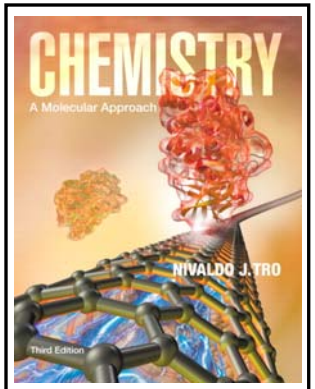
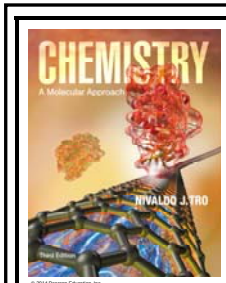


The chapter under discussion must be brought to class.

AND



Lecture Presentation

Chapter 1

Matter, Measurement, and Problem Solving

Christian Madu, Ph.D.
Collin College

If PowerPoint slides are used in class and posted in advance for you to download, print them and bring them to class so you may take notes on them.

COME TO LAB PREPARED:

Do the assigned Advance Study Assignment (ASA) before coming to class. Thoughly read the lab exercise to be conducted and prepare questions to ask regarding anything you don't understand about the procedure. You will need a blue or black ink pen to sign the attendance sheet, a TI-30 calculator, safety glasses on lab days, your notebook and the lab manual. Dress appropriately for lab work, as described on the safety rules. Bring your Z87.1 approved splash resistant safety glasses or goggles. You will not be allowed to be in the lab (and will be marked absent) if you are not dressed appropriately for lab (as described on the safety rules) or if you do not have and wear Z87.1 splash approved safety glasses or goggles while in the lab.

PREPARE FOR EXAMS AND THEN COME TO EXAMS PREPARED:

Study, study and then study some more. The more you study the "luckier" you will be in earning a high grade. If you are ever unsure of what to do on an exam day, check the lab door, 3.66NB, for instructions.

Arrive early:

If you don't have a class immediately prior to the exam, please arrive approximately 15 minutes before your scheduled exam. The attendance sheet will be circulated in the hallway outside the classroom. Note your seat number as you sign the attendance sheet. The seat number will be the four digit number in the middle column, immediately to the left of your signature. It will likely not be your usual seat number. Remember or write down that number, as you will need to know it when you enter the classroom.

Sit in assigned seat:

When instructed to enter the classroom, enter and sit in the seat labeled with your exam seat number.

Follow the instructions of the proctors and hallway monitors:

The proctors assigned to your classroom will walk you through these instructions. It is important that you not try to anticipate what to do next and get ahead of the proctor. Doing so will not result in more exam time. Listen carefully to what they say and follow their instructions so the exam can be promptly started.

Put all materials, including electronic devices, under your seat:

Put all materials other than a pen, pencil and your TI-30 calculator (with its case removed) under your seat. Make sure all chemistry related books, manuals, and notes, as well as rubber bands, PDAs and cell phones,[1] are placed in a closed bag or other opaque covering under your seat and not visible to you or anyone else in the room. It is your responsibility to make sure no one can gain an unfair advantage from material(s) brought with you to the college on exam day. Please note: You are not permitted to have any non-medical electronic devices, notes or other chemistry-related material on your person at any time during exams. If you do not bring a bag or other opaque covering with you on exam day to store your materials under your seat, leave the material(s) at home.

Relax:

The exam will fairly assess the chapters/topics you were told would be on the exam.

[1] Cell phones, PDAs, and similar devices, and their accessories, may not be accessible, accessed or used during the exam for any purpose. (If truly extraordinary circumstances, such as a seriously ill family member, requires the cell phone to be on vibrate, write your name and seat# on the envelope provided by the proctor, who will store the phone on the front desk and provide it to you should it vibrate.)

CHE 104 Lecture Schedule

LEC	DATE*	TOPICS / Readings	TEXTBOOK EXERCISES (Also see MChomework note on right)
1	(05/28)	Course Intro; Ethics, Science and the Scientific Method; MC	
		11.1 Climbing Geckos and Intermolecular Forces	
		11.2 Solids, Liquids, and Gases: A Molecular Comparison	
		11.3 Intermolecular Forces: The Forces That Hold Condensed States Together	49, 51, 55, 57, 59
2		11.4 Intermolecular Forces in Action: Surface Tension, Viscosity, and Capillary Action	61, 63, 65
		11.5 Vaporization and Vapor Pressure	71, 73, 77
		11.6 Sublimation and Fusion	79, 81, 83
		11.7 Heating Curve for Water	
		11.8 Phase Diagrams	85, 86, 87
		11.9 Water: An Extraordinary Substance	91, 93
3	06/02 Note: MAP deadline (see next page)	11.10 Crystalline Solids: Determining Their Structure by X-Ray Crystallography	95, 96
		11.11 Crystalline Solids: Unit Cells and Basic Structures	97, 99, 101
		11.12 Crystalline Solids: The Fundamental Types	105, 107, 109, 111
		11.13 Crystalline Solids: Band Theory	115, 117
4		12.1 Thirsty Solutions: Why You Shouldn't Drink Seawater	1, 2
		12.2 Types of Solutions and Solubility	29, 31
		12.3 Energetics of Solution Formation	35, 37
		12.4 Solution Equilibrium and Factors Affecting Solubility	41, 43
5	(06/04)	12.5 Expressing Solution Concentration	51, 53, 55, 63
		12.6 Colligative Properties: VPL, FPD, BPE, and Osmotic Pressure	70, 71, 73, 77, 79, 83
		12.7 Colligative Properties of Strong Electrolyte Solutions	87, 91, 93
		12.8 Colloids	26, 27, 28
6		13.1 Catching Lizards	1
		13.2 The Rate of a Chemical Reaction	25, 29, 31
		13.3 The Rate Law: The Effect of Concentration on Reaction Rate	35, 37, 39
		13.4 The Integrated Rate Law: The Dependence of Concentration on Time	45, 51, 53
7	06/09	13.5 The Effect of Temperature on Reaction Rate	57, 59, 67, 69
		13.6 Reaction Mechanisms	73, 75, 76
		13.7 Catalysis	78, 79
8		14.1 Fetal Hemoglobin and Equilibrium	1
		14.2 The Concept of Dynamic Equilibrium	2
		14.3 The Equilibrium Constant (*K*)	21, 23, 27
		14.4 Expressing the Equilibrium Constant in Terms of Pressure	31, 32
9	(06/11)	14.5 Heterogeneous Equilibria: Reactions Involving Solids and Liquids	33, 34
		14.6 Calculating the Equilibrium Constant from Measured Equilibrium Conc.	35, 37, 41, 43
		14.7 The Reaction Quotient: Predicting the Direction of Change	47, 48, 49
10		14.8 Finding Equilibrium Concentrations	51, 53, 59, 61
		14.9 Le Châtelier's Principle: System at Equilibrium Response to Disturbances	63, 65, 67, 69, 71

Summer 2014 Semester Details

First day of classes: 5/28
There are no holidays this summer on class days.
Last day of classes: 7/21
Reading Day: NONE
Che 104 Department Exam Day: 7/22
Finals Week: 7/25 (one day during summer)

Occasionally due to classroom space limitations on Dept. Exam Day, another day may be used to give the General Chemistry Departmental Exams.

Do not make vacation or other plans for any part of 5/28-7/25. Exam dates are subject to change.

SYMBOLS USED IN THIS SYLLABUS
S or s = Study. Each time you see the letter it should be a reminder to study. The more you study, the "luckier" you will be come exam time.

Wednesday 02/20 is a JJ Monday. Monday classes meet. Wednesday classes do not meet.NOTE: EXAM 4 IS ON FRIDAY, 7/25.
PLAN ACCORDINGLY

Last day to withdraw without academic penalty is Friday, 06/27

‡ Last Day of Course, 07/25

MC = MasteringChemistry®
= required and graded online homework.
Go to http://MasteringChemistry.com

LOANED CLICKERS – AVOIDING THE STOP

Students who drop or withdraw have 7 days from the drop or withdrawal date to return the Loaned Clicker to avoid the "SC" Science Department stop. For all others, Clickers must be returned and Loan Agreement cancelled by 7/23 at 5pm to avoid an "EQP" Science Dept. equipment registration HOLD being imposed.

Timely Return or Replace the Clicker

LECTURE	DATE*	TOPICS / Readings	TEXTBOOK EXERCISES (Also see Homework note on right)
	06/16	**LECTURE EXAM 1— starts 8:00am**	**Chapters 11, 12 and 13**
11	(06/18)	15.1 Heartburn	1
		15.2 The Nature of Acids and Bases	2, 3
		15.3 Definitions of Acids and Bases	33, 35, 37, 39
		15.4 Acid Strength and the Acid Dissociation Constant (K_a)	41, 43, 44, 45
12		15.5 Autoionization of Water and pH	47, 49, 51, 52
		15.6 Finding the $[H_3O^+]$ and pH of Strong and Weak Acid Solutions	57, 59, 65, 73, 79
		15.7 Base Solutions	81, 87, 89, 93
		15.8 The Acid–Base Properties of Ions and Salts	95, 97, 101, 103
		15.9 Polyprotic Acids	111, 113, 115
13	06/23	15.10 Acid Strength and Molecular Structure	117, 119, 121
		15.11 Lewis Acids and Bases	123, 125, 126
		15.12 Acid Rain	31, 32
14		16.1 The Danger of Antifreeze	1
		16.2 Buffers: Solutions That Resist pH Change	29, 33, 37, 39, 41
		16.3 Buffer Effectiveness: Buffer Range and Buffer Capacity	51, 53, 57, 59
15	(06/25)	16.4 Titrations and pH Curves	61, 63, 67, 71, 83
		16.5 Solubility Equilibria and the Solubility Product Constant	85, 87, 89, 97
16		16.6 Precipitation	103, 105, 107
		16.7 Qualitative Chemical Analysis	25, 26
		16.8 Complex Ion Equilibria	109, 110, 111
	06/30	**LECTURE EXAM 2— starts 8:00am**	**Chapters 14 and 15**
17	(07/02)	17.1 Nature's Heat Tax: You Can't Win and You Can't Break Even	1, 2, 3
		17.2 Spontaneous and Nonspontaneous Processes	27, 28
		17.3 Entropy and the Second Law of Thermodynamics	29, 31, 33
		17.4 Heat Transfer and Changes in the Entropy of the Surroundings	35, 37, 38
		17.5 Gibbs Free Energy	39, 41, 43
18		17.6 Entropy Changes in Chemical Reactions: Calculating $\Delta S°_{rxn}$	45, 47, 49, 51
		17.7 Free Energy Changes in Chemical Reactions: Calculating $\Delta G°_{rxn}$	55, 57, 59, 63
		17.8 Free Energy Changes for Nonstandard States: $\Delta G°_{rxn}$ vs ΔG_{rxn}	65, 67, 68
		17.9 Free Energy and Equilibrium: Relating $\Delta G°_{rxn}$ to the Equilibrium Constant (K)	69, 71, 73, 75
19	07/07	18.1 Pulling the Plug on the Power Grid	1, 2
		18.2 Balancing Oxidation–Reduction Equations	37, 39, 41
		18.3 Voltaic/Galvanic Cells: Generating Electricity from Spontaneous Chemical Rxns	43, 44, 49
20		18.4 Standard Electrode Potentials	45, 47, 51, 53, 61, 63
		18.5 Cell Potential, Free Energy, and the Equilibrium Constant	65, 67, 69, 71
		18.6 Cell Potential and Concentration	73, 75, 77, 81

THE MATHEMATICS & SCIENCE RESOURCE CENTER (MSRC) IS AVAILABLE TO HELP

Tutoring is available free of charge for this course in the Mathematics & Science Resource Center (MSRC). The center also has a computer lab with internet access and a room for quiet study.

How do you get the most out of a tutoring session?

i. *Start right away*. Students who begin tutoring from the beginning of the semester typically do better than those who wait.

ii. *Book your appointments early*. During peak times, you may need to book at least a week in advance to get the times you want. To book your own appointments over the web, first read the instructions on the MSRC web site, then log on to TutorTrac at the URL below.

iii. *Come prepared*. Please bring your class notes and textbook. Look over the reading and try the problems. If you can, bring a list of specific questions. The more you prepare, the more you will get out of the session.

iv. If you miss a class, please get notes from a classmate *before* your session. Tutoring is not a substitute for attending class.

v. MAP: If you are repeating this course (previous grade of "F" or "W"), you are eligible to participate in the Math Advancement Program (MAP) which provides weekly one-on-one tutoring with an experienced tutor. Contrary to the name, MAP also applies to repeated science courses. The deadline to sign up for MAP is Thursday, January 30, 5:00pm. Please see Ms. Michele Doney in room 01.94 NB by *5:00 PM* on January 30 for details.

Contact Information for the MSRC:
Room: 01.94 NB:
Phone: (646) 557-4635
Email: msrc@jjay.cuny.edu

MSRC Website:
http://www.jjay.cuny.edu/academics/592.php

TutorTrac (for scheduling appointments):
https://jjctutortrac.jjay.cuny.edu

21	(07/09)	18.7 Batteries: Using Chemistry to Generate Electricity	83, 85, 87
		18.8 Electrolysis: Driving Nonspontaneous Chemical Reactions with Electricity	89, 95, 99, 100
		18.9 Corrosion: Undesirable Redox Reactions	34, 35, 36
22		19.1 Diagnosing Appendicitis	1
		19.2 The Discovery of Radioactivity	2
		19 .3 Types of Radioactivity	31, 33, 35
		19.4 The Valley of Stability: Predicting the Type of Radioactivity	37, 39, 41
		19.5 Detecting Radioactivity	13
		19.6 The Kinetics of Radioactive Decay and Radiometric Dating	45, 47, 49, 51, 55
	07/14	**LECTURE EXAM 3— starts 8:00am**	**Chapters 16 and 17**
23	(07/16)	19.7 The Discovery of Fission: The Atomic Bomb and Nuclear Power	57
		19.8 Converting Mass to Energy: Mass Defect and Nuclear Binding Energy	65, 67, 69
		19.9 Nuclear Fusion: The Power of the Sun	59, 17, 18
		19.10 Nuclear Transmutation and Transuranium Elements	61, 63, 24, 25, 26
		19.11 The Effects of Radiation on Life	73, 27, 28
		19.12 Radioactivity in Medicine and Other Applications	75, 30
24		24.1 The Colors of Rubies and Emeralds	'---
		24.2 Properties of Transition Metals	17, 18, 19, 20
		24.3 Coordination Compounds	21, 23, 25, 27
25	**07/21**	24.4 Structure and Isomerization	29, 31, 33, 39
		24.5 Bonding in Coordination Compounds	41, 43, 47, 49, 51
		24.6 Applications of Coordination Compounds	53, 55
	(07/23)	**DEPARTMENT EXAM DAY— Lab Exam: starts 8:00am**	**ACS Exam: 2:00-4:00pm**
	07/25‡	**LECTURE EXAM 4— starts 8:00am**	**Chapters 18,19 and 24**

STOP THE STOP

RETURN THE LOANED CLICKER WITHIN SEVEN DAYS OF WITHDRAWING/ DROPPING THE COURSE OR BY DEPARTMENT EXAM DAY, 07/23/14, WHICHEVER OCCURS FIRST

Did you know that an "EQP" Science Equipment/Key Stop (also known as Hold) restricts students from registering, receiving financial aid, requesting transcripts, receiving certification letter of attendance, receiving the diploma, etc.? JJC Policy Reg.017 12/15/12

Email FSheehan@jjay.cuny.edu in advance of the deadline to make arrangements to return the Clicker or submit an identical replacement by the deadline, to cancel your Clicker Loan Agreement.

GOT THE MESSAGE?

We want the clickers back so other students may benefit from their use.

CHE 104 Laboratory / Recitation* Schedule

SESSION	-01L1, -01L2	-01L5	LABORATORY SESSION	LAB MANUAL PGS****
1	05/28	05/29	Introduction, Syllabus, Safety Rules, Emergency Notification Data, Grading, Math Intro, Significant Figures & Scientific Notation, Accuracy of Common Measuring Devices** Introduction to Advance Study Assignments, Lab Drawer Check-In and Equipment **	Handouts & Appendices IV, V
2	06/02	06/03	Rates of Chemical Reactions: Iodination of Acetone **	103 (111)
3	06/04	06/05	Determination of the Equilibrium Constant for a Chemical Reaction **	125 (133)
4	06/09	06/10	Properties of Systems in Equilibrium, Le Chatelier's Principle **	113 (123)
5	06/11	06/12	*Review of Chapters for Monday, June 16, Lecture Exam I (two periods)******	
6	06/16Δ	06/17	Analysis of an Unknown Chloride ** (U)	151 (155)
7	06/18	06/19	Determination of the Solubility Product $Ba(IO_3)_2$ **	143 (149)
8	06/23	06/24	Standardization of a Basic Solution and Determination of Equivalent Mass ** (U)	135 (141)
9	06/25	06/26	*Review of Chapters for Monday,June 30, Lecture Exam II (two periods)* *****	
10	06/30Δ	07/01	Standardization of a Basic Solution and Determination of Equivalent Mass (continued) **	
11	07/02	07/03	Determination of Iron by Reaction with Permanganate: A Redox Titration ** (U)	157 (161)
12	07/07	07/08	Spot Tests for Some Common Anions ** (U)	163 (169)
13	07/09	07/10	*Review of Chapters for Monday, July 14, Lecture Exam III (two periods)* *****	
14	07/14Δ	07/15	Qualitative Analysis of Group I Cations ** (U)	171 (177)
	07/23	07/23	*DEPARTMENTAL COMPREHENSIVE LAB EXAMINATION (STARTS 8:00AM)* ***	

* There are two recitation sessions per week, after lecture, in accordance with the boxed schedule on page one. ** = Must have/wear safety glasses Δ = lab is held after lecture exam

*** The Comprehensive Lab Examination will be held on Departmental Exam Day. The date, 7/23, is subject to change, so plan to be present 7/23 – 7/25. (U) = graded unknown
The Advance Study Assignment (ASA) for each exercise may be found on the page indicated in ( ) and must be completed prior to the scheduled lab.

**** You must be prepared to hand in Advanced Study Assignments (ASA's) at the beginning of the laboratory session. Located at the end of each laboratory exercise in your lab manual, they are designed to assist you in understanding the theoretical principles and mathematical calculations required before you come to the laboratory so that you can work efficiently and-- more importantly-- safely. Failure to submit a completed ASA when requested will result in a severe performance factor penalty. In order to receive full credit on an ASA, you must show all work, including, when applicable, formulas, unit conversions required to use the formulas, significant digits, etc. Do not omit documenting any steps. Note: On Exam Day, scheduled labs will meet but Recitation Sessions will not since classrooms will be used for exams.

*****The instructors will review the chapters which will be the subject of the next exam. It is not a review of the upcoming exam and they will not "teach to the test." Students prepare by learning the chapters' contents.

General Chemistry lab technicians (responsible for all lab preparations, supplies and equipment):
Angela Vuong (Supervising CLT, 03.82.04NB). Karol Alvarez (3.82.02NB, Tue/Thu labs).

Lab Manual: (The lab manual must be brought to each lab session.
JJC Science Dept. General Chemisty CHE 103-104 Customized Laboratory Manual. Cengage Learning Inc. 2013. (ISBN-13: 978-1-285-90999-8)

Other required material (must be brought to each laboratory session):

--- Splash-resistant safety goggles or safety glasses meeting the ANSI Z87.1 standard. All students must wear safety glasses or goggles in lab. Students requiring corrective lenses must wear safety glasses or goggles over the lenses. (Two sizes of safety glasses and large goggles are available at the book store. Ask specifically for Che 103/104 safety glasses at the help desk.)

--- Chemical-resistant gloves.

--- An approved calculators specified in this syllabus. Course professors will use Texas Instruments TI-30XA.

A SIGNED COPY OF THE SAFETY RULES MUST BE TAPED TO THE INSIDE COVER OF YOUR LAB MANUAL