a-g CHEMISTRY A & B

COURSE TITLE/ TRANSCRIPT CODE

a-g Chemistry A 6E1003
a-g Chemistry B 6E1010

COURSE DESCRIPTION

This Chemistry course is designed to give students the fundamental knowledge, analytical abilities, and laboratory skills necessary for applying and understanding inorganic chemical reactions, carbon and organic compounds, and biological chemistry. Students will cover the concepts of atomic and molecular structure, energy and matter, moles, bonding, stoichiometry, chemical equilibrium, ionic and covalent compounds, gasses, solutions, acids and bases, redox and nuclear chemistry, and thermodynamics.
The purpose of this course is to expose students to a greater depth in the physical science of chemical reactions. The fundamental theories and laboratory techniques covered in this course will provide students with solid foundation so that will better enable them to explore other scientific fields, such as biology, physics, and geosciences. Students will demonstrate their critical thinking ability by answering analytical questions from their textbook and selected lab activities.

PREQUISITES: Completion of Algebra 1 with a grade of "C" or better.

REQUIRED TEXTBOOK: HOLT CALIFORNIA CHEMISTRY; 2007; Holt, Rinehart and Winston

SUPPLEMENTAL INSTRUCTIONAL MATERIALS: CHEMISTRY LAB KIT by Quality Science Labs

COURSE PURPOSE

In this course students will:
- be exposed to a greater depth in the physical science of chemical reactions.
- demonstrate their understanding of fundamental theories.
- demonstrate appropriate laboratory techniques.
- apply the scientific method.
- be provided with a solid foundation that will better enable them to explore other scientific fields, such as biology, physics, and geosciences.
- master the California Chemistry Content Standards.
- demonstrate their critical thinking ability by answering analytical questions from the textbook and selected lab activities.

COURSE OUTLINE

Chapter content and California Science Content Standards covered.

Chapter 1 – This chapter introduces students to the study of chemistry. The students will learn about three states of matter. They will also learn about physical and chemical properties and changes in matter. The SI system of measurement is introduced along with conversion factors to convert one unit of measure to another. The concept of density is also presented. Finally the classification of matter

introduces the concepts of atoms, elements, molecules, compounds, and mixture. (2d, 7b, IE1g)

Chapter 2 – In section 1 of this chapter, students learn that all changes in matter involve a change of energy but that the amount of energy in a system is conserved during any chemical or physical change. The difference between heat and temperature is also explained. The scientific method is described in Section 2 and the definitions for theory and scientific laws are given. Students also learn that experiments must be controlled in order to draw valid conclusions from the data produced. Finally, in Section 3, students are introduced to accuracy precision, significant figures and scientific notation. (4e, 4f, 7a, 7b, 7d, IE1a, IE1b, IE1c, IE1d, IE1e, IE1f, IE1j)

Chapter 3 – The chapter begins with historical evidence for the existence of atoms and Dalton's model for the structure of the atom. The chapter continues with descriptions of the experiments of Thomson, Rutherford, and Bohr. These scientists and other scientists revised and refined the model of the atom to the quantum model of today. The nuclear structure of the atom is also explained in the chapter and students learn to write electron configurations. Finally, the mole is introduced as a way of counting particles. (1a, 1e, 3b, 3c, 3d, IE1g, IE1k, IE1n)

Chapter 4 – This chapter traces the historical development of the periodic table, including the modern periodic table. Students will learn how the periodic table orders elements by increasing atomic number and properties of elements. Certain groups of elements with distinctive characteristics will be examined. Students will learn how to use the periodic table to predict properties and trends of groups and periods. Students will also lean how one element can change to another element when nuclear changes occur. (1a, 1b, 1c, 1d, 1f, 1g, 2g)

Chapter 5 – This chapter introduces students to ions and ionic compounds. Students will learn how ions are formed from their atoms, how ions bond to form ionic compounds, how to identify ionic compounds, how to identify ionic compounds by their properties and how to name and write the formulas for ionic compounds. (1d, 1g, 2a, 2c, 2g, 7b)

Chapter 6 – This chapter introduces covalent compounds. Students will earn how covalent bonds form, how ionic and covalent substances differ, how to draw and name covalent compounds, and how the shape of a molecule affects its properties. (1c, 2a, 2b, 2e, 2f, 2g, 2h)

Chapter 7 - This chapter introduces the mole and used Avogadro's number to convert between the amount in mole s and the number of particles. Students will solve problems using moles, particles and molar mass. They will relate moles to chemical formulas and determining molar mass. Empirical and molecular formulas are also determined from percentage composition and formulas mass, and percentage composition is derived from empirical and molecular formulas. (3b, 3c, 3d, IE1e, IE1m)

Chapter 8 – This chapter examines different types of evidence of chemical reactions. Students learn to describe chemical reactions by using word equations and unbalanced and balanced formula equations. Students learn how mass is conserved in chemical reactions and how to relate conservation of mass to a balanced equation. Different types of chemical reactions are described, and students learn to predict

products for each type. Students also learn to distinguish between and write total and net ionic equations. (3a)

Chapter 9 – This chapter discusses the use of a balanced chemical equation to determine quantities of one of more substances involving in a reaction. Mole ratios from the balanced equation are the basis for all of these stoichiometry problems. Stoichiometry problems can involve amount in moles, number of particles, volume, and mass. Other concepts presented include finding limiting reactants, theoretical yield, and percentage yield. The last section of the chapter applies stoichiometric concepts to cars, especially in air bags, engine efficiency, and pollution generation and control. (3e, 3f, IE1l)

Chapter 10 – In this chapter, students are introduced to thermodynamics. In Section 1, the differences between heat and temperate are explored and enthalpy is defined. In Section 2, enthalpy change is described and thermodynamics is defined. Section 3 describes how enthalpy changed during a reaction and Hess's Law. Section 4 describes entropy and Gibbs energy. (7a, 7b, 7d, 7e, 7f, IE1m)

Chapter 11 – This chapter describes the states of solid, liquid, and gas and the changes from one state to another. It relates the properties of state of its energy content and particle arrangement. The forces and energy changes involved in the change of state are also examined. Intermolecular forces, such as hydrogen bonds and London forces, are studied. Students will learn about energy that is involved in state changes. Topics such as enthalpy and entropy are covered, as well as their application in calculating melting and boiling points and how they are affect by pressure. Students will learn about phase equilibrium, including interpreting phase diagrams. (2d, 3h, 4c, 7c, 7d, 7f)

Chapter 12 – This chapter focuses on one specific state of matter – gasses. In studying this chapter, students will become familiar with the characteristics of gases such as compressibility and density. The concept of pressure is explained, as well as standard conditions. The kinetic-molecular theory is introduced. A large portion of this chapter is devoted to developing the mathematical relationships between pressure, volume, temperature and amount of gas by mans of the gas laws. The final section of the chapter develops molar relationships for gases, among them the ideal gas law and stoichiometry. (3d, 4a, 4b, 4c, 4d, 4g, 4h, 4i)

Chapter 13 – This chapter introduces students to mixture and solutions. Molarity is defined and students are told that it is the most commonly used measure of concentration in chemistry. Students learn how to calculate morality and learn how to use morality when solving stoichiometry problems. Factors that affect solubility and the dissolving process are described, and the concept of saturation is explained. Finally, properties of solutions such as electrical conductivity and colligative properties are described and explained. (5a, 6a, 6b, 6c, 6d, 6e, 6f, IE1a)

Chapter 14 – This chapter introduces student to chemical equilibrium. Students will learn that chemical equilibrium is dynamic and involves processes that proceed in opposite directions at the same rate. They will also learn how stress on a system in equilibrium causes the system to adjust to establish a new equilibrium that relieves the stress. (7b, 9a, 9b, 9c, IE1m)

Chapter 15 – The chapter begins by defining acids and bases according to the Arrhenius and Bronsted-Lowry definitions. Students will learn the significance of the self-ionizing of water and how pH is used to measure the acidity or basicity of solutions. They will understand the meaning of neutralizations, lean how to carry out a titration, and make calculation based on titration data. The acid-ionization constant and buffer solutions will be introduced. (5a, 5b, 5c, 5d, 5e, 5f, 5g, IE1e)

Chapter 16 – In this chapter, students will define the rate of a reaction and learn what factors affect the rate. They will learn that activation energy determines the speed of a reaction and how catalysts, including enzymes, operate to lower the activation energy. (8a, 8b, 8c, 8d)

Chapter 17 – This chapter introduces students to electrochemistry. Students learn about the process of oxidation and lean how to assign oxidation number to atoms. Students also learn how to recognize redox reactions and to balance them using half-reactions. Students then learn the basic components of electrochemical cells. Students study several examples of galvanic cells and lean how to calculate the voltage of a cell. Finally, students study several examples of electrolytic cells, including those used in electrolysis and electroplating. (3g, IE1m)

Chapter 18 – This chapter explores the area of nuclear chemistry. In Section 1, students learn about the binding energy of nuclei and how it is related to nuclear stability. Rules for predicting nuclear stability are also given. In Section 2, students learn about different types of nuclear change. Students also learn about the particles and electromagnetic waves that are produced by radioactive decay and how to balance nuclear equations. Section 3 describes the applications of nuclear chemistry, such as radioactive dating and nuclear medicine. (1e, 11a, 11b, 11c, 11d, 11e, 11f, 11g, IE1i)

Chapter 19 - This chapter explores carbon and organic compounds. In section 1, students learn about compounds of carbon. In section 2, students learn about the names and structures of organic compounds. Section 3 explores organic reactions. (2b, 10a, 10b, 10d, 10e)

Chapter 20 - In this chapter students explore biological chemistry. In Section 1 students explore carbohydrates and lipids (what they are, how they are classified, how sugars are combined by condensation and broken down by hydrolysis, etc.) In section 2, students learn about proteins (amino acids, identity of R, condensation of amino acids, the form and function of proteins.) Section 3 describes nucleic acids, what they are made of, DNA, encoding genetic information, and gene technologies (fingerprinting, cloning, recombinant DNA, etc.) (2b, 8c, 10a, 10b, 10c, 10f, IE1l)

LABORATORY ACTIVITIES –
Required laboratory activities for this course include, but are not limited to, the following MicroChem Chemistry Laboratory Activities (Quality Science Lab Manual):

Paper Chromatography – the purpose of this lab is to gain an understanding of chromatography and to observe the separation of metal ions and the components of ink.

Melting Points and Super Cooling – The purpose of this lab is to measure the melting points of two organic

compounds and observe the super cooling of a liquid.

Electrical Conductivity of Several Solutions – The purpose of this lab is observe the conductivity of solutions of salts, strong acids or strong bases that have a high degree of dissociations, and well as weak acids or bases that have a lower degree of dissociation. In addition, students will observe the conductivity of an organic solution and an organic liquid.

Mole Ratios – Students will observe mole ratios and simple reactions. In addition, they will observe excess reactants and limiting reactants.

Double Replacement Reactions – Students will gain a better understanding of double replacement reactions and become aware that reactions go to completion when one of the products is removed.

Oxidation-Reduction Lab – Students will evaluate reactions of copper nitrate, lead nitrate and zinc nitrate in an effort to illustrate single replacement reactions, redox reactions, and the reactivity of some metals.

Decomposition – Students will observe the decomposition of H2O and NaCl. In this lab, students will be able to distinguish exothermic from endothermic reactions, and become aware of a stepwise reaction.

Boyle's Law – In this lab, student will observe the relationship between the pressure and volume of an enclosed gas and use one method of correction fro atmospheric pressure.

Charles's Law – Students will observe the relationship between temperature and the volume of a gas and estimate absolute zero by extrapolation.

Solubility Product Constant – Students will estimate the solubility constant and become aware of a solubility product constant.

pH and pH Indicators – In this lab, students will gain a better understanding of pH and how it relates to the concentrations of strong acids or strong bases. In addition, students will make solutions with a series of pH values. Student will also observe the pH range of several commercial and natural indicators.

Microscale Titration – Students will understand molarity and performing simple titration. They will calculate the molarity of vinegar and calculate the percent of acetic acid in the vinegar.

Molar Mass by Titration – Students will verify the moral mass of potassium hydrogen phthalate and gain more experience with moles, solutions and molarity.

Buffer Solution – In this lab, students will prepare a buffer solution and observe the properties of buffer solutions.

Reaction Rates: The Effect of Concentration, Reaction Order – Students will observe the effect of concentration on reaction rates and develop a mathematical relationship between concentration and

reaction rate. In addition, they will determine the order of the reaction and observe the effect of a catalyst.

Reaction Rates: The Effect of Temperature – Students will observe the relationship between reaction rates and temperature and will evaluate the "rule of thumb" that states "a 10°C rise in temperature doubles the reaction rate".

Electrochemistry: Galvanic Cells – In this lab, students will recognize the relationship between reduction half-cell reactions and oxidation half-cell reactions. Also, they will determine the relative reduction potentials of several metals. When given the reduction potential of one metal and the cell potential, students will be able to calculate the reduction potential of another metal.

KEY ASSIGNMENTS

Key Assignments:

Textbook Practice Problems (60% of Final Grade)

Students will be required to answer all of the "Section Review" and "Practice" problems at the end of each assigned chapter section.

In addition, students will also be required to answer problems under the titles "Understanding Key Ideas", "Practice Problems", and "Critical Thinking" within the "Chapter Review" questions at the end of each assigned chapter.

Sample questions from chapter 1 include:

- Understanding Key Ideas: Your friend mentions that she eats only natural foods because she wants her food to be free of chemicals. What is wrong with this reasoning?
- Practice Problems: Using Appendix A, convert the following measurements to the units specified:

a. 357 mL = ?L

b. 25 kg + ? mg

c. 35 000 cm3 = ?L

d. 2.46 L = ? cm3

e. 250 ug = ?g

f. 150 ug = ? kg

- Critical Thinking: A white crystalline material that looks like table salt releases gas when heated under certain conditions. There is no change in the appearance of the solid, but the reactivity of the material changes

a. Did a chemical or physical change occur?

b. Was the original material an element or a compound? Explain your answer

A student leaves an uncapped watercolor marker on an open notebook. Later, the student discovers the leaking marker has produced a rainbow of colors on the top page.

a. Is this an example of a physical change or a chemical change? Explain your answer

b. Should ink be classified as an element, a compound, or a mixture? Explain your answer.

Laboratory Investigations (20% of Final Grade)

Student will be required to complete a Subject Matter Expert (SME) supervised/ directed 2-hour lab

class activity a minimum of once every two weeks. Students will apply the scientific method to their lab activities. Data collected and represented in tables and graphs will be incorporated into lab reports with concept analysis questions.

Exams (20% of Final Grade)
End-of-chapter exams will be administered at the conclusion of each textbook chapter.
Mid-term and final exams will be administered each semester.

GRADING CRITERION:
Grading Scale:
90-100% A
80-89% B
70-79% C
60-69% D
below 60% F

Textbook Practice Problems: 60% of final grade
Laboratory Investigations: 20% of final grade
Exams: 20% of final grade

INSTRUCTIONAL METHODS AND/OR STRATEGIES
Instructional methods include, but are not limited to, the following:
Direct Instruction
Teacher demonstration
Lecture
Discussion
Guided practice
Tutorials
Multimedia presentations
Student directed study
Laboratory Experimentation
Cooperative problem solving
Regular access to Subject Matter Expert (SME)

ASSESSMENT METHODS AND/OR TOOLS
Methods by which student progress is assessed will be through a variety and/or combination of methods. The methods available include but are not limited to the following:
Review of work by Education Specialist (credentialed teacher) and Subject Matter Expert (SME)
Portfolios
Observation of student by parent facilitator, Education Specialist, and Subject Matter Expert (SME) observation
Student demonstrations
Student grades

Student work samples
Discussion
Written examinations
Observation by Subject Matter Expert (SME) during participation in lab activities.
Laboratory reports