COURSE OUTLINE

NAME OF COURSE: CHEMISTRY

COURSE NUMBER: SCI 303 **WRITTEN / REVISED:** September, 2011

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

PREREQUISITES: COMPLETION OF ALGEBRA 1 - B WITH A MINIMUM GRADE OF 70%

GRADE LEVELS OFFERED TO: 10-11-12

COURSE DESCRIPTION:

College Prep Chemistry B is a full year laboratory science course designed primarily for the college bound student who will not 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 (when available) 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 - Scientific Practices

5.2 - Physical Science

SPECIFIC BEHAVIORAL OBJECTIVES/PROFICIENCIES AND TIME LINES:

UNIT 1 - ALCHEMY – Atoms, Elements and Compounds Time=10 to 12 weeks

Main topics:

1. Periodic table, atomic number, atomic mass
2. Periodic table, metals, nonmetals, groups
3. Periodic trends in properties
4. Periodic table and number of valence electrons
5. Size and mass of the nucleus
6. Lanthanide and actinide elements
7. Electron configurations
8. Experimental basis for atomic structure
9. Types of bonds: covalent, metallic, ionic
10. Ionic bonds
11. Nuclear forces
12. Nuclear energy
13. Isotope, radioactive isotopes
14. Radioactive decay
15. Damage due to radioactive decay

Objectives – Students will be able to:

1. define matter and chemistry
2. identify lab equipment and safety considerations
3. calculate density, determine an unknown element by density
4. apply chemical symbols and names
5. demonstrate that matter cannot be created or destroyed
6. write chemical reactions to demonstrate the conservation of matter
7. determine periodic trends of element properties
8. predict properties of elements from the periodic table
9. define basic atomic structure
10. demonstrate that the number of protons define an element
11. describe electrons as 2000 times smaller than a proton
12. demonstrate that the number of neutrons defines an isotope
13. demonstrate that the number of electrons determine the chemical properties of the element
14. describe how electrons are arranged in a specific pattern
15. demonstrate that electrons arrange themselves into shells
16. define valence and non-valence electrons
17. explain that when electrons jump or fall between shells there is an absorption or emission of energy
18. explain how atomic stability is related to the neutron/proton ratio
19. explain why an atom is radioactive
20. explain alpha and beta radioactivity

21. calculate changes in atomic mass and atomic number resulting from radioactive decay
22. define nuclear fusion and nucleosynthesis
23. determine patterns and generalizations about substances that conduct electricity
24. demonstrate that chemical bonds hold atoms together
25. define different types on bonds
26. realize that metals tend to lose electrons and nonmetals tend to gain electrons to obtain a noble gas configuration
27. define and apply the “rule of eight” to make new compounds

UNIT 2 - SMELLS – Molecular Structure and Properties Time = 10 to 12 weeks

Main topics:

1. Periodic trends – electronegativity
2. Periodic table – number of valence electrons
3. Covalent bonds
4. Intermolecular forces
5. Lewis dot structures
6. Shape and polarity
7. Random motion of gases
8. Bonding characteristics of carbon
9. Functional groups
10. Ionic bonds
11. Chemical reactions
12. Role of a catalyst
13. Large molecules (polymers)

Objectives – Students will be able to:

1. develop common terminology to describe smells
2. use molecular formulas to predict smells
3. discriminate between molecular formula and structural formula
4. write molecular formulas from structural formulas
5. define functional groups
6. draw structural formulas from molecular formulas using the HONC 1234 rule
7. use Lewis dot structures to prove the HONC 1234 rule
8. use Lewis dot structures to predict number of hydrogens in a molecule
9. use structural information to predict properties of compounds
10. synthesize an ester from an acid and an alcohol and prove that the reaction took place
11. write the ester synthesis reactions
12. recognize that molecular name, structural formula and molecular formula are not always sufficient to predict smell.
13. use ball-and-stick drawings to represent molecules
14. use Lewis dot structures to predict shapes of molecules
15. use actual ball-and-stick molecular models to create basic molecular shapes

16. explain that the shape of a molecule affects its chemical properties
17. form a connection between the shape of a molecule and the way it smells
18. define and identify stringy, flat and round molecules
19. utilize functional group, shape and molecular formula to predict smell
20. define molecules as stable entities that stay intact during phase changes
21. define receptor site model for perceiving smells
22. define polarity and its relationship to smell
23. describe why water is a polar molecule
24. define electronegativity and polarity
25. discuss how shape relates to polarity
26. define the relationship between electronegativity and bonding
27. determine if a bond is ionic, polar covalent or non-polar covalent
28. establish a comprehensive model for molecular smells utilizing the molecular polarity,size, phase and type of bonding

UNIT 3 – WEATHER – Gas Laws and Phase Changes Time = 10 to 12 weeks

Main topics:

1. Mole/number conversions
2. Gas pressure
3. Random motion of gas particles
4. Charles' Law
5. Gay Lussac Law
6. Boyle's Law
7. STP
8. Temperature scales
9. Absolute zero
10. Kinetic theory of gases
11. Temperature and heat

Objectives – Students will be able to:

1. articulate weather as the interaction of the sun's heat, the atmosphere and water
2. describe water phase changes
3. describe precision and proportional relationships
4. demonstrate changes in volume and density from sublimation
5. articulate that phase changes drive the water cycle and thus weather patterns
6. describe phase changes with respect to density and volume changes
7. articulate that thermometers reflect changes in temperature by recording changes in the volume of a liquid
8. calculate Celsius temperatures from Fahrenheit temperatures
9. relate volume changes with density changes
10. define Kelvin temperature, absolute zero and Charles' Law
11. describe the heating curve of water
12. define words relating to phase changes
13. articulate the difference between heat and temperature

14. define air pressure and factors that change air pressure
15. describe the inverse relationship between volume and pressure
16. define and apply Boyle's law
17. define and apply Gay-Lussac's Law
18. describe and apply combined gas laws
19. explain how air moves vertically and laterally in the atmosphere
20. explain air pressure and how a barometer works
21. explain and define Avagadro's number
22. explain and apply the ideal gas law
23. explain cloud formation using gas laws and humidity
24. explain the relationship between temperature and absolute/relative humidity
25. define dew point
26. predict when it will rain based on atmospheric variables

UNIT 4 - TOXINS – Chemical Reactions and Stoichiometry Time = 10 to 12 weeks

Main topics:

1. Balanced chemical equations
2. Mole/number conversions
3. Mass/mole conversions
4. Stoichiometry, relating masses of reactants and products
5. Properties of acids, bases, and salt solutions
6. pH scale
7. Definitions of acids and bases
8. Relationship between pH and hydrogen-ion concentration
9. Solutes and solvents
10. Dissolution at the molecular level
11. Concentration

Objectives – students will be able to:

1. perform concentration calculations and amount calculations
2. define solution, concentration, and molarity.
3. predict the effects of concentration on physical and chemical proprieties
4. define solutions as homogeneous and heterogenus
5. recognize solutes as soluble, partially soluble and insoluble,
6. convert from mass to number of individual items and then more specifically from mass to moles
7. prepare solutions of specific concentrations
8. quantitatively analyze the contents of three unknown solutions to determine if these solutions are safe to drink.
9. interpret and apply chemical notation to describe a chemical reaction
10. relate chemical equations to experience and predict outcomes based on chemical equations
11. distinguish between chemical and physical changes using chemical equations
12. explain that all chemical reactions abide by the conservation of mass

13. explain that balancing equations like mathematical equations is a direct consequence of the conservation of atoms
14. define mechanisms of action of toxins by placing them into two general types of chemical reactions, single replacement and double replacement.
15. describe that some chemical reactions produce a solid product from soluble reactants. predict insoluble products using solubility rules.
16. determine the products of solubility equations and by integrating chemistry principles be able to name, identity charge and formulas of compounds involved.
17. apply coefficients in a solubility reaction to determine the amount of reactants required to produce the most product in a precipitation reaction
18. explain what is a limiting reactant and determine limiting reactants in a particular reaction
19. give a general definition of acid and bases and some examples of each
20. explain the pH scale and recognize that the acidity or alkalinity of a solution depends on the concentration of acid or base
21. give a mathematical definition of pH
22. explain how acids react with bases in neutralization reactions
23. perform titration

1. Sterno Lab (colloids)
2. pH of Common Substances

UNIT 5 - FIRE – Energy and Thermochemistry Time = 10 to 12 weeks

Main topics:

1. Temperature and heat flow
2. Exothermic and endothermic processes
3. Energy associated with phase changes
4. Heat flow problems, specific heat capacity, latent heat
5. Enthalpy of reaction, Hess's law
6. Catalyst
7. Activation Energy

Objectives – Students will be able to:

1. describe fire as the result of a chemical change
2. define heat, fire and energy
3. define exothermic and endothermic
4. explain heat transfer; define heat, internal energy, system and surroundings
5. complete calorimetry measurement
6. quantify heat transfer and explain calories found on food nutritional labels
7. explain the difference between heat and temperature
8. define heat capacity and latent heat
9. articulate conditions necessary for fire
10. identify patterns in combustion reactions
11. predict what materials are combustible based on their chemical make-up
12. define two major types of combustion reactions

13. identify stoichiometry patterns in combustion reactions
14. relate flame to glowing hot gases
15. articulate some of the chemical attributes of good fuel
16. sum up conditions necessary for fire
17. explain explosions
18. explain the differences of exothermic and endothermic reactions using energy diagrams
19. explain activation energy and heat of reaction
20. interpret energy diagrams
21. apply Hess's Law to calculate heats of reaction
22. explain heat of reaction, enthalpy and heat of formation

MATERIALS / RESOURCES:

Text: :
Stacy, Angelica M. ; Coonrod, Jan; and Claesgens, Jennifer,
Living by Chemistry, General chemistry : Key Curriculum Press : 2004

1. **ALCHEMY – Atoms, Elements and Compounds**
2. **SMELLS – Molecular Structure and Properties**
3. **WEATHER – Gas Laws and Phase Changes**
4. **TOXINS – Chemical Reactions and Stoichiometry**
5. **FIRE – Energy and Thermochemistry**

Additional text:
Introductory Chemistry ;A Conceptual Focus, Russo and Silver
Addison Wesley Longman - 2000

Lab Manual: Stacy, Angelica M. ; Coonrod, Jan; and Claesgens, Jennifer,
Living by Chemistry, General chemistry : Key Curriculum Press : 2004

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

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 / Quizzes	40%
2. Lab Reports	30%
3. Worksheets and homework	30%

B. PERIODIC EVALUATION OF OBJECTIVES AND GUIDE:

Next evaluation due by June 2013.

C. SUPPLEMENTARY READINGS AND INSTRUCTORS BIBLIOGRAPHY:

General Chemistry - Problem Solving 1 - Drago- Heath 1984
Daily Assignment Problems in First Year Chemistry - Hannaman - Alpha Publishing - 1985
Chemistry Problems - Newton - Walch Publishing - 1984
Chemistry - Schaum's 3000 Solved Problem's - Schaum - McGraw Hill - 1988
Teacher Resource Package - Merrill for Chemistry A Modern Course – 1998
Chemistry, Connections To Our Changing World – Prentice Hall – 2000

DATE MID-TERM / FINAL REVISED

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

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.