

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. Sarah Boesdorfer

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Online Office Hours: By appointment. Happy to Zoom, Google Meet, or just phone chat. Just email and we will set it up since summer and no one's schedule is the same week to week.

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 and/or medical/mental health condition should contact Student Access and Accommodation Services at 350 Fell Hall, (309) 438-5853, or visit the website: StudentAccess.IllinoisState.edu.

Materials:

Required: Access to the ReggieNet Course Website

Required: Access to the Flinn Scientific High School Laboratory Safety certification video program (Access to this is free but requires registration) and the following Flinn E-Learning Packages (3), which contain 12 episodes total:

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

Links in Reggienet to all Videos

Required: Flinn Chemical and Biological Catalog and Safety Reference Manual (2015 or more recent- laws have changed). Request one for free at: <https://www.flinnsci.com/flinn-freebies/request-a-catalog/> You can use the digital version, but it is strongly recommended you have a print copy as a reference for the course and beyond.

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

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. Flinn Scientific High School Certification OR Other High School Safety Resources Activity.

Flinn has a series of videos on the legal and safety consideration for teaching high science. There are quizzes with the videos from Flinn and you receive a certificate of completion when the series is completed which will be submitted as evidence in ReggieNet.

OR

If students have completed the Flinn Certification prior to May 2021, then they will explore other safety related resources for High School Science teaching, answering questions in an assignment about these resources. Assignment details and access to the resources will be in ReggieNet. Resources explored will include:

American Chemistry Society (ACS) High School Chemistry Safety Resources:

Guidelines for Chemical Laboratory Safety in Secondary Schools
(Safety) Learning Outcomes for High School Students
Safety Guidelines and Rubric for Assessing Chemical Demonstrations

At Home Lab Safety

Laboratory Safety Institute: Safe Science at Home
NSTA: Safety for Hands-On Science Home Instruction

Either of these assignments is done until it meets expectations in the certification or the assignment.

2. Online quizzes within ReggieNet over scholarly journal articles about safety (provided in the online course) and three Flinn safety packages for teaching safety., 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:

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.

3. 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 to expectations 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 six different components:

1. Flinn Safety Certification OR Other High School Safety Resources Assignment
2. Quizzes over safety lesson videos and articles (3 Quizzes)
3. Truck Project (*Category 1*)
4. Identifying Safety Hazards Project (*Category 1*)
5. Lab Re-Write (*Category 2*)
6. Safety Lesson Plan (*Category 2*)

The grading scale requires completion of the following components:

A = Flinn Safety Course/Alternative Assignment, Online Quizzes passed, *ALL* “Category 1” projects, *ALL* “Category 2” projects

B = Flinn Safety Course/Alternative Assignment, Online Quizzes passed, *ONE* “Category 1” project, *ONE* “Category 2” project

C = Flinn Safety Course/Alternative Assignment and Online Quizzes passed

D = Flinn Safety Course/Alternative Assignment and Quizzes (2 out of 3 passed)

F = Does not meet the criteria for a D.

If you complete the projects but do not complete the Flinn Certification or Alternative Assignment OR Do not complete the Online Quizzes

(ex. Student completes one each Category 1 and Category 2 project, but does not pass all 3 online quizzes—that student would receive a C).

Assessment Schedule (Summer 2021)

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

| <u>Date</u> | <u>Assignment/Event</u> |
|-------------|--|
| June 07 | Class Starts |
| 18 | “Category 1” project (student choice of which project) |
| 25 | <u>Flinn Certification OR Alternative Assignment Completed,</u> |
| 30 | <i>“Category 1” project resubmission (if needed)</i> |
| July 02 | “Category 2” project (student choice of which project) |
| 09 | Quiz 1 & Quiz 2 <i>“Category 2” project resubmission (if needed)</i> |
| 16 | Quiz 3 & Quiz 4 |
| 23 | “Category 1” project |
| 28 | “Category 2” project <i>“Category 1” project resubmission (if needed)</i> |
| 30 | <i>“Category 2” project resubmission (if needed)</i> |

Bereavement

Illinois State University has several systems in place to assist our students in times of crisis and bereavement. If you have suffered a bereavement, you may choose to notify the Office of the Vice President for Student Affairs of your loss, (phone: (309) 438-5451, e-mail: StudentAffairs@IllinoisState.edu) and they will contact all your professors on your behalf so you don't have to worry about it. The Dean on Duty (phone: (309) 438-2008, email: deanofstudents@illinoisstate.edu) and Student Counseling Services (phone: (309) 438-3655, email: counseling@illinoisstate.edu) are also there to help students deal with traumatic life events.