

LAST REVIEW: 2009-10

(i.e. 2003-2004)

NEXT REVIEW: 2014-15

(i.e. 2008-2009)

STATUS: A

(A, I, D)

COURSE TITLE: Fire Chemistry

COMMON COURSE NUMBER: FFP 2111

CREDIT HOURS: 3

CONTACT HOUR BREAKDOWN

(per 16 week term)

CLOCK HOURS:

(Voc. Course ONLY)

Lecture: **48**

Lab:

Clinic:

Other:

PREREQUISITE(S): None

COREQUISITE(S): None

PRE/COREQUISITE(S):

COURSE DESCRIPTION *(750 characters, maximum):*

Study of the physical and chemical properties of matter, with a particular emphasis on hazardous materials, hydrocarbons, oxidation-reduction chemistry, and residuals of pyrolysis. Topics covered include atomic structure, the periodic table, chemical bonding, chemical measurement, stoichiometry, and the study of chemical properties according to group, class, and reactivity. Sample collection and analysis is included as a practical component of the course.

General Education Requirements – Associate of Arts Degree (AA), meets Area(s): Area

General Education Requirements – Associate in Science Degree (AS), meets Area(s): Area

General Education Requirements – Associate in Applied Science Degree (AAS), meets Area(s): Area

UNIT TITLES

1. Characteristics of Hazardous Materials and Applicable US/DOT Regulations
2. Responding to Hazardous Materials Incidents
3. Physical Properties of Matter and Energy
4. Chemical Forms of Matter
5. Principles of Chemical Reactions
6. Properties of Common Elements
7. Properties of Corrosive and Water Reactive Materials
8. Distinguishing Properties of Toxic Materials
9. Oxidation-Reduction Reactions
10. Properties of Organic Compounds, Plastics, and Textiles
11. Properties of Chemical Explosives
12. Properties of Radioactive Materials

13. Collecting Physical Evidence
14. Procedures for Submitting Samples for Analysis

EVALUATION:

Please provide a brief description (250 characters maximum) that details how students will be evaluated on the course outcomes.

1. Quizzes, Test, and/or Final Exam (cumulative/comprehensive);
2. Selected faculty may assess homework, projects, class participation/attendance, and/or extra credit projects.

**** Complete the following only if course is seeking general education status ****

GENERAL EDUCATION Competencies and Skills*:

Please highlight in green font all Competencies/Skills from the list below that apply to this course. In the box to the right of the Competency/Skill, enter all specific learning outcome numbers (i.e. 1.1, 2.7, 5.12) that apply.

1. Read with critical comprehension	
2. Speak and listen effectively	
3. Write clearly and coherently	
4. Think creatively, logically, critically, and reflectively (analyze, synthesize, apply, and evaluate)	
5. Demonstrate and apply literacy in its various forms: (highlight in green ALL that apply) (1. technological, 2. informational, 3. mathematical, 4. scientific, 5. cultural, 6. historical, 7. aesthetic and/or 8. environmental)	
6. Apply problem solving techniques to real-world experiences	
7. Apply methods of scientific inquiry	
8. Demonstrate an understanding of the physical and biological environment and how it is impacted by human beings	
9. Demonstrate an understanding of and appreciation for human diversities and commonalities	
10. Collaborate with others to achieve common goals.	
11. Research, synthesize and produce original work	
12. Practice ethical behavior	
13. Demonstrate self-direction and self motivation	
14. Assume responsibility for and understand the impact of personal behaviors on self and society	
15. Contribute to the welfare of the community	

** General Education Competencies and Skills endorsed by '05-'06 General Education Task Force*

Common Course Number: FFP 2111

UNITS

Unit 1 Characteristics of hazardous materials and Applicable US/DOT Regulations**General Outcome:**

- 1.0 The students should be able to recognize the characteristics of hazardous materials, and requirements of applicable US DOT statutes related to placarding, labeling, handling, shipping, storage, and disposal.

Specific Measurable Learning Outcomes:**Upon successful completion of this unit, the student shall be able to:**

- 1.1 Distinguish between hazardous and non-hazardous materials.
- 1.2 Describe the seven classes of hazardous materials.
- 1.3 Describe the common chemical and physical properties that relate to hazardous materials.
- 1.4 Determine applicable Federal statutes relating to labeling, handling, shipping, storage, and disposal of hazardous materials.
- 1.5 Correctly interpret and utilize MSDS's to protect against dangers, implement necessary precautions, and identify appropriate first aid response.
- 1.6 Identify location of shipping papers for various methods of transportation.
- 1.7 Describe hazards associated with materials based on information provided in shipping papers.
- 1.8 List and describe the nine DOT Hazardous Material Classes.
- 1.9 Distinguish between and explain requirements for DOT placards.
- 1.10 Distinguish between and explain requirements for DOT labels.

Common Course Number: FFP 2111

Unit 2 Responding to Hazardous Materials Incidents

General Outcome:

- 2.0 The students should be able to determine and describe the correct response to various hazardous materials incidents.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 2.1 List the six primary clues that indicate presence of a hazardous material.
- 2.2 Identify four sources that may help identify the specific hazardous material.
- 2.3 Identify three components of a hazardous materials incident.
- 2.4 Describe four types of spills and explain the significance of each in determining the potential course and harm of the incident.

Common Course Number: FFP 2111

Unit 3 Physical Properties of Matter and Energy

General Outcome:

- 3.0 The students should be able to define and describe the three states of matter, the transitions among the three states, and the energy involved in these transitions.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 3.1 Describe the physical properties of matter.
- 3.2 Describe the physical properties of energy.
- 3.3 Explain and define the three physical states of matter.
- 3.4 Differentiate between a chemical and physical change.
- 3.5 Differentiate between an endothermic and exothermic reaction.
- 3.6 Perform density calculations.
- 3.7 Describe three methods of heat transfer.
- 3.8 Distinguish between the following units of heat measure:
- 3.8.1. British Thermal Unit (BTU)
 - 3.8.2. Fahrenheit ($^{\circ}\text{F}$)
 - 3.8.3. Celsius ($^{\circ}\text{C}$)
 - 3.8.4. Calorie (C)
- 3.9 Perform calculations using Boyle's and Charles' Law.
- 3.10 Identify two chemical, mechanical, and electrical heat sources.
- 3.11 Define and distinguish between flash point, fire point, and ignition temperature.

Common Course Number: FFP 2111

Unit 4 Chemical Forms of Matter

General Outcome:

- 4.0 The students should be able to describe the structure and components of atoms, appropriately utilize the periodic table to determine the properties of various elements, and distinguish between elements, ions, molecules, and compounds.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 4.1 Define and distinguish between elements, ions, molecules, and compounds.
- 4.2 Classify elements as metals, nonmetals, or metalloids.
- 4.3 Determine the atomic number and mass of a given element.
- 4.4 Label groups IA-VIIIA on the periodic table.
- 4.5 Distinguish between covalent and ionic bonding.
- 4.6 Write and interpret chemical formulas.
- 4.7 Perform calculations using molecular and formula weight, and the mole.

Common Course Number: FFP 2111

Unit 5 Principles of Chemical Reactions

General Outcome:

5.0 The students should be able to recognize the principles, types, and consequences of typical chemical reactions.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 5.1 Balance simple chemical equations.
- 5.2 Identify reactions as combination, decomposition, single replacement, or double replacement.
- 5.3 Define and describe oxidation.
- 5.4 Define and describe reduction.
- 5.5 Define and describe combustion.
- 5.6 Define and describe the hazard of finely divided fuels as they relate to the combustion process.
- 5.7 Define and describe how the concentration of oxygen effects the combustion process.
- 5.8 Define and describe thermal balance and imbalance.
- 5.9 Define and describe fire (flaming combustion).
- 5.10 Explain the fire triangle and fire tetrahedron.
- 5.11 Describe the methods and principles of extinguishment.

Common Course Number: FFP 2111

Unit 6 Properties of Common Elements

General Outcome:

- 6.0 The students should be able to recognize the distinguishing properties of common elements.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 6.1 Define and describe the properties of oxygen.
- 6.2 Define and describe the properties of hydrogen.
- 6.3 Define and describe the properties of fluorine.
- 6.4 Define and describe the properties of chlorine.
- 6.5 Define and describe the properties of bromine.
- 6.6 Define and describe the properties of phosphorus.
- 6.7 Define and describe the properties of ozone.
- 6.8 Define and describe the properties of sulfur.
- 6.9 Define and describe the properties of carbon.

Common Course Number: FFP 2111

Unit 7 Properties of corrosive and Water Reactive Materials

General Outcome:

- 7.0 The students should be able to recognize the distinguishing properties of common corrosive, and water reactive materials.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 7.1 Define the properties of acids.
- 7.2 Define the properties of bases.
- 7.3 Determine corrosivity of compounds based on pH.
- 7.4 Describe appropriate emergency response to incidents involving corrosives.
- 7.5 Determine which types of compounds may react violently with water.
- 7.6 Describe applicable methods for extinguishing fires involving water reactive chemicals.

Common Course Number: FFP 2111

Unit 8 Distinguishing Properties of Toxic Materials

General Outcome:

8.0 The students should be able to recognize the distinguishing properties of common toxic chemicals and hazardous materials.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 8.1 Identify several classes of toxic compounds, providing specific examples of the hazards of each.
- 8.2 Describe the classification of toxic effects.
- 8.3 Describe how toxic substances may enter the body.
- 8.4 Indicate the factors affecting toxicity.

Common Course Number: FFP 2111

Unit 9 Oxidation-Reduction Reactions

General Outcome:

9.0 The students should be able to assign oxidation numbers, identify oxidation-reduction reactions, and perform fundamental calculations.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 9.1 Determine oxidation numbers of elements.
- 9.2 Recognize the elements that are oxidizing agents.
- 9.3 Indicate the oxidizing and reducing agents in a chemical reaction.
- 9.4 Define and describe the four classes of fire.

Common Course Number: FFP 2111

Unit 10 Properties of Organic Compounds, Plastics, and Textiles

General Outcome:

10.0 The students should be able to recognize the distinguishing properties of common organic compounds, plastics, and textiles.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 10.1 Define the term organic compound.
- 10.2 Name the functional group in a given compound.
- 10.3 Identify the chemistry of common petroleum products.
- 10.4 Describe the term polymer.
- 10.5 Explain the properties associated with the burning of synthetic polymers.
- 10.6 Describe and distinguish between flashover and backdraft.
- 10.7 Identify three products of combustion commonly found in structural fires that create a life hazard.

Common Course Number: FFP 2111

Unit 11 Properties of Chemical Explosives

General Outcome:

11.0 The students should be able to recognize the distinguishing properties of common chemical explosives.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

11.1 Identify common chemical explosives.

11.2 Describe the characteristics and classes of chemical explosives.

11.3 Distinguish between high explosives, low explosives, and rapid oxidation.

11.4 Describe the proper handling of typical chemical explosives.

Common Course Number: FFP 2111

Unit 12 Properties of Radioactive Materials

General Outcome:

12.0 The students should be able to recognize the distinguishing properties of common radioactive materials.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

12.1 Describe the features of atomic nuclei.

12.2 Identify the types and hazards of radiation.

12.3 Explain the three types of radioactive labels utilized by the US/DOT.

Common Course Number: FFP 2111

Unit 13 Collecting Physical Evidence

General Outcome:

13.0 The students should be able to properly collect evidence at a crime scene.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

13.1 Determine which areas of the crime scene will yield useful samples.

13.2 Select an appropriate container for samples to be obtained.

13.3 Properly collect solid samples.

13.4 Properly collect liquid samples.

13.5 Properly collect comparison samples.

13.6 Avoid contamination of the sample containers and the evidence.

Common Course Number: FFP 2111

Unit 14 Procedures for Submitting Samples for Analysis

General Outcome:

14.0 The students should be able to properly submit crime scene samples of laboratory analysis.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

14.1 Recognize concepts related to chain-of-custody for evidence.

14.2 Properly prepare and submit a property receipt.

14.3 Properly prepare a laboratory submission form.