

# FIRE 0640 - HAZARDOUS MATERIALS TECHNICIAN 1A, BASIC CHEMISTRY

## Catalog Description

Prerequisite: Completion of FIRE 170 with grade of "C" or better or approved Federal/State equivalent course

Hours: 40 lecture

Description: Basic aspects of chemistry and physics related to management of a hazardous materials incident. Covers physical and chemical properties of matter, atomic structure, periodic table, metals and non-metals, salts, hydrocarbons and derivatives, forms of energy, the combustion process, flammable and combustible liquids. Meets standards prescribed by the CA State Fire Marshal, and Office of Emergency Services. (not transferable) (not degree applicable) (pass/no pass grading)

## Course Student Learning Outcomes

- CSLO #1: Differentiate between chemical compounds in terms of general categories and classifications.
- CSLO #2: Identify the physical and chemical properties and the differences between pure substances and mixtures.
- CSLO #3: Identify symbols, names of elements, and atomic numbers on a periodic table.
- CSLO #4: List the names of four chemical families and describe their hazards.

## Effective Term

Fall 2019

## Course Type

Credit - Nondegree-applicable

## Contact Hours

40

## Outside of Class Hours

80

## Total Student Learning Hours

120

## Course Objectives

1. Differentiate between chemical compounds in terms of general categories and classifications;
2. Define the terms chemistry and matter;
3. Examine the three states of matter;
4. Analyze physical and chemical properties and the differences between pure substances and mixtures;
5. Identify the three physical forms or states of matter;
6. Distinguish the differences between chemical and physical change;
7. List the six different processes that result in a physical change in state;
8. Compare the terms exothermic and endothermic;

9. Identify the roles of catalysts;
10. Identify symbols, names of elements, and atomic numbers on a periodic table;
11. Examine the logical systematic order of elements;
12. List the names of four chemical families and describe their hazards;
13. Diagram the parts and regions of an atom, define the weight and charge of each atomic particle;
14. Categorize the four families and their outer shell electron configuration;
15. Examine the octet/duet rule and predict the type of ion formed by each family;
16. Identify the hazard of each family including reactivity and oxidation ability;
17. Examine the features of reducing agents and oxidizing agents;
18. Define bonding, determine the composition of a salt or a non-salt and recognize the two types of bonding;
19. Identify the type of salt and predict the hazards, recognize the general physical, chemical, health and environmental properties of salts and non-salts;
20. Distinguish between non-salts and hydrocarbons;
21. Compare and contrast the general properties of non-salts and hydrocarbons;
22. Analyze the difference between saturated and unsaturated compounds;
23. Identify alkaline, alkene, alkyne and aromatic hydrocarbons;
24. Diagram the structures of hydrocarbons including isomers or aromatics;
25. Compare the general toxicity of saturated and unsaturated hydrocarbons;
26. Define the terms isomer and hydrocarbon radical;
27. Name and diagram the structure of the alkane, alkene, alkyne and aromatic radical or isomer;
28. Identify the type of derivative and identify its hazardous properties;
29. Define the physical parameters of vapor pressure, vapor content, vapor density, specific gravity, boiling point, flash point, polarity standard and normal temperature and pressure, and correctly identify the relative ranking of chemicals with respect to these physical parameters when compared to other chemicals;
30. Categorize those materials that are explosive, provide examples and define the terms fuel, oxidizer, explosive and crystals as they relate to explosives;
31. Identify the three states that gases are transported in and define the term expansion ratio;
32. Categorize those compounds that are most likely to be flammable liquids or gases and polar solvents, based upon their chemical characteristics, name and formula;
33. Identify those elements or compounds that are likely to be solids and identify their potential, combustible or pyrophoric;
34. Categorize those compounds that are most likely to be oxidizers or organic peroxides based upon their chemical composition;
35. Categorize the common names and formulas associated with poisons and list field test methods;
36. Define the term corrosivity, describe the two main divisions of corrosives, list the physical states that corrosives are found in and identify some of the hazards of corrosive materials;
37. Categorize those compounds that are most likely to be radioactive based upon their chemical composition;
38. Define the concepts: fire, oxidation, the fire tetrahedron, heat transfer, ignition temperature, flammable limits, and standard temperature and pressure;

39. Assess the difference between slow and fast oxidation, the effects of oxygen on the combustion process, and the factors to consider when assessing an incident for the potential of fire;
40. List the three products of combustion, the three factors that determine heat content, and the three factors that determine vapor quantity;
41. Examine the effect of flame on combustion, and differentiate between the products of complete and incomplete combustion;
42. Define backdraft and flashover and explain the conditions that lead to those events;
43. List at least three of the products of incomplete combustion that are considered toxic; and
44. Classify a sample of an unknown solid, liquid or gas using simple meters and field laboratory techniques.

## General Education Information

- Approved College Associate Degree GE Applicability
- CSU GE Applicability (Recommended-requires CSU approval)
- Cal-GETC Applicability (Recommended - Requires External Approval)
- IGETC Applicability (Recommended-requires CSU/UC approval)

## Articulation Information

- Not Transferable

## Methods of Evaluation

- Objective Examinations
  - Example: Students will take a multiple-choice examination on Hazardous Gases. Standard Grading. Example Question: What Hazard Classification number is used for Gases? A. Class 1, B. Class 2, C. Class 3, D. Class 4
- Problem Solving Examinations
  - Example: Students will examine the effect of flame on combustion, and differentiate between the products of complete and incomplete combustion. Rubric Grading.

## Repeatable

No

## Methods of Instruction

- Lecture/Discussion
- Distance Learning

Lecture:

1. The instructor will lecture on the basic principles of chemistry. Class time will then be spent identifying atomic number, symbol, atomic weight and families of elements using a periodic table of elements.
2. The instructor will lead a discussion on bonding. The class will then be broken into small groups and develop a list of 4 examples each of chemical bonding, metallic bonding, ionic bonding, and covalent bonding.

Distance Learning

1. Online lecture on chemical and physical change, followed by a student report that distinguishes the differences between chemical and physical change, giving specific examples. Reports are posted for online instructor lead discussion.

## Typical Out of Class Assignments Reading Assignments

1. The student will read the chapter in the textbook on the periodic table of elements and develop a list of the families of elements.
2. After reading the material on flammable solids in the text and handouts, the student will determine from a list of flammable solids which substances are pyrophoric materials by reviewing their chemical formula.

## Writing, Problem Solving or Performance

1. The student will categorize chemical compounds into their toxic class.
2. The student will classify each of the organic compounds below as an alcohol, carboxylic acid, aldehyde, ketone, ether or ester, and draw its structural formula.

## Other (Term projects, research papers, portfolios, etc.) Required Materials

- Hazardous Materials Technician 1A Basic Chemistry
  - Author: California Specialized Training Institute
  - Publisher:
  - Publication Date: 2003
  - Text Edition:
  - Classic Textbook?:
  - OER Link:
  - OER:
- Chemistry of Hazardous Materials
  - Author: Eugene Meyer
  - Publisher: Brady
  - Publication Date: 2010
  - Text Edition: 5th
  - Classic Textbook?:
  - OER Link:
  - OER:
- Hazardous Chemistry Study Guide
  - Author: Jill Meryl Levy
  - Publisher: Firebelle Productions
  - Publication Date: 2005
  - Text Edition: 4th
  - Classic Textbook?:
  - OER Link:
  - OER:
- Emergency Response Guidebook
  - Author: Department of Transportation
  - Publisher: U.S. Department of Transportation
  - Publication Date: 2016
  - Text Edition:
  - Classic Textbook?:
  - OER Link:
  - OER:

**Other materials and-or supplies required of students that contribute to the cost of the course.**