COURSE OUTLINE

NAME OF COURSE: CHEMISTRY

COURSE NUMBER: SCI 502 **WRITTEN / REVISED:** September, 2011

LEVEL OF COURSE: AP **NUMBER OF CREDITS:** SIX (6)

PREREQUISITES: Honors Chemistry or qualifying test.
Concurrent enrollment or completion of Pre-Calculus

GRADE LEVELS OFFERED TO: 11TH AND 12TH

COURSE DESCRIPTION:

Advanced Placement Chemistry is a full year course for the exceptional science student. The course is designed to prepare the student for the AP Chemistry exam. The curriculum covers the equivalent of one full year of college level General Chemistry, comparable to a first year course at a college or university. **AP Chemistry is a rigorous math-based course, with a strong laboratory component.** It is intended for students who have demonstrated a willingness to commit time to studying and completing assignments outside of class, and who have successfully completed a prior high school chemistry course. **This course will meet six periods a week for forty weeks, with at least two periods per week dedicated to the laboratory investigation.**

The course will develop the student's ability to incorporate mathematical skills in the solution of chemistry problems, both through the use of textbook problems and **laboratory activities**. Students must be able to work in **collaboration with their peers and instructor to be successful**. Since the AP Chemistry exam no longer allows the use of calculators, significant emphasis will be placed on developing the student's ability to solve problems through dimensional analysis and estimation. In addition, a large part of the AP exam focuses on the planning and writing of answers to essay questions. Development of student's skills to answer these questions will also be a focus of the course. **The laboratory component of the course, comparable to college level chemistry, requires the student to keep a thorough and accurate ongoing laboratory report notebook.**

Areas of study include, review of 1st year chemistry course topics, thermodynamics, atomic theory, chemical bonding and molecular geometry, kinetics, equilibria, acid-base theory and equilibria, nuclear chemistry, electrochemistry, predicting chemical reactions, and organic nomenclature.

Students are expected to take the AP Chemistry examination in May.

The Following Core Curriculum Content Standards are addressed in this course:

5.1 – Science Practices

5.2 – Physical Science

SPECIFIC BEHAVIORAL OBJECTIVES/PROFICIENCIES AND TIME LINES:

Unit 1- Review of Stoichiometry and Reactions: 4 - 5 weeks

Objectives: The student will be able to:

1. Extend the stoichiometric relations developed in Chemistry 1
2. Solve stoichiometric relations dealing with empirical formulas and relationships
3. Write reactions and predict products
4. Learn and apply the solubility rules
5. Explain the difference between, and be able to write, full molecular, ionic, and net ionic equations
6. Assign oxidation states
7. Write and balance oxidation-reduction equations
8. Solve limiting reagent problems
9. Use the Ideal Gas Law and mole relations to calculate densities and molecular masses of gases
10. Define and calculate molarity, molality, percent composition, weight percent, and mole fraction of various solutions
11. Use chemical equations and the Ideal Gas Equation to solve gas stoichiometry problems
12. Calculate various solution concentrations
13. Describe how to prepare solutions at various concentrations
14. Describe and apply the technique of titration
15. Carry out quantitative mole calculations relating to titration data

Unit 2-Structure of Matter: 5 - 6 weeks

Objectives: The student will be able to:

1. Review the structure of the atom and the evidence leading to the modern quantum mechanical model
2. Review the various bonding forces within the between molecules and their relationship to states, structures, and properties of matter
3. Review the periodic relationships such as atomic radii, ionization energies, electron affinities, etc.
4. Predict nature of bonds based on electro negativities and % ionization character
5. Draw Lewis and resonance structures
6. Relate the linear combinations of atomic orbitals, hybridization of orbitals, and VSEPR theory to molecular structure
7. Use VSEPR theory to predict molecular structure, predict bonding polarities and symmetries, and to predict properties of molecules
8. Review the behavior of matter in the solid, liquid and gaseous state and the kinetic molecular theory
9. Use the relationship between vapor pressure, temperature, and heat of vaporization to determine unknowns
10. Use phase diagrams to identify critical temperatures, critical pressures, normal boiling point, normal melting point and the pressure-temperature relations of substances
11. Determine the intermolecular attractive forces and relate these to the properties of the substance
12. Calculate the density, atomic mass, and dimensions of a close-packed crystalline substance
13. Relate the type of solution to the colligative properties such as freezing point depression and boiling point elevation, calculate molecular mass of the solute

Unit 3-Nuclear Chemistry: **1 week**

Objectives: The student will be able to:

1. Differentiate among the types of radioactive decay
2. Identify the various islands of stability from the periodic table
3. Calculate half-lives and decay rate
4. Complete nuclear decay equations

Unit 4-Acid/Bases and Equilibrium: **6 - 7 weeks**

Objectives: The student will be able to:

1. Predict the direction of realignment after a chemical reaction at equilibrium has been disturbed according to LeChatelier's Principle
2. Calculate the concentrations of species in an equilibrium system after the system has been disturbed and then realigned at a new equilibrium
3. Explain Arrhenius, Bronsted-Lowry and Lewis acid-base theories
4. Write dissociation and ionization equations for acid and base solutions
5. Identify strong and weak acids and bases
6. Calculate percent ionization, pH, pOH, hydronium ion concentration, and hydroxide ion concentration at equilibrium given the concentration and equilibrium constant of a weak acid or base
7. Calculate all in objective #6 when an additional amount of common ion is added to the system
8. Compute the effect of buffers on pH
9. Calculate the solubilities of various substances in aqueous solution using Ksp
10. Calculate the effect of the addition of a common ion and how this will affect precipitation in aqueous solution
11. Interpret heating and cooling curves
12. Sketch titration curves and be able to suggest a suitable indicator for a particular titration
13. Explain the hydrolysis of salts and the effect this has on Ph

Unit 5-Thermodynamics and Kinetics: **5 - 6 weeks**

Objectives: The student will be able to:

1. Define/apply state function, enthalpy change, Hess's Law, heat of formation, heats of vaporization and fusion, and the first law of thermodynamics
2. Differentiate between heat and work and internal energy
3. Define entropy, enthalpy, Gibbs Free Energy, and reaction spontaneity
4. Review the concept and mathematical ways of expressing rate of reaction
5. Calculate the order of reaction and the rate constant from experimental data
6. Apply the concepts of activation energy and catalysts
7. Relate the variables in the Arrhenius equation to the collision theory
8. Identify the rate determining step and reaction mechanism
9. Determine possible mechanisms for a reaction given the rate determining step

Unit 6 - Electrochemistry: 2 - 3 weeks

Objectives: The student will be able to:

1. Describe the electrode notation and terminology for oxidation-reduction reactions
2. Compare and contrast electrolytic and galvanic cells
3. Construct and measure oxidation-reduction reactions in electrolytic and galvanic cells
4. Solve electrochemical problems from reduction potential data and calculate amperage, time or masses needed for electrolytic cells and galvanic cells to operate properly.
5. Use the Nerst Equation to calculate EMF's for nonstandard conditions
6. Relate Gibbs Free Energy change, the cell potential, and equilibrium constant together mathematically

Unit 7-Organic chemistry nomenclature and function groups: 1 week

Objectives: The student will be able to:

1. Identify common names, IUPAC names and structures for commonly used organic materials
2. Identify nomenclature for alkanes, alkenes, Alkynes, alkyl halides, substituted hydrocarbons, alcohols, aldehydes, carboxylic acids, esters, ethers, amines, and amides
3. Draw structural formulas from IUPAC names of organic molecules
4. Name organic molecules from pictures of the structural formula
5. Identify isomers and isomeric forms of organic compounds

Additional topics of study and laboratory activities that will be covered before and after the AP exam as time permits:

1. Transition metals and coordination chemistry
2. Descriptive chemistry
3. Quantitative analysis
4. Separation techniques
5. Preparation and performance of chemical demonstrations
6. Organic reactions

MATERIALS / RESOURCES:

1. Text: Chemistry, *Sixth Edition,* Zumdahl & Zumdahl
   Houghton Mifflin Company 2003

2. Lab Manuals:
   1. Experimental Chemistry, *Sixth Edition,* James F. Hall
      Houghton Mifflin Company 2003
   2. Laboratory Experiments for Advanced Placement Chemistry, Sally Ann Vonderbrink
      Flinn Scientific Inc. 1995
   3. Chemical Princliples in the Laboratory with Qualitative Analysis, Slowinski, Wolsey, Masterton, Brooks/Cole 1997

3. Supplemental Materials:
   1. Online Tutorials, Lab Simulations, and Websites
   2. Teacher generated materials
   3. Assorted audio-video materials

EVALUATION:

The following are the items included in the evaluation of student achievement and the computation of the grade of the student:

1. Tests and quizzes 50%
2. **Lab reports**, Demonstrated Techniques, Research Projects 35%
3. Homework, Assignments, Class preparation/participation 15%

DATE MID-TERM / FINAL REVISED

1. Mid-term – January 2012
2. Final – June 2012

SPECIAL COURSE POLICIES:

As explained in the initial meetings of class, the lab portion of this class is imperative. Each laboratory experiment will run a minimum of 84 minutes per week but many will require additional time. Failure to hand in a laboratory report or maintain a proper lab report notebook will significantly impact your grade.

PERIODIC EVALUATION OF OBJECTIVES AND GUIDE:

Next evaluation due June 2012

High Point Regional High School's curriculum and instruction are aligned to the State's Core Curriculum Content Standards and address the elimination of discrimination by narrowing the achievement gap, by providing equity in educational programs and by providing opportunities for students to interact positively with others regardless of race, creed, color, national origin, ancestry, age, marital status, affectionate or sexual orientation, gender, religion, disability or socioeconomic status.