

I. CATALOG DESCRIPTION:

- A. Division: Science and Math
Department: Chemistry
Course ID: CHEM 110
Course Title: Consumer and Environmental Chemistry
Units: 3
Lecture: 3 hours
Prerequisite: None

B. Course Description:

A study of the role of chemistry in society that fulfills a general education requirement. These topics are included: physical and chemical properties of common elements and compounds, gases, reactions, atomic structure, simple organic and biochemical compounds, causes and possible solutions for chemical pollution, household and medical uses of chemicals.

Schedule Description:

An introduction to the role of chemistry in society with information on atoms, molecules, chemical pollution, and household and medical uses of chemicals.

II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: One

III. EXPECTED OUTCOMES FOR STUDENTS

Upon completion of the course, the student should be able to:

- A. Identify chemical use in society
- B. Distinguish elements and compounds, physical and chemical properties
- C. Employ basic measurements
- D. Relate atomic structure to periodic trends
- E. Evaluate the characteristics and significance of ionic and covalent bonding
- F. Assess the factors involved in chemical reactivity
- G. Differentiate the acidic and basic properties of common substances
- H. Describe common roles of oxidation and reduction reactions
- I. Recognize the role of organic chemistry in fuels, polymers, and biological processes
- J. Appraise the role of chemistry in both the cause and alleviation of environmental pollution

IV. CONTENT:

- A. Understanding the Role of Chemistry in Modern Life
 1. Discussion of composition of matter and conservation of mass
 2. Information on how scientist communicate
 3. Presentation on color, the dispersion of light, and the use of color indicators.
- B. Standards for Measurement
 1. An overview of the development and use of the metric system
 2. Application of measuring systems to solution concentration
- C. Using Models to Predict Behavior and Function
 1. The Kinetic Molecular Model for gases
 2. Other uses of modes to demonstrate molecular interaction
- D. Properties and Classification of Matter
 1. The properties of solids, liquids, and gases
 2. Effects of temperature, pressure, or a change of state on properties

- E. Atomic Theory
 - 1. The basic subatomic particles, the electron, the proton, the neutron
 - 2. Discussion of experiments leading to the discovery of subatomic particles
 - 3. Discussion of energy levels for electrons

- F. The Periodic Table
 - 1. The format of the periodic table
 - 2. The periodic trends in groups and periods
 - 3. Symbols for elements and simple nomenclature
 - 4. Rules for filling electron orbitals

- G. Chemical Bonds
 - 1. The formation of chemical bonds: ionic and covalent
 - 2. Examples of bond forming and bond breaking

- H. Shapes of Molecules
 - 1. The geometry of molecules with covalent bonds
 - 2. The shape of fats and oils
 - 3. Introduction to optical isomers

- I. Spectroscopy
 - 1. The electromagnetic spectrum and energy
 - 2. The interaction of radiation with matter

- J. The Mole
 - 1. The development of the concept of the mole
 - 2. The value of Avagadro's number
 - 3. Atomic mass and mole calculations

- K. Water
 - 1. The extraordinary physical properties of water
 - 2. Forces that influence the function of water- hydrogen bonding and polarity
 - 3. Dealing with contaminated water

- L. Energy Effect in Chemical Reactivity
 - 1. Recognition of exothermic and endothermic reactions
 - 2. The application of reaction rates to industrial and biological processes
 - 3. Activation energy: applying additional energy and the consequences

- M. Oxidation and Reduction
 - 1. The role of electrons in oxidation-reduction reactions
 - 2. Application of redox reactions to industry

- N. Acids and Bases
 - 1. The properties of acids and bases and the role of the proton
 - 2. Application of the pH scale to common substances

- O. Our Atmosphere
 - 1. Explanation of normal atmospheric conditions
 - 2. The balance of CO₂ and O₂; the necessity of the ozone layer

- P. The Role of Chemistry in the Environment
 - 1. The problem of chemical waste
 - 2. Methods for cleaning up and waste reduction

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- Q. The Carbon Atom in Organic Chemistry
 - 1. The types of bonds C forms
 - 2. Introduction to functional groups and common organic compounds

- R. Polymers
 - 1. Various types of polymers: silk, protein, and polyethylene
 - 2. Uses of polymers

- S. Proteins
 - 1. Amino acid building block of proteins, and secondary and tertiary structure
 - 2. The roles of several proteins.

- T. Genetic Code
 - 1. Nucleic Acid composition and structure
 - 2. The role of DNA and RNA
 - 3. The effect of mutations

- U. Optional Topics
 - 1. Radioactivity – uses and dangers
 - 2. The structure and uses of metals and ores
 - 3. Special properties of surfaces
 - 4. Chemistry of geology

V. METHODS OF INSTRUCTION:

Proposed methods may include:

- A. Pre-recorded Videos on Television
- B. Lecture
- C. Discussion
- D. Demonstration
- E. Work groups
- F. Examination
- G. Interactive on-line delivery (internet)
- H. CD-ROM (combination of technology)
- I. Live interactive television

VI. TYPICAL ASSIGNMENTS:

Read chapter on, "Water: Plenty of It, But What Quality?" in the text World of Chemistry Essentials, 2nd edition.

"Name three common household wastes and the kinds of chemicals they contain that might be harmful to water quality."

Read unit on "Water," in The Study Guide for World of Chemistry Telecourse,

"Describe three unusual properties of water. How do we account for these properties?"

VII. EVALUATIONS:

A. Exams

Four exams and one comprehensive final will be given.

Exams may include an objective component such as multiple choice and/or true/false, and will include a critical thinking component with problem solving and/or essay questions.

Typical Multiple Choice question:

A neutral atom can be converted to a negative ion if it

- a. gains electrons
- b. loses electrons
- c. gains protons
- d. loses protons

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Typical Problem Solving questions:

How will a stream of electrons behave in an electric field?

How do antioxidants like vitamin E and vitamin C help protect the body?

B. Optional evaluations

Homework collected and evaluated

Papers on assigned topics or projects

VIII. TYPICAL TEXT(S):

Joesten & Wood, World of Chemistry Essentials, San Diego, CA: Saunders College Publishing, 1999.

Or

Sherman, A. & Sherman, S., Chemistry and Our Changing World, 3rd Edition, Prentice Hall, 1992.

IX. OTHER SUPPLIES REQUIRED OF STUDENTS:

A scientific calculator.