COURSE OUTLINE

NAME OF COURSE: CHEMISTRY

COURSE NUMBER: SCI 302 **WRITTEN / REVISED:** September, 2011

LEVEL OF COURSE: COLLEGE PREP A **NUMBER OF CREDITS:** SIX (6)

PREREQUISITES: 70 in C. P. Biology A and 70 in C.P. Algebra 1 A or Geometry A and recommended for Algebra 2 A or College Prep Geometry A.

GRADE LEVELS OFFERED TO: 10 -11 -12

COURSE DESCRIPTION:

College Prep Chemistry A is a full year laboratory science course designed primarily for the college bound student who may be majoring in science. The basic theories of Chemistry and their necessary math skills will be reinforced. Applications of the topics will be integrated into the laboratory work, when possible, to allow greater understanding of the course material.

The concepts of Chemistry are introduced by the teacher through lecture and the use of the chalkboard, overhead projector, computer software and/or audio-visual presentation. The concepts are developed during class discussions, homework and laboratory work analysis.

Problem solving is a major part of Chemistry education and so, typically a large portion of the class time is devoted to the methods required for problem solution. Questions used are selected from the text and workbook or created by the instructor. Solutions and answers will be reviewed with the group or individually as class time allows. Students needing more individualized instruction are encouraged to make an appointment with the teacher.

Homework and class work (which includes the writing of laboratory reports) will be the responsibility of the student. Teacher analysis of the skills presented and/or effort shown will allow for evaluation of the student's grade.

Laboratory work time will be scheduled. The topics will usually relate to class lecture. The teacher will demonstrate any new or difficult techniques; however, it is the student's responsibility to read, understand, and question any lab instruction. The qualitative and quantitative aspects of the application of chemical principles is considered extremely important to the development of chemical concepts. Therefore, the student will be required to "write-up" the laboratory reports according to departmental format and/or be evaluated according to their understanding of the concepts.

COURSE OBJECTIVES:

When this Chemistry course has been completed, students should be able to:

a. develop an appreciation for the integral relationship between the properties of matter and its structure.

b. develop an understanding of matter, its changes, energies involved in those changes, reactivity, and stability.

c. recognize the predictability of the periodic properties of the elements.

d. develop a working knowledge of the care, precision, and systematic approach to problem solving.

e. recognize the need for consistency in the conventions of formula and equation writing and the naming of compounds.

CORE CONTENT STANDARDS ADDRESSED:

5.1 - Science Practice

5.2 - Physical Science

SPECIFIC BEHAVIORAL OBJECTIVES/PROFICIENCIES AND TIME LINES:

UNIT 1 – Introduction to Chemistry Time= 1 week

Main topics:

1. What is chemistry?
2. Chemistry and you
3. Scientific method
4. Problem solving (unit conversions)
5. Lab safety

Objectives – Students will be able to:

1. Identify five traditional areas of study in chemistry
2. Identify reasons to study chemistry
3. Identify some areas of research affected by chemistry and describe examples of research in chemistry
4. Distinguish between macroscopic and microscopic views
5. Explain how alchemy laid the groundwork for chemistry
6. Identify three steps in the scientific method
7. Identify a general approach to solving a problem
8. Describe three steps for solving numeric problems
9. Demonstrate safety in the laboratory

UNIT 2 – Matter and Change Time = 1 to 2 weeks

Main topics:

1. Properties of matter
2. Mixtures
3. Elements and compounds
4. Basic chemical changes

Objectives – Students will be able to:

1. Identify physical properties and physical changes
2. Distinguish intensive properties from extensive properties
3. Differentiate among states of matter
4. Classify a sample of matter as a substance or a mixture
5. Distinguish between homogeneous and heterogeneous samples of matter
6. Describe two ways that components of mixtures can be separated
7. Explain the difference between an element and a compound
8. Distinguish between a substance and a mixture
9. Identify the chemical symbols of elements, and name elements, given their symbols
10. Describe what happens during a chemical change
11. Identify four possible clues that a chemical change has taken place
12. Apply the law of conservation of mass/matter to chemical reactions

UNIT 3 – Scientific Measurement Time = 2 to 3 weeks

Main topics:

1. Measurements and uncertainity
2. The International System of Units
3. Conversion Problems
4. Density

Objectives – Students will be able to:

1. Convert measurements to scientific notation
2. Distinguish among the accuracy, precision, and error of a measurement
3. Identify the number of significant figures in a measurement and in the result of a calculation
4. List SI units of measurement and common SI prefixes
5. Distinguish between the mass and weight of an object
6. Convert between Celsius, Fahrenheit and Kelvin temperature scales
7. Construct conversion factors from equivalent measurements
8. Apply the techniques of dimensional analysis to a variety of conversion problems
9. Solve problems by breaking the solution into steps
10. Convert complex units, using dimensional analysis
11. Calculate the density of a material from experimental data
12. Describe how density varies with temperature

UNIT 4 – Atomic Structure Time = 2 to 3 weeks

Main topics:

1. Defining the atom
2. Structure of the nuclear atom
3. Distinguishing among atoms

Objectives – students will be able to:

1. Identify three types of subatomic particles
2. Describe the structure of atoms according to the Rutherford model
3. Explain how isotopes differ from one another
4. Use the atomic number and mass number of an element to find the numbers of protons, electrons, and neutrons
5. Calculate the atomic mass of an element from isotope data

UNIT 5 – Electrons and Atoms Time = 3 to 4 weeks

Main topics:

1. Models of the Atom
2. Electron arrangements in atoms
3. Atomic spectra

Objectives – Students will be able to:

1. Identify inadequacies in the Rutherford atomic model

2. Identify the new assumption in the Bohr model of the atom
3. Describe the energies and positions of electrons according to the quantum mechanical model
4. Describe how the shapes of orbitals at different sublevels vary
5. Describe how to write the electron configuration for an atom
6. Explain why the actual electron configurations for some elements differ from those predicted by the Aufbau principle
7. Describe the relationship between the wavelength and frequency of light
8. Explain how the frequencies of light are related to changes in electron energies
9. Identify the cause of the atomic emission spectrum

UNIT 6 - The Periodic Table – Time = 2 to 3 weeks

Main topics:

1. Organizing the elements
2. Classifying the elements
3. Periodic trends

Objectives – Students will be able to:

1. Explain how elements are organized in a periodic table
2. Compare early and modern periodic tables
3. Identify three broad classes of elements
4. Describe the information in a periodic table
5. Classify elements based on electron configuration
6. Distinguish representative elements and transition metals
7. Describe trends among elements for atomic size
8. Explain how ions form
9. Describe and explain periodic trends for first (and multiple) ionization energy, ionic size, and electronegativity

UNIT – 7 Ionic and Metallic Bonding Time= 2 weeks

Main topics:

1. Ions
1. Ionic bonds
2. Ionic compounds
3. Metallic bonding
4. Metallic compounds

Objectives – Students will be able to:

1. Determine the number of valence electrons in an atom of a representative element
2. Explain the octet rule
3. Describe how cations form
4. Explain how anions form
5. Explain the electrical charge of an ionic compound

6. Describe three properties of ionic compounds
7. Model the valence electrons of metal ions
8. Describe the arrangement of atoms in a metal
9. Explain the importance of alloys

UNIT 8 – Covalent Bonding Time= 2 weeks

Main topics:

1. Molecular compounds
2. Nature of covalent bonding
3. Basic bonding theories
4. Polar bonds
5. Polar molecules
6. molecular shapes

Objectives – Students will be able to:

1. Distinguish molecular compounds from ionic compounds
2. Identify the information a molecular formula provides
3. State a rule that usually tells how many electrons are shared to form a covalent bond
4. Describe how electron dot formulas are used
5. Predict when two atoms are likely to be joined by a double or a triple covalent bond
6. Distinguish between a single covalent bond and other covalent bonds
7. Describe how the strength of a covalent bond is related to its bond dissociation energy
8. Describe how resonance structures explain bonding
9. Identify some exceptions to the octet rule
10. Identify the difference between atomic and molecular orbits
11. Describe how VSEPR theory helps predict the shapes of molecules
12. Describe how electronegativity values determine the charge distribution in a polar bond
13. Describe what happens to polar molecules when placed between oppositely charged metal plates
14. Distinguish intermolecular attractions from ionic bonds and from covalent bonds

UNIT 9 – Chemical Names and Formulas Time= 2 weeks

Main topics:

1. Naming ions
2. Naming and writing formulas for ionic compounds
3. Naming and writing formulas for molecular compounds
4. Naming and writing formulas for acids

Objectives – Students will be able to:

1. Determine the charges of monatomic ions by using the periodic table and write the names of the ions
2. Define a polyatomic ion and write the names and formulas of the most common polyatomic ions
3. Identify the two common endings for the names of most polyatomic ions.
4. Apply the rules for naming and writing formulas for binary ionic compounds
5. Apply the rules for naming and writing formulas for compounds with polyatomic ions
6. Interpret the prefixes in the names of molecular compounds in terms of their chemical formulas
7. Apply the rules for naming and writing formulas for binary molecular compounds
8. Apply three rules for naming acids
9. Apply the rules in reverse to write formulas of acids
10. Apply the rules for naming bases

UNIT 10 – Chemical Quantities Time= 2 to 3 weeks

Main topics:

1. The mole; a measurement of matter
2. Mass-mole relationships
3. Mole-volume realtionships in gases
4. Percent composition
5. Empirical formulas
6. Molecular formulas

Objectives – Students will be able to:

1. Relate Avogadro's number to a mole of a substance
2. Calculate the mass of a mole of any substance
3. Compare and contrast the atomic mass of an element and its molar mass
4. Avogadro's hypothesis
5. Standard temperature and pressure (STP)
6. molar volume of gases
7. Calculate the percent by mass of an element in a compound
8. Interpret an empirical formula
9. Compare and contrast empirical and molecular formulas

UNIT 11 – Chemical Reactions

Time= 2 to 3 weeks

Main topics:

1. Word chemical equations
2. Skeleton equations
3. Balancing equation steps
4. Five types of reactions
5. Products of five reactions
6. Net ionic equations
7. Products in a double replacement reaction

Objectives – Students will be able to:

1. Explain how to write a word equation
2. Describe how to write a skeleton equation
3. List the steps for writing a complete chemical equation
4. Describe the five general types of reactions
5. Predict the products of the five general types of reactions
6. Describe the information found in a net ionic equation
7. Predict the formation of a precipitate in a double-replacement reaction

UNIT 12 – Stoichiometry Time= 2 to 3 weeks

Main topics:

1. Mathmatics of chemical equations
2. Chemical calculations
3. Limiting reagent
4. Percent yield

Objectives – Students will be able to:

1. Interpret balanced chemical equations in terms of interacting moles, representative particles, masses, and gas volume at STP
2. Construct mole ratios from balanced chemical equations and apply these ratios in mole-mole stoichiometric calculations
3. Calculate stoichiometric quantities from balanced chemical equations, using units of moles, mass, representative particles, and volumes of gases at STP
4. Identify and use the limiting reagent in a reaction to calculate the maximum amount of product(s) produced and the amount of excess reagent
5. Calculate theoretical yield, actual yield, or percent yield given the appropriate information

UNIT 13 – Behavior of Gases (Chapter 14) Time= 2 weeks

Main topics:

1. Properities of gases
2. Gas laws
3. Ideal gases
4. mixtures of gases
5. movements of gases

Objectives – Students will be able to:

1. Explain why gases are easier to compress than solids or liquids are
2. Describe the three factors that affect gas pressure
3. Describe the relationship among the temperature, volume, and pressure of a gas
4. Use the combined gas law to solve problems
5. Compute the value of an unknown using the ideal gas law
6. Compare and contrast real and ideal gases
7. Relate the total pressure of a mixture of gases to the partial pressures of the component gases
8. Explain how the molar mass of a gas affects the rate at which the gas diffuses and effuses

UNIT 14 - Solutions (Chapter 16) – Time= 2 weeks

Main topics:

1. Properities of solutions
2. Solution concentrations
3. Basic colligative properties

Objectives – Students will be able to:

1. Identify the factors that determine the rate at which a solute dissolves
2. Identify the units usually used to express the solubility of a solute
3. Identify the factors that determine the mass of solute that will dissolve in a given mass of a solvent
4. Solve problems involving the molarity of a solution
5. Describe the effect of dilution on the total moles of solute in solution
6. Define what is meant by percent by volume [%(v/v)] and percent by mass [%(m/m)]
7. Identify the three colligative properties of solutions
8. Describe why the vapor pressure, freezing point, and boiling point of a solution differ from those properties of the pure solvent.
9. Calculate the molality and mole fraction of a solution

UNIT 15 - Acids, Bases and Salts (Chapter 19) Time= 1 week

Main topics:

1. Acid-base theories
2. Hydrogen ions and acidity
3. Hydroxide ions and basisity
4. Relative strengths of acids and bases

Objectives – Students will be able to:

1. Define the properties of acids and bases
2. Compare and contrast acids and bases as defined by the theories of Arrhenius and Brønsted-Lowry
3. Classify a solution as neutral, acidic, or basic, given the hydrogen-ion or hydroxide-ion concentration
4. Convert hydrogen-ion concentrations into values of pH
5. Describe the purpose of pH indicators

UNIT 16 – Hydrocarbons (Chapter 22) Time= 1 week

Main topics:

1. Hydrocarbons
2. Isomers
3. Saturated vs. unsaturated hydrocarbons

Objectives – Students will be able to:

1. Describe the relationship between number of valence electrons and bonding in carbon
2. Define and describe *alkanes*
3. Relate the polarity of hydrocarbons to their solubility
4. Describe the difference between unsaturated and saturated hydrocarbons
5. Distinguish the structures of alkenes and alkynes
6. Explain why structural isomers have different properties
7. Identify optical isomers

MATERIALS / RESOURCES:

Text: :
Wilbraham, Antony C., et al; Chemistry: Prentice Hall (2009)

Additional text:
Metcalf et al: Modern Chemistry: Holt, Rhinehart, Winston (2009)

Other Labs

1. Now We're Cooking – Calorimetry
2. It 's Only a Phase – Heating Curve
3. Glassware Cutting, Fire Polishing and Bending
4. Shape Matters
5. Synthesis of Soap
6. Polymer Crosslinking
7. Paper Chromatography

Additional Lab Manuals:

Modern Chemistry, Holt, Rinehart & Winston
Chemistry of Common Substances, Silver Burdett
Laboratory Manual for Chemistry, Abco Standard Pub.
Chemistry: An Experimental Science, Freeman & Co.
Laboratory Investigations in Chemistry, Silver Burdett
Introductory Chemistry Lab Manual , Addison Wesley Longman
Chem, Connections To Our Changing World, Prentice Hall

Supplemental Materials

General Chemistry Online
http://antoine.frostburg.edu/chem/senese/101/index.shtml
Website – " The Chemistry Place" ™ www.chemplace.com/intro/russo
Modern Chemistry: Exercises and Experiments
Teacher generated materials and Computer software
Assorted audio-visual materials as indicated and as available on loan or from purchase

Date Mid-term / Final Revised

1. Mid-term – January 2011
2. Final – June 2011

Evaluation:

A. STUDENT PROGRESS:

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	25%
3. Worksheets and homework	25%

B. PERIODIC EVALUATION OF OBJECTIVES AND GUIDE:

Next evaluation due by June 2013.

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.