KAP Chemistry
2014-2015

Instructor: Mrs. Kerr

Classroom: Room 305 Danville High School

Email: Lisa.Kerr@danvilleschools.org

Course Overview

- KAP Chemistry meets Monday thru Friday, one block per day 83 minutes. Prerequisites include Physical Science, Biology, Chemistry I, and Algebra II with a B or higher.
- KAP Chemistry is a college level course that is designed to not only provide students with a solid general chemistry education but also to develop the student's abilities in the following areas:

(1) read, understand, and interpret information from a wide variety of sources

(2) use appropriate problem solving skills

(3) use mathematical reasoning in solving problems

(4) complete lab experiments, including data acquisition, interpreting the results and acknowledging the uncertainties associated with the experimental outcome. Students should expect to spend time studying outside of class in order to master the course material.

- An average of two periods/ 1 block per week is spent in the laboratory. Labs vary from prescribed or "cookbook", to limited investigations with some direction, and finally open ended investigations with little or no direction.
- Students are required to compile a portfolio of graded lab reports to show schools when you register for college courses.
- Students are required to take the ACS College General Chemistry Exam in the spring. This will be substituted for your final.

I am confident that this class will challenge you to expand both your knowledge of chemistry and your ability to think critically. It is going to be a great year!

About KAP

Students participating in the KAP program will receive credit for the four following Kenyon courses, totaling **12 semester hours** of college credit:

Chemistry 121 Introductory Chemistry Lecture (0.5 Kenyon units; 4 semester hours)
Chemistry 123 Introductory Chemistry Laboratory (0.25 Kenyon units; 2 semester hours)
Chemistry 124 Biophysical and Medicinal Chemistry (0.5 Kenyon units; 4 semester hours)
Chemistry 125 Biophysical and Medicinal Chemistry (0.25 Kenyon units; 2 semester hours)

Textbook:

Chemistry Principles and Reactions ©2004
5th edition by Masterton and Hurley
ISBN 0-534-40878-8
Brooks/Cole-Thompson Learning, Belmont CA 94002

Materials

You will need the following items for this course:

- 3-ring binder with dividers for notes, handouts, labs and homework
- pencils and pens (pen required for lab)
- TI-84 or TI-83 calculator, or other graphing calculator

Assessments

- Tests will be announced and typically cover one to two chapters of the textbook.
- Quizzes will be given frequently. They may or may not be announced. There will be several pre-lab quizzes required before entry to a lab.
- Homework will be collected at random and will be graded for both completion and correctness.
- Formal lab reports are required and must be compiled into a portfolio of graded lab reports.
- Each report consists of: 20 pts each

Purpose
Materials
Procedure
Table(s) of Data
Computations
Graph(s) of Results
Conclusion (including error analysis)

I grade according to the approved Danville High School Student Handbook.

A= 100%-92%

B= 91%-81%

C= 80%-70%

F< 60%

Late Work and Absence Policy

Late work will be penalized 10% per day late. All late work should be placed in the Absent/Late bin and must be received prior to the unit test to receive credit.
In the case of absence, it is YOUR responsibility to determine any assignments missed and turn them in within the required time. A list of daily assignments and all handouts will be available in the classroom. All work must be made up within the number of days absent unless other arrangements are explicitly approved by me. If you are absent for a lab day, you will be expected to complete the lab outside of regular class time. All missed work must be completed prior to the unit test to receive credit.

Course Outline

- **Review of Fundamentals (10 days)**

1. Measurement, units, and significant figures
2. Inorganic nomenclature
3. Moles, grams, and molecules
4. Empirical formulas, molecular formulas
5. Molarity vs molality (separate quiz)
6. Equation stoichiometry
7. Labs:

    1. Determination of chloride ion concentration in salt water
    2. Determining the empirical formula of a hydrate
    3. Gravimetric analysis of a metal carbonate

- **Bonding (12 days)**

1. Ionic bonding
2. Covalent bonding
3. Polar covalent bonds
4. Electronegativities
5. Lewis structures
6. VSEPR theory
7. Resonance
8. Formal charge
9. Hybridization
10. Sigma and pi bonding
11. Labs:

    1. Molecular model building

- **Spectrophotometry (12 days)**

1. Nature of light
2. Beer's Law
3. Organic nomenclature
4. NMR
5. IR
6. Labs:

    1. Absorption spectra
    2. Beer's law
    3. Synthesis and analysis of a coordination compound
    4. Analysis of an unknown using NMR and IR spectroscopy

- **Electronic Structure and the Periodic Table (10 days)**

1. Nature of light
2. The Bohr Atom
3. The quantum mechanical atom
4. The periodic table and trends in properties of the elements
5. Ions
6. Labs:

    1. Flame tests

- **Graphical Treatment of Experimental Data (5 days)**

1. Direct proportions
2. Direct square proportions
3. Inverse proportions
4. Inverse square proportions 5. Labs:
   1.Relation between the volume of a gas and its pressure

- **Gases (12 days)**

1. Gas laws
2. Ideal gas equation
3. Avogadro's Law
4. Dalton's Law of Partial Pressures
5. Graham's Law of Effusion
6. Kinetic Molecular Theory
7. Real vs. ideal gases
8. Labs:
    1. Molar volume and mass of CO_2
    2. Molar volume of H_2
    3. Determination of molar mass of a volatile liquid
    4. Graham's law of effusion

- **Kinetics (12 days)**

1. Meaning of reaction rate
2. Rate law from initial rate data
3. Integrated rate laws
4. Collision theory of reaction rates
5. Factors affecting the rates of reaction
6. Catalysts
7. Mechanisms
8. Potential energy diagrams
9. Labs:
    1. Factors affecting the rate of a reaction
    2. Determination of the rate law of the Iodine Clock reaction
    3. Rate Law determination of the Crystal Violet reaction

- **Equilibrium (15 days)**

1. The nature of equilibrium
2. The equilibrium constants KC and KP
3. LeChatelier's principle 4. Labs:
    1. Pop-bead equilibrium
    2. Determining the KC of the FeSCN2+ equilibrium
    3. LeChatelier's Principle

- **Solubility Equilibria (5 days)**

1. The solubility product, Ksp
2. The common ion effect
3. Solubility rules
4. Labs:
    1. Micro-progressive precipitation
    2. Ksp of calcium hydroxide
    3. Qualitative analysis of cations and anions

- **Acid-base Equilibria (15 days)**

1. Acid-base models: Arrhenius, Bronsted/Lowry, Lewis
2. Strong acids and bases
3. Kw
4. pH, pOH
5. weak acids and bases, Ka and Kb

6. Hydrolysis
7. Buffers
8. Henderson-Hasselbalch equation
9. Indicators
10. Titrations
11. Labs:
    1. Hydrolysis of salts
    2. Buffers
    3. Titration of a strong acid and strong base
    4. Titration of a weak acid with a strong base to find the % acid in vinegar

- **Thermodynamics (15 days)**

1. Nature of heat and heat flow
2. First Law of Thermodynamics
3. Calorimetry
4. Enthalpy
5. Hess's Law
6. Heats of formation and heats of reaction
7. Entropy
8. Second Law of Thermodynamics
9. Free Energy 10. The equilibrium constant
11. Labs:
    1. Hess's Law
    2. Urea solubility thermodynamics

- **Electrochemistry (15 days)**

1. Oxidation-reduction reactions
2. Redox-titrations
3. Electrolysis
4. Electrochemical cells
5. Cell potentials
6. Nernst equation
7. Labs:
    1. Mass % of commercial hydrogen peroxide solution
    2. Voltaic cells
    3. Electrolysis of $CuCl_2$

- **Liquids and Solids (5 days)**

1. Bonding
2. Intermolecular forces
3. Changes in state
4. Heating and cooling curves

5. Vapor pressure curves
6. Phase diagrams
7. Labs
    1. Separation and identification of amino acids
    2. Heat and changes of state

- **Colligative Properties of Solutions (5 days)**

1. Concentration units: molarity, molality
2. Solubility curves
3. Colligative properties of solutions
4. Labs:
    1. Boiling point elevation and freezing point depression

- **The Nucleus (5 days)**

1. Radioactive decay
2. Transformation rules
3. Artificial transformations
4. Decay rate and half life
5. Labs:
    1. Nuclear decay rate simulation (virtual lab)

- **Organic Chemistry (5 days)**

1. Nomenclature
2. Functional groups
3. Labs
1. Synthesis and analysis of aspirin

All provisions of the syllabus are subject to change at the instructor's discretion – students will be notified of any changes.