

This course was submitted to UC Doorways for approval 6/29/2010

FAME Public Charter School A-G Course Template

Course Title: a-g Chemistry

Prerequisites: Algebra 1 with a C or better

Recommended Co-Requisite: Algebra 2

Brief Course Description - Briefly (in a short paragraph) describe the course focusing on content. This should look like something you would see in a course catalog. Type the information in the text box below. All text boxes will expand as needed.

This course centers on the study of the science of Chemistry. Through investigation and activities, students gain firsthand experience with such learning skills and processes as observing, classifying, identifying, measuring, inferring, hypothesizing, interpreting, and predicting. Students will develop an understanding of the diversity of matter and energy, will gain firsthand experience with descriptive chemistry as well as the mechanics of chemistry and the composition of the periodic table. Students will complete chemistry labs relevant to the topics studied and complete lab reports. The labs are designed to promote technical lab competence, utilize the scientific process of research and reporting, and teach and reinforce scientific concepts. Students will also complete a semester term paper on a chosen topic.

Textbooks

Include list of Primary and Secondary Texts. Make sure to note the books that will be read entirely and those that will be as excerpts. Textbook information is not necessary if your course is a Visual and Performing Arts course. Online texts or non-standard text materials should include a link to the online text.

Title: Holt Modern Chemistry

ISBN: 0030367867

Edition:

Publication Date: 2009

Publisher: Holt, Reinhart, Winston

Author(s): Raymond E. Davis, Regina Frey, Mickey Sarquis, and Jerry L. Sarquis

URL Resource(s):

or

Title: Chemistry

ISBN: 0132512106

Edition:

Publication Date: 2008

Publisher: Prentice Hall

Author(s): Dennis D. Staley, Michael S. Matta, Edward L. Waterman, and Antony C. Wilbraham

URL Resource(s):

Supplemental Instructional Materials - Please describe. If using online text or non-standard material, please provide the title of the material or webpage and the URL link.

Introductory Chemistry Kit #3 - eScience Lab Company (order number - KIT4003)
Chemistry Lab Manual (comes on CD Rom with the kit) - eScience Lab Company
Go to www.esciencelabs.com for pricing

Teacher's Edition ISBN for Holt Chemistry: 0030367875

Teacher's Edition ISBN for Prentice Hall Chemistry: 0132512114

Course Objectives – what the students will know at the end of the course

The course content teaches the behavior of matter in terms of:

The Science of Chemistry

Matter and Energy

Atomic Structure and Electron Configuration

The Periodic Table

Ionic Compounds

Covalent Bonds and Molecular Forces

Carbon and Organic Compounds

The Mole

Stoichiometry

Causes of Change

Gases and Liquids

Solutions

Chemical Equilibrium

Acids and Bases

Reaction Rates

Electrochemistry

Nuclear Chemistry

Course Goals and Major Student Outcomes – what the students will be able to do at the end of the course

Student will work towards mastering California State Chemistry Content Standards. Student understanding of the standards will be measured by teachers, working collaboratively, to consider the multifaceted view of what constitutes a mature understanding of concepts. Upon completion of the course student will understand that:

1. The periodic table displays the elements in increasing atomic number and shows how periodicity of the physical and chemical properties of the elements relates to atomic structure. As a basis for understanding this concept:
2. Biological, chemical, and physical properties of matter result from the ability of atoms to form bonds from electrostatic forces between electrons and protons and between atoms and molecules.
3. The conservation of atoms in chemical reactions leads to the principle of conservation of matter and the ability to calculate the mass of products and reactants.
4. The kinetic molecular theory describes the motion of atoms and molecules and explains the properties of gases.
5. Acids, bases, and salts are three classes of compounds that form ions in water solutions.
6. Solutions are homogeneous mixtures of two or more substances.
7. Energy is exchanged or transformed in all chemical reactions and physical changes of matter.
8. Chemical reaction rates depend on factors that influence the frequency of collision of reactant molecules.
9. Chemical equilibrium is a dynamic process at the molecular level.
10. The bonding characteristics of carbon allow the formation of many different organic molecules of varied sizes, shapes, and chemical properties and provide the biochemical basis of life.

11. Nuclear processes are those in which an atomic nucleus changes, including radioactive decay of naturally occurring and human-made isotopes, nuclear fission, and nuclear fusion.

Course Outline by Units of Study – the content you will cover arranged in units

Course Outline

1. The Science of Chemistry

- a. What is chemistry?
- b. What is matter?
- c. What is the nature of matter?
- d. How is matter classified?

2. Matter and Energy

- a. What is energy?
- b. What is the process of science?
- c. How do chemicals measure quantities?

3. Atomic Structure and Electron Configuration

- a. How do we know atoms exist?
- b. What is the internal structure of atoms?
- c. How are an atom's electrons configured?

4. Periodic Table

- a. What makes a group of elements
- b. What gives metals their distinctive properties?
- c. What trends are found in the periodic table?
- d. Where did the element come from?

5. Ionic Compounds

- a. How are ions different from atoms?
- b. What hold a salt together?
- c. What are the polyatomic ions?

6. Covalent Bonds and Molecular Forces

- a. Why do some atoms form covalent bonds?
- b. How are molecules depicted?
- c. How are molecular shapes determined?
- d. What forces exist between molecules?

7. Carbon and Organic Compounds

- a. What kinds of covalent compounds can carbon form?
- b. How are carbon compounds named and drawn?
- c. What is a polymer?

8. The Molecule

- a. How are atoms counted and measured?
- b. How is the molecular concept related to chemical formulas?

9. Chemical Equations

- a. What is a chemical reaction?
- b. How are chemical equations for reactions written?
- c. What does a chemical equations tell you?
- d. How are chemical reactions classified?

10. Stoichiometry

- a. How much can a reaction produce?

- b. How much does a reaction really produce?
- c. How can Stoichiometry be used?
- 11. Causes of Change
 - a. How does heat differ from other forms of energy?
 - b. How does temperature affect enthalpy and entropy?
 - c. What happens during a change of state?
 - d. How does thermodynamics apply to reactions and nutrition?
- 12. Gases and Liquids
 - a. What are the characteristics of gases?
 - b. What behaviors are described by the gas laws?
 - c. How do the gas laws fit together?
 - d. What conditions will cause a gas to condense?
- 13. Solutions
 - a. What is a solution?
 - b. Does substance A dissolve in substance B?
 - c. What causes conductivity in solutions?
 - d. How are a liquid's properties changed by solutes?
- 14. Chemical Equilibrium
 - a. What is an equilibrium system?
 - b. How is equilibrium measured?
- 15. Acids and Bases
 - a. What are acids and bases?
 - b. Can the strengths of acids and bases be quantified?
 - c. How are acidity and pH related?
 - d. What is a titration?
- 16. Reaction Rates
 - a. What is a reaction rate?
 - b. How can reaction rates be explained?
 - c. How do catalysts change the rates of chemical reactions?
- 17. Electrochemistry
 - a. What is electrochemistry all about?
 - b. How are electrolytic cells used?
 - c. How do batteries work?
 - d. What can be learned from an equilibrium cell?
- 18. Nuclear Chemistry
 - a. Which atomic nuclei are stable?
 - b. What kinds of nuclear change occur?
 - c. How is nuclear chemistry used?

Key Assignments

In addition to chapter readings, assignments, quizzes, and tests, students will complete the following:

I. A total of 24 labs must be completed. All questions that are presented in the laboratory manuals must be completed and a thorough write up of each of the 24 labs must be submitted and retained in the student's portfolio.

II. Research Projects: Students will complete one research project each semester on an environmental topic related to their chemistry studies. The instructor must approve the topic in advance. Some examples of topics include: the chemistry behind hybrid vehicles, water chemistry as it relates to water pollution, the use of chemistry as it creates or alleviates environmental issues. The following components of this project are required to be completed and turned in by the end of each semester.

1. 5-7 page research paper in MLA format including a reference page with no less than 3 sources.
2. A visual representation of the project. Here are some examples:
 - a. A three dimensional model
 - b. A Power Point presentation
 - c. A video presentation, an interview or demonstration
 - d. A lab demonstration and explanation
3. An oral presentation explaining the major ideas expressed in the research paper using the visual representation to assist in teaching the audience the concepts studied.

III. One lab project each semester where the student works with a partner designing and testing a hypothesis. A full lab write up explaining the process and a presentation is required.

Laboratory Activities

Laboratories are an essential, integral part of any chemistry course. Each student must participate in the laboratory to fully reach the course objectives and to receive credit for laboratory assignments. Students will be expected to complete written laboratory reports from the 258 page lab manual listed in the support materials section as well as assigned one substantial lab project each semester where the students will be designing and testing their own hypothesis. The 24 required labs from the required kit and their objectives and activity descriptions are as follows:

Lab 1: Introduction and Safety

- Learn how work to safely in the chemical laboratory
- Learn when and how to use the safety equipment in the chemical laboratory
- Learn the names of the equipment used in the experiments

Lab 2: Scientific Methods

- Make testable observations using the tables and graphs provided
- Write up a hypothesis and null hypothesis for a variety of case scenarios
- Explain the steps and conduct a successful experiment
- Describe the role of variables and control in an experiment
- Demonstrate organized data collection and successful analysis

Lab 3: Measurements

- Learn how to use significant figures and understand their importance
- Make effective and useful measurements in a chemistry lab using the proper equipment
- Convert measurements as assigned in lab manual making accurate calculations using the tables provided
- Become familiar with the relationship between volume and mass and density and calculate density using linear measurements and water displacement methods

Lab 4: Properties of Matter – Density

- List the chemical properties of substances

- Determine the densities of a variety of items using the density formula
- Apply the density concept by measuring the density of various plastics and making a density gradient column

Lab 5: Mixtures and Solutions

- Use physical properties to separate the heterogeneous and homogeneous components of a variety of mixtures
- Use laboratory techniques to separate the components of a mixture

Lab 6: Chemical and Physical Change

- Recognize the differences between chemical and physical changes
- After preparing two solutions (aspirin and water, aspirin and NaHCO_3) in the lab observe and record the data regarding the changes that take place under a variety of conditions.

Lab 7: Heat and Calorimetry

- Read about specific heat, its relationship to caloric measurement and the equation for measuring kcals
- Calculate the caloric content of a number of food samples using the lab set up provided and compare the results across food items

Lab 8: Chemical Processes

- Understand the difference between endothermic and exothermic processes through the measurement of temperatures of the contents of a cold pack and hand warmer over time. Calculate the overall temperature change and graph the data
- Understand the concept of enthalpy and be able to explain which substance demonstrated the greatest change in enthalpy

Lab 9: Electron Configuration

- Observe energy emitted from different energy levels when salt compounds are ignited
- Using four different lab solutions and the equipment provided observe the color changes then be able to explain what produces different colors in fireworks

Lab 10: Light Spectrum

- Understand the meaning of all the terms associated with the lab regarding light spectrum and complete all practice problems using the “grating equation.”
- Using lab equipment and lab techniques determine the wavelength measurement of a red laser light.

Lab 11: Molecular Models

- Create a molecular model based on knowledge of particular molecular shapes
- Determine the shapes and bond angles of various molecules using the VSEPR model

Lab 12: Ionic and Covalent Bonds

- Explain the differences between ionic and covalent bonding
- Link ionic and covalent bonding with the physical properties of matter using the nail test lab and the melting point lab for information and data collection

Lab 13: Polar Bonding

- Compare and contrast the chemical bonding properties of slime and silly putty
- Develop an experimental hypothesis regarding polar and non-polar bonding, test the hypothesis and report the results
- Conduct a chromatography lab experiment and explain how chromatography is used to separate the components of a mixture

Lab 14: Chemical Reactions I

- Understand qualitative tests for ions that are based on solubility

- Learn that Na^+ , K^+ , NH_4^+ , NO_3^- , and CH_3COO^- are water soluble
- Recognize balanced chemical equations
- Conduct qualitative tests for fluoride ions in mouth rinses using the equipment and techniques provided

Lab 15: Chemical Reactions II

- Observe chemical reactions, combustion, synthesis, decomposition and double reaction, and be able to identify the reactants and products
- Create a data chart with will classify types of chemical reactions and their products
- Practice balancing chemical equations

Lab 16: Metals and Oxidation

- Observe an oxidation-reduction reaction
- Use the properties of a reaction product to verify its identity
- Rank the reactivity of certain metals in a weak acid, and compare it to their order in the Activity Series of Metals

Lab 17: The Mole and Avogadro's Number

- Understand the importance of Avogadro's Number in the measurement of moles; understand and know where to find and calculate atomic weight and molar mass using the equations and lab techniques provided
- Approximate the value of Avogadro's Number by conducting the lab provided

Lab 18: The Periodic Table

- Understand the periodic table and its uses
- Relate the characteristics within a group on the periodic table
- Calculate mass and moles using the data given and by using the recorded data from the chemical reactions observed in the lab.

Lab 19: Stoichiometry

- Demonstrate the use of stoichiometry to synthesize calcium carbonate
- Find the limiting reagent, the theoretical yield, and the percent yield

Lab 20: Ideal Gas Law Objectives

- Use the ideal gas law to determine the percentage of hydrogen peroxide in a commercially available hydrogen peroxide solution
- Observe how a catalyst affects a reaction
- Determine the decomposition rate of the hydrogen peroxide solution

Lab 21 – Reaction Rate

- Conduct five reaction activities recording the data for each. Calculate the reaction rates and the compare the results for an understanding of how temperature, surface area, and concentration influence the rate of a reaction
- Be able to explain the reaction rates on a molecular level

Lab 22: Catalysts

- Use peroxide and a variety of catalysts to determine and evaluate reaction rates
- Classify the catalysts as heterogeneous and homogeneous
- Explain how varying quantities of a catalyst affect the reaction

Lab 23: Acids and Bases

- Understand pH and its logarithmic scale as well as the properties and reactions of acids, bases and neutrals
- Observe the neutralization of various acids and based using a grape juice indicator. Test various household items for their acidity or alkalinity

Lab 24: Titration

- Demonstrate an understanding of the process of titration.
- Use titration with a standard Na_2CO_3 solution to determine whether SweeTarts® or Smarties® candies requires more standard base per gram of candy to reach the endpoint.
- Use titration with a standard Na_2CO_3 solution to determine whether SweeTarts® or Smarties® candies has more moles of acid per gram of candy.

Instructional Methods and Strategies

Students will be expected to develop and present work as described in the lab activities section and under the key assignments section as well as those required in the textbook/curriculum used. Students will work independently through the text as a primary resource. In order to support this process teachers may provide each student:

- *Direct instruction in the form of lecture
- *Opportunities to discuss and define complex issues orally or via email
- *Modeling of activities and expected outcomes
- *A variety of print and non-print resources including the use of technology as a research tool
- *Modeling of study strategies appropriate for different learning styles
- *Discussions around points of view
- *Opportunities to summarize, analyze, compare/contrast, describe, classify, and persuade
- *Opportunities for practice in preparation for presentations

Assessment Methods and Strategies

A variety of assessment tools may be used. Written work, as described in the key assignments, will be graded using a standard rubric. Assessment tools include but are not limited to:

- Criterion based chapter tests and quizzes
- Quizzes, mid-term and end of semester exams
- Laboratory journals and tests
- Teacher observation
- Student self-evaluation
- Surveys and questionnaires
- Research reports

Comments provided by UC as to why course was not approved.

Comments: You told us what was done but did not tell us the process; for instance, Lab 21 – Reaction Rate

- Understand how temperature, surface area, and concentration influence the rate of a reaction
- Relate reaction rates on a molecular level

There is no information on how this is done.

Please furnish some examples of the research paper project.