Murrieta Valley Unified School District
High School Course Outline
May 2008

Department: Science

Course Title: Living By Chemistry

Course Number: 3035

Grade Level: 10-12

Length of Course: One year

Prerequisite: By placement

UC/CSU (A-G) Requirement: G

Brief Course Description:
This course meets the UC/CSU elective and district physical science graduation requirements. This is a guided inquiry based course that uses a variety of strategies and approaches to problem solving. The curriculum consists of 5 units that explore the chemistry of: alchemy, smells, toxins, weather, and fire. The scaffolding approach is utilized to cover real world chemistry concepts such as: periodic table, physical and chemical properties of matter, bonding, conservation of matter, stoichiometry, kinetic and molecular theory, acids, bases, and salts, solutions, chemical reactions- energy exchange and rates, and nuclear chemistry. A minimum of 30-40% of class time will be spent on laboratory experiences.

I. Goals

The student will:

A. Use scientific methods of measuring and calculating with emphasis on SI prefixes and SI units, and the factor label method of problem solving (*Chemistry Standard1-all; Investigation and Experimentation*)

B. Be able to understand the organization of the periodic table and the following: predict trends, properties and changes in matter, electron configuration, and atomic structure (*1a-e,g)*

C. Be able to differentiate between the different types of radioactive decay and their damage; understand concept of isotopes and nuclear forces and their effect on stability (11a,c,d,e)

D. Be able to explain covalent and ionic chemical bonding and its' relationship to atomic structure (2a-e).

E. Demonstrate the proficiency in writing chemical formulas and in naming compounds using oxidation numbers (1d, 2a, 3a).

F. Use Avogadro's constant to define the mole and relate it to molar mass of a compound and molarity of a solution (*3b-d*)

G. Write and balance chemical equations, differentiate the five types of chemical reactions, determine the factors that affect reaction rates, and perform stoichiometric calculations based on reactions (3a-e).

H. Know the definitions of solute and solvent and be able to use a solubility table to predict whether or not a precipitate will form. Students will also know how to perform various concentration calculations (6a,d).

I. Distinguish the definitions and properties of acids and bases, and know how to use the pH scale to characterize them. (*5a,b,d).*

J. Understand the random motion of gas molecules; how to apply the gas laws to determine the relationships between pressure, temperature, and volume; know the values of STP and the definition of absolute zero; and how to convert between Celsius and Kelvin temperatures (*4a,c,d,e,f).*

K. How to describe temperature and heat flow, and understand exothermic and endothermic processes in chemical reactions (7a,b).

L. Know the role of catalyst and other factors on reaction rates (8c).

II. Outline of Content for Major Areas of Study

Semester I

A. Scientific method/Measurements and Calculations
   1. Steps in the scientific process
   2. Laboratory safety and skills
   3. Units and Measurement
   4. Conversions/Factor label method

B. Alchemy
   1. Introduction to Chemistry and matter
   2. Organization of periodic table- atomic number, atomic mass; metals, metalloids, nonmetals; groups and valence electrons
   3. Size and mass of nucleus
   4. Electron configurations
   5. Atomic structure

6. Nuclear forces
7. Isotopes and radioactive isotopes
8. Radioactive decay

C. Smells
1. Periodic trends – electronegativity, number of valence electrons
2. Types of bonds: ionic, covalent, and metallic
3. Octet rule
4. Lewis dot structures

D. Chemical Formulas and Chemical Compounds
1. Formula writing and naming

Semester II

A. Toxins
1. Balancing chemical equations
2. Types of chemical reactions
3. Mole/number conversions
4. Stoichiometry – mass/mole conversions, mass/mass conversions
5. Law of conservation of matter
6. Properties and definitions of acids, bases, salts
7. pH scale
8. Solutes and solvents/ concentration/ molarity
9. Dissolving process at molecular level

B. Weather
1. Random motion of gas particles
2. Gas laws
3. STP
4. Temperature scales
5. Absolute zero
6. Kinetic theory of gases
7. Specific heat

C. Fire
1. Temperature and heat flow
2. Exothermic and endothermic processes
3. Catalyst
4. Activation Energy

III. Accountability Determinants

A. Key Assignments
1. Density and physical properties lab – “All That Glitters”
2. Periodic table lab – “Breaking the Code”

3. Flame test and electron movement – “Technicolor Atoms”
4. Formation of the elements investigation - “Elementary Education”
5. Relating bonding and properties – “As Good as Gold”
6. Connect the dots : Lewis Dot Structures
7. Quantitative analysis – “Is it Toxic?”
8. Manipulatives lab – Conservation of Matter
9. Grammies lab – Solubility, Balancing Chemical Equations, Mole/Mass Conversions
10. Acid/Base lab – “Heartburn”
11. Specific heat capacity lab – “Hot Cement”
12. Combined Gas Law Lab – “What Goes Up”
13. Applying gas laws, humidity – “Up In the Clouds”
14. Specific heat/Latent heat – “Burning Questions Lab”

Lab Activities (more than 20% of class). This is a partial list as there are also many demonstrations and minilabs to introduce and reteach topics.

1. Density and physical properties lab – “All That Glitters”
    a. Mass and Volume Calculations – use of scales, graduated cylinders.
    b. Physical Properties – color, magnetism, malleability, hardness etc.
2. Periodic table lab – “Breaking the Code”
    a. arrangement of the Periodic Table based on physical and chemical properties of the various elements.
3. Flame test and electron movement – “Technicolor Atoms”
    a. When exposed to flame, a chemical sample burns a characteristic color. These colors can then be used to identify unknown or combinations of elements in a chemical sample.

4. Relating bonding and properties – “As Good as Gold”
    a. this lab turns a copper penny into a brass (gold) penny by first chemically plating a layer of zinc to the copper penny. Then heat binds the two metals to create brass. Students learn about the reactivities of metals, single displacement chemical reactions and formation of alloys.
5. Connect the dots : Lewis Dot Structures
    a. Students learn how to draw Lewis structures through the arrangement of the chemicals on the Periodic table.
6. Quantitative analysis – “Is it Toxic?”
    a. Singe and double displacement reactions allow students to purify and analyze reaction products

7. Grammies lab – Solubility, Balancing Chemical Equations, Mole/Mass Conversions

    a. Use of single and double displacement reactions to predict products. The products are then analyzed, by prior methodologies to determine if the student's prediction is correct.

8. Acid/Base lab – "Heartburn"
    a. This is a not so traditional titration lab except antacids are used to determine the strength (molarity) of the unknown acid.
9. Specific heat capacity lab – "Hot Cement"
    a. A not so traditional calorimitry lab where students note heat, chemical and physical changes as cement hardens.
10. Combined Gas Law Lab – "What Goes Up"
    a. Gas temperature, Pressure and Volume (density) changes are measured.
11. Applying gas laws, humidity – "Up In the Clouds"
    a. students create a cloud in a jar to discover the set of conditions necessary for cloud formation.
12. Specific heat/Latent heat – "Burning Questions Lab"
    a. Another not so traditional calorimitry lab where students burn Cheetos (high fat / calorie food) and other products to determine calories, specific and latent heat.

B. Assessment Methods
1. Teacher observations of day-to-day participation, effort, behavior, and achievement.
2. Individual performances on Chemistry Catalyst questions, daily lab investigations, Making Sense, Check In questions, and homework.
3. Individual performance on exams and quizzes.
4. Evaluation of cooperative group activities.

IV. Instructional Materials and Methodologies

A. Required Textbook(s)
Living By Chemistry Teacher/Student Guides: Alchemy, Smells, Toxins, Weather, and Fire

Stacy, Coonrad, Claesgens: *Living By Chemistry*, Emeryvile,CA; Key Curriculum Press, 2004

B. Supplementary Materials
Dingrado, Tallman, Hainen, Winstrom: *Chemistry Matter and Change*, Columbus,OH; Glencoe/McGraw Hill Companies, 2007.

Unit kit with supplies – Alchemy, Toxins, Weather, Fire, and Smells.

C. Methodologies

1. Teacher observations of day-to-day participation, effort, behavior, and achievement.
2. Individual performances on Chemistry Catalyst questions, daily lab investigations, Making Sense, Check In questions, and homework.
3. Individual performance on exams and quizzes.
4. Evaluation of cooperative group activities