

Illinois State University
Department of Chemistry
CHE 403.01
Teaching Science Safely: Secondary Schools
3 credit hours

Catalog Description:

CHE 403.01 Teaching Chemistry Safely: Secondary Schools

3 sem. hrs. Topical analysis of current best practices in teaching chemistry safely. Not for credit in MS in Chemistry. Course may be repeated for credit. **Prerequisite:** *CHE 301, CHE 401, CHE 402, or equivalent*

Instructor: Dr. Allison Meyer

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Contact Hours:

This course is a structured, asynchronous course available online for 8 or 16 weeks from the course start date. Each assignment will be available at the start of the course but will have specific deadlines for when they need to be completed.

Accommodations:

Any student needing to arrange a reasonable accommodation for a documented disability should contact Disability Concerns at 350 Fell Hall, 438-5853 (voice), 438-8620 (TTY).

Materials:

Required (Provided by ISU):

Access to the ReggiNet Course Website – Available three days after course registration.

Required Flinn Scientific E-Learning modules

In this course you will need access to the Flinn Scientific High School Laboratory Safety certification video program **and** the following Flinn E-Learning Packages (3), which contain 12 episodes total:

- Start with Safety
- Safe Laboratory Practices
- Teaching Safety To Students

Required Flinn Chemical and Biological Catalog and Safety Reference Manual

You will also need a copy of the Flinn Chemical and Biological Catalog and Safety Reference Manual 2009 or more recent.

Any additional required material will be provided within the ReggieNet course.

Required Technology:

Processors	Pentium PC, 500 MHz or better
RAM	512 MB+
Screen Resolution	1024 x 768 or higher
Color Depth	High Color, 16 Bit millions
Bandwidth	128 Kbps download, dedicated broadband or faster
Video Player	Flash Player 9.0.115.0 or above required for movie player Visit http://get.adobe.com/flashplayer/ to download.

PC Requirements	Mac Requirements
Operating System	Operating System
Windows 2000, XP and above	10.4 and above
Browser	Browser
Internet Explorer 6.0 - 7.0	Safari 2.0+
Firefox 2.0+	Firefox 2.0+

Course Overview and Objectives:

This course constitutes a survey course of ways in which we can understand and teach chemistry safely. Students will improve their chemistry safety knowledge from the resource materials as well as be expected to search local and internet-based resources for current best practices. Students will be introduced to a safety certification program as well as ways to introduce their pupils to safe practices. It will help develop answers to the following questions:

1. What is our current best understanding of how to teach chemistry safely?
2. What are the safety considerations and risks associated with teaching chemistry?
3. What is the role of the National Standards and State Standards in determining how to teach chemistry safely?
4. What pedagogical techniques are appropriate for teaching chemical safety in secondary schools?
5. What are the challenges associated with teaching chemistry safely?

Student Tasks/Assignments:

1. Online quizzes within ReggieNet over scholarly journal articles about safety (provided in the online course), three Flinn safety packages, and each unit of the Flinn Scientific High School Laboratory Safety certification. Each chapter of the safety program includes a series of assessments designed to test the student's knowledge of current best practices in teaching chemistry safely. The Flinn packages and certification units are outlined below:

Certification Unit I. Introduction and Overview

Certification Unit II. Safety—The Teacher's Duty of Care

The Teacher's Duty of Care
Legal Foundation of Negligence
Causes of Laboratory Accidents
Legal Analysis—Teacher's Duty to Instruct and Warn
Ideas to Demonstrate You Are a Responsible Science Teacher
Legal Analysis—Establishing the Teacher's Duty of Care

Certification Unit III. Chemical and Laboratory Safety Regulations

Hazard Communication and the Laboratory Standard
Laboratory Ventilation and Use of Fume Hoods
Material Safety Data Sheets and Chemical Label Requirements
Five-Minute Safety Inspection
Emergency Alert and First Aid

Certification Unit IV. Principles of Toxicology

Basic Principles of Toxicology
Relative Toxicity—Understanding and Assessing Risks
Reducing Exposure to Laboratory Chemicals
FAQs—Applying the Principles of Toxicology

Certification Unit V. The Use of Personal Protective Equipment

Goggle Safety
Aprons, Gloves, and Other Personal Protective Equipment
FAQ—Proper Lab Attire

Certification Unit VI. Laboratory Safety Equipment and Procedures

The Duty to Provide and Maintain Safe Laboratory Facilities
Master Utility Controls
Electrical Safety
Fire Blankets
Fire Extinguisher Basics and Training
Eyewash Requirements
Safety Showers
FAQ—Lack of Proper Safety Equipment

Certification Unit VII. Safe Laboratory Practices

The Duty to Supervise— Classroom Management Tips
How to Conduct a Safe Lab Activity
Safety Guidelines for Chemical Demonstrations
Biology Lab Safety—Dissection and Microbiology
Glassware Safety

Certification Unit VIII. Safe Chemical Management—Principles and Practice

Chemical Purchasing Guidelines

Procurement Procedures
Classroom Chemical Storage and Security
Dispensing Chemicals and Acid Safety
Chemical Spill Control

Certification Unit IX. Storage and Disposal of Chemicals

Safety and Design of the Chemical Storeroom
Chemical Storeroom Ventilation
Chemical Storage—Storing Chemicals by Compatible Families
Chemical Treatment and Disposal Options
FAQ—Radioactive Chemicals
Licensed Hazardous Waste Disposal

Certification Unit X. How To Improve Laboratory Safety

FAQ—Administration and Safety Concerns
How to Get Action—Developing a 3-Year Plan

Flinn Video Packages: Activities for Teaching Chemical Safety

Start with Safety—Safety Demonstrations - Simple, practical, effective demonstrations will help you teach students the meaning of specific hazard warnings and the importance of following safety precautions.

Safety Demonstrations
Flaming Vapor Ramp
Sulfuric Acid & Nylon
"Do Not Open" Bottle
Grease Fire

Safe Laboratory Practices - These activities will help you model safe laboratory practices and will remind you to perform a “safety checklist” when working in the lab.

Contact Lens Demonstration
The Red Plague
Whoosh Bottle
Methyl Alcohol Flame Test

Teaching Safety To Students - Getting students to comply with laboratory safety rules and teaching them proper lab technique are two of the most important responsibilities of every chemistry teacher.

Goggle Safety
Laboratory Safety Challenge
MSDS Challenge Inquiry Lab

Journal Articles on Safety (provided within the ReggieNet course)

- Hays, L., Smith, M., & Eick, C. (2005, Sep). Habits of mind for the science laboratory: Establishing proper safety habits in the laboratory will help minimize the risk of accidents. *The Science Teacher*, 72(6), 24-29.
- Wright, S.M. (2005). Introducing safety topics using a student-centered approach. *Journal of Chemical Education*, 82(10), 1519-1520.
- Zirkel, P.A., & Barnes, M.B. (2011). Negligence liability of K-12 chemistry teachers: The need for legal balance and responsible action. *Journal of Chemical Education*, 88(8), 1057-1061.
- Alaimo, P.J., Langehan, J.M., & Tanner, M.J. (2010). Safety teams: An approach to engage students in laboratory safety. *Journal of Chemical Education*, 87(9), 856-861.

Quizzes are scored as credit or no credit. To receive credit for a quiz, students must receive a 90% or better on the quiz. Quizzes may be retaken *up until the submission deadline* until a 90% or higher is achieved.

2. Student Project's by Category:

“Category 1” Projects:

Truck Project - For this assignment, you will take a picture of yourself with EITHER a Department of Transportation placard from a truck or other shipping method – OR– a NFPA diamond hazard placard. In your paper, you will provide a brief personal introduction along with information on the compound involved in the placard. The paper will follow APA formatting guidelines.

Identifying Safety Hazards Project - Safety hazards can occur in laboratory settings, even with the best preparation on the part of the teacher. For this project, you will examine photos taken during a specific heat lab. For each picture, you will identify the safety hazard and explain the steps that could be taken to remove this hazard.

“Category 2” Projects:

Lab Re-Write - Find an experiment or demonstration which you currently do or would like to do that is missing information about safety. Improve the safety of this experiment or demonstration. You can do this in one of two ways: either rewrite the experiment/ demonstration to include the safety information, or create an extra “safety information sheet” that accompanies the original experiment or demonstration.

Safety Lesson Plan - Create an Introduction to Laboratory Safety lesson plan (Or improve upon your current lesson). When students are finished with this lesson, they should be prepared for their first experiment. Your lesson could be designed as an introductory lesson for a specific course (chemistry, AP chemistry, biology, physical science, etc.) and so should consider students prior knowledge and the safety issues relevant to experiments that would be carried out in that course. For this assignment, No more than 50% of the lesson should be direct instruction.

Students ***must*** complete all four of these projects throughout the course in order to receive an “A” grade, or one project from each category throughout the course in order to receive a “B” grade. Specific details and rubrics for each project will be provided within the course. Projects are also graded as credit or no credit. Each student will have two attempts to complete each project. A checklist is provide for each project to determine if the project has been mastered and receives credit. The checklist will be filled out by the instructor. Upon initial submission, if the project does not meet the stated requirements in the rubric/checklist, then the student will have one week (see calendar below) to redo and resubmit that project. If the student fails to resubmit by the deadline or does not meet the requirements of the assignment after the second attempt, that project will not be counted towards the student’s grade. For a description of the grading process, see the Grading Scale section below.

Grading Scale

This course uses a **Mastery System** for grading. The course contains five different components:

1. Quizzes over safety videos and articles
2. Truck Project (*Category 1*)
3. Identifying Safety Hazards Project (*Category 1*)
4. Lab Re-Write (*Category 2*)
5. Safety Lesson Plan (*Category 2*)

The grading scale requires completion of the following components:

A = 92% of the quizzes (11 out of 12), *ALL* “Category 1” projects, *ALL* “Category 2” projects

B = 83% of the quizzes (10 out of 12), *ONE* “Category 1” project, *ONE* “Category 2” project

C = 83% of the quizzes (10 out of 12)

D = 75% of the quizzes (9 out of 12)

F = Less than 9 of the quizzes completed and no projects completed.

If you complete the projects but do not complete the number of required quizzes, you will receive one grade lower than described.

*(ex. Student completes all four Category 1 and Category 2 projects but only completes 10 out of 12 quizzes—that student would receive a **B**).*

Assessment Schedule (Fall 2016)

All assignments are due at midnight central time on the following days unless otherwise specified within the course calendar in ReggieNet.

<u>Due Date</u>	<u>Assignment</u>
Sep 05	Quiz Practice & Quiz 1
12	Quiz 2
19	“Category 1” project (student choice of which project)
26	Quiz 3
Oct 03	Quiz 4 & “Category 1” project resubmission
10	Quiz 5 & “Category 2” project (student choice of which project)
17	Quiz 6
24	Quiz 7 & “Category 2” project resubmission
31	Quiz 8
Nov 07	“Category 1” project
14	Quiz 9
21	Quiz 10 & “Category 1” project resubmission
28	Quiz 11
Dec 05	“Category 2” project
12	Quiz 12 & “Category 2” project resubmission