

Course
Forensic Science

Unit I
Safety &
Scientific Method

Essential Question
Why is lab safety vital in science?

TEKS
§130.295(c)
(1)(A)(B)

Prior Student Learning
None

Estimated Time
2 ½ to 3 hours

Rationale

Lab safety is one of the most fundamental lessons in any science course. Understanding and applying safety rules is required in all labs and in the field of forensic science. Knowing accurate lab safety is vital because it makes us aware of potential dangers and problems that may occur. This in turn shows us how to approach these situations and deal with them correctly and safely.

Objectives

The student will be able to:

1. Demonstrate safe practices in labs and field investigations.
2. Demonstrate how to use and conserve resources in labs and how to dispose of or recycle materials in labs.

Engage

Demonstrate some lab behaviors for the students: some that follow safety protocol and some that do not. Have the students guess if it is a “do” or a “don’t.” For example, some safe behaviors are pulling hair back away from the face and wearing goggles. Some unsafe behaviors are horseplay in the lab and returning unused chemicals back into the original *container* (*Note: instead of demonstrating, a teacher may want to research, select, and show some images of examples. If you choose to demonstrate, select the unsafe behavior(s) with caution*). Discuss the importance of each behavior and why it is considered a “do” or a “don’t.” Use the Discussion Rubric for assessment.

Key Points

- I. The Purpose of Lab Safety
 - A. Science courses are hands-on and usually include many laboratory and/or field investigations
 - B. Safety in the science classroom should be the number one priority of the teachers, students, and parents
 - C. Knowledge of safe practices includes what to do if an emergency occurs in the class
 - D. Identifying potential dangers that may occur in the classroom, labs and/or field investigations could be vital to preventing accidents from happening, but only if everyone knows what to look for
- II. General Safety Rules
 - A. Students should
 1. Follow all directions given by the teacher at all times
 2. Read the instructions completely before starting the lab
 3. Know where all of the safety equipment is in the laboratory including, but not limited to
 - a) Eyewash station
 - b) Fire extinguisher

- c) First aid kit
- d) Safety shower
- 4. Work in a well-ventilated area and/or use the fume hood at all times
- 5. Always wash hands before and after labs with soap and water
- 6. Keep their personal lab areas clean
- 7. Confirm that the lab area and all equipment is cleaned and/or unplugged before leaving
- 8. Notify the teacher immediately of any spills or accidents

B. Students should not

- 1. Begin any lab until told to do so or without the teacher present
- 2. Bring any food, drinks, or gum into the laboratory
- 3. Goof around or allow any horseplay in the lab

III. Protective Clothing and Equipment Rules

A. Eyewear

- 1. Safety goggles should be worn for the entirety of all labs
- 2. If contact lenses are worn, an eye doctor and the teacher should be consulted before performing any labs
- 3. Eyeglasses should never be worn in lieu of safety goggles

B. Gloves

- 1. No glove can protect from all hazards
- 2. Always check for rips, tears, or holes
- 3. Assess the lab and see what type of gloves are best for that situation
 - a) Cloth – good for light abrasives, but not for liquids
 - b) Rubber – good for solvents and corrosives
 - c) Leather – good for heat, sparks, and rough abrasives

C. Attire

- 1. Wear closed-toed, low, or non-heeled shoes
- 2. Wear long pants and long-sleeved shirts around chemicals and/or specimens
- 3. Wear aprons and/or lab coats during labs
- 4. Pull hair out of the way and away from the face
- 5. Do not wear loose or baggy clothing and/or dangling jewelry in the lab

IV. Chemical Rules

A. Do not taste or smell any chemicals in the lab unless a teacher directs otherwise

B. To smell a chemical always “waft” it

- 1. Waft – wave your hand above the chemical towards your nose so that small amounts of vapor can be smelled without causing harm

C. Make sure to clearly label all chemicals for others

- D. Ensure accurate use by reading the label twice before using the chemical in the lab
- E. Avoid contamination by not returning used chemicals back into their original container
- F. Dispose of chemicals using the method described on the container and/or the Material Safety Data Sheet (MSDS)
- G. Add acid to water, never water to acid (adding water to acid could cause acid to splash out of the container and cause harm)
- H. Be careful with flammable chemicals near any heat source
- I. Do not take any chemicals out of the lab for any reason
- J. Keep chemical containers that are not in use closed
- K. Notify the teacher immediately if any chemical is spilt at any time

V. Glassware and Equipment Rules

- A. Do not use dirty, chipped, or broken glassware in the lab
- B. Notify the teacher immediately if/when any glassware is broken, so he or she can clean it up
- C. Inform the teacher of any damaged electrical equipment
- D. Use protective equipment when handling glassware (hot and cold glassware look similar)

VI. Heating Substances Rules

- A. Never leave any heat sources unattended (whether a hot plate or a Bunsen burner)
- B. Never lean over a flame
- C. Always point the open end of a heated test tube away from yourself and others
- D. Always use tongs or protective gloves to handle heated glass or metal
- E. Always make sure that long hair is pulled back when dealing with a flame or heat

VII. Material Safety Data Sheet (MSDS)

- A. MSDS's are available for every chemical (online and/or a hardcopy is included with the chemicals when shipped)
- B. MSDS's always include the following information for a chemical
 1. Chemical product information – formula, name, and company info
 2. Ingredients – additional chemicals, if more than one, are listed by percentage
 3. Hazards identification – products with possible health effects including the routes into the body
 4. First aid measures – actions to take in case of harmful contact with a chemical
 5. Firefighting measures – properties of fire and explosive
 6. Accidental release measures – proper ways to clean up small and large spills

7. Handling and storage – how to properly store and handle the chemical
8. Exposure controls/Personal protection – how to help protect yourself from exposure to the chemical
9. Physical and chemical properties – odor, pH, boiling point, taste, color, etc.
10. Stability and reactivity – if a chemical is stable and/or the conditions of its instability
11. Toxicological information –mostly for medical professionals
12. Ecological information – not always considered, but can help a Hazmat team determine the environmental effects
13. Disposal considerations – the proper disposal method for the chemical
14. Transport information – the procedure for transporting the hazardous chemical
15. Regulatory information – the federal and state regulations associated with the chemical
16. Any additional information – can include references, legends, and the revision date of the most recent MSDS

Activities

1. Create safety posters. Divide the class into groups and assign each group a section of safety rules from the key points. Have each group review their section of rules and create a safety poster portraying them. After the poster is complete, have the groups present them to the class. This is so everyone will have an understanding of all of the sections of the safety rules (optional – the final posters may be displayed in the lab as a constant reminder). Use the Safety Poster Handout for the activity. Use the Presentation Rubric, the Individual Work Rubric and the Group Evaluation as needed for assessment.
2. MSDS Activity. Give each group an MSDS about a chemical that they may use in the lab this year (these are included with chemicals when they are shipped. If you do not have the hardcopy, find a copy on the Internet and print it). Give each student the MSDS Activity Worksheet and have them complete it using the MSDS you provide. Use the MSDS Activity Worksheet and the MSDS Activity Worksheet Key for assessment.

Assessments

Lab Safety Quiz and Key
MSDS Activity Worksheet Key
Discussion Rubric
Group Evaluation
Individual Work Rubric
Presentation Rubric

Materials

Lab Safety computer-based presentation
Poster board and markers
Safety Poster Handout
MSDS Activity Worksheet
MSDS on chemicals

Resources

Occupational Safety & Health Administration www.osha.gov
Texas Education Agency, Forensic Certification Training, Sam Houston State University

Do an Internet search for the following: Flinn Scientific.

Accommodations for Learning Differences

For reinforcement, students will create and act out “rights” and “wrongs” in the lab. Other students can guess what category they fall into. Use the Individual Work Rubric for assessment.

For enrichment, students will teach a safety lesson at a nearby elementary or middle school to a class. Use the Individual Work Rubric for assessment.

State Education Standards

Texas Essential Knowledge and Skills for Career and Technical Education
§130.295. Forensic Science (One Credit).

- (1) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:
 - (A) demonstrate safe practices during laboratory and field investigations; and
 - (B) demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials.

College and Career Readiness Standards

- I. Nature of Science: Scientific Ways of Learning and Thinking
 - C. Collaborative and safe working practices
 1. Collaborate on joint projects.

Name _____ Date _____

Lab Safety Quiz

Multiple Choice:

1. _____ When you are finished with your lab, place your used chemicals
 - a) In the trash
 - b) Where your teacher tells you
 - c) Down the sink
 - d) Back in the original containers
2. _____ To find out the odor of a substance you should
 - a) Waft the fumes toward your nose
 - b) Heat it up
 - c) Sniff directly into the container
 - d) Stir it briskly
3. _____ When working with a flame and hazardous chemicals, always wear
 - a) Gloves
 - b) Apron
 - c) Goggles
 - d) All of the above
4. _____ Eating and drinking is
 - a) Sometimes permitted in the lab
 - b) Always permitted in the lab
 - c) Usually permitted in the lab
 - d) Never permitted in the lab
5. _____ If you wear contact lenses, you should
 - a) Tell your lab partner
 - b) Not have to wear goggles
 - c) Tell your instructor
 - d) Not tell anyone
6. _____ If you spill a chemical, the first thing you should do is
 - a) Rinse it down the sink
 - b) Notify your teacher
 - c) Mix it with other chemicals
 - d) Wipe it up with a towel

7. ____ The only type of shoes that should be worn during labs are
- a) Sandals
 - b) Open-toed shoes
 - c) Flip-flops
 - d) Closed-toed shoes
8. ____ Which of the following is against lab rules
- a) Long, loose clothing
 - b) Flammable clothing
 - c) Dangling jewelry
 - d) All of the above
9. ____ Horse play in the lab is
- a) Never allowed
 - b) Okay
 - c) Not dangerous
 - d) Fine if you are working at the same time
10. ____ Goggles should be worn
- a) Some of the time
 - b) When you feel like it
 - c) During every lab
 - d) Only if you do not wear contacts or glasses
11. ____ To put out a fire on someone's hair or clothing use
- a) A fire extinguisher
 - b) A fire blanket
 - c) Water from sink
 - d) The safety shower
12. ____ When heating test tubes, always point them
- a) At the ceiling
 - b) At yourself
 - c) At your lab partner
 - d) Away from all people
13. ____ If diluting an acid always place the
- a) Acid into the water
 - b) Water into the acid
 - c) Acid into the base
 - d) Base into the acid

14. ____ Material safety data sheets (MSDS) can tell you all of the following except
- a) Chemical properties
 - b) First aid measures
 - c) How much the chemical costs
 - d) Handling and storage
15. ____ You need to notify the teacher of the following
- a) Any spills
 - b) Any broken glassware
 - c) Both a and b
 - d) Neither a or b

Lab Safety Quiz Key

1. B
2. A
3. D
4. D
5. C
6. B
7. D
8. D
9. A
10. C
11. B
12. D
13. A
14. C
15. C

Safety Poster

Each group will create a safety poster that illustrates a section of safety rules covered in the notes. You will work on the posters in class and present them to the class after they are completed. Your group will be the only one covering that section of the rules, so make sure you showcase the most important ones.

Guidelines:

- No more than 15 words
- Should have at least 4 graphics/pictures
- Clearly shows the safety rules assigned
- Easy to understand
- Looks decent and not thrown together
- School appropriate
- Colorful and neat

Name _____ Date _____

MSDS Activity Worksheet

Throughout the year we may use some hazardous chemicals in the lab. To avoid injury, it is important to know how to find the information on the Material Safety Data Sheet (MSDS). Each group will be given a MSDS for a chemical that we may use this year. Answer the following questions using your group's chemical MSDS:

1. In what section of the MSDS would you find information that may help if you use this substance in a lab with a Bunsen burner?
2. If some of the chemical splashed in your eye, what section of the MSDS would you consult?
3. When you are done with the lab, what section of the MSDS tells you what to do with any leftover chemical?
4. What section on the MSDS tells you the protective measures you should take when dealing with the chemical?
5. What chemical does your group have? Who is its manufacturer?
6. What kind of Personal Protective Equipment should be used with this specific chemical?
7. What are some chemical and physical properties of your chemical?
8. If you got this chemical in your eye, what specific procedures would you follow?
9. Would you feel comfortable using this chemical next to an open flame? Why or why not?
10. Describe the stability and reactivity of this chemical.

MSDS Activity Worksheet Key

1. Section 5 – Firefighting measures section
2. Section 4 – First aid measures section
3. Section 13 – Disposal considerations section
4. Section 8 – Exposure control and person protection section
5. Varies depending on the chemical but the answer will be in section 1
6. Varies depending on the chemical but the answer will be in section 8
7. Varies depending on the chemical but the answer will be in section 9
8. Varies depending on the chemical but the answer will be in section 4
9. Varies depending on the chemical but the answer will be in section 5
10. Varies depending on the chemical but the answer will be in section 10

Name _____

Date _____

Discussion Rubric

Objectives	4 pts. Excellent	3 pts. Good	2 pts. Needs Some Improvement	1 pt. Needs Much Improvement	N/A	Pts.
Participates in group discussion						
Encourages others to join the conversation						
Keeps the discussion progressing to achieve goals						
Shares thoughts actively while offering helpful recommendations to others						
Gives credit to others for their ideas						
Respects the opinions of others						
Involves others by asking questions or requesting input						
Expresses thoughts and ideas clearly and effectively						
Total Points (32 pts.)						

Comments:

Name _____

Date _____

Group Evaluation

Group 1

Did the group take the assignment seriously?

No										Yes
1	2	3	4	5	6	7	8	9	10	

Could you tell what the group was trying to portray?

No										Yes
1	2	3	4	5	6	7	8	9	10	

Was the group portrayal creative?

No										Yes
1	2	3	4	5	6	7	8	9	10	

Did the group include the correct elements?

No										Yes
1	2	3	4	5	6	7	8	9	10	

Would you like to see this group demonstrate their talent for you in the future?

No										Yes
1	2	3	4	5	6	7	8	9	10	

Total Score _____

Group 2

Did the group take the assignment seriously?

No										Yes
1	2	3	4	5	6	7	8	9	10	

Could you tell what the group was trying to portray?

No										Yes
1	2	3	4	5	6	7	8	9	10	

Was the group portrayal creative?

No										Yes
1	2	3	4	5	6	7	8	9	10	

Did the group include the correct elements?

No										Yes
1	2	3	4	5	6	7	8	9	10	

Would you like to see this group demonstrate their talent for you in the future?

No										Yes
1	2	3	4	5	6	7	8	9	10	

Total Score _____

Group 3

Did the group take the assignment seriously?

No
1 2 3 4 5 6 7 8 9 Yes
10

Could you tell what the group was trying to portray?

No
1 2 3 4 5 6 7 8 9 Yes
10

Was the group portrayal creative?

No
1 2 3 4 5 6 7 8 9 Yes
10

Did the group include the correct elements?

No
1 2 3 4 5 6 7 8 9 Yes
10

Would you like to see this group demonstrate their talent for you in the future?

No
1 2 3 4 5 6 7 8 9 Yes
10

Total Score _____

Group 4

Did the group take the assignment seriously?

No
1 2 3 4 5 6 7 8 9 Yes
10

Could you tell what the group was trying to portray?

No
1 2 3 4 5 6 7 8 9 Yes
10

Was the group portrayal creative?

No
1 2 3 4 5 6 7 8 9 Yes
10

Did the group include the correct elements?

No
1 2 3 4 5 6 7 8 9 Yes
10

Would you like to see this group demonstrate their talent for you in the future?

No
1 2 3 4 5 6 7 8 9 Yes
10

Total Score _____

Group 5

Did the group take the assignment seriously?

No									Yes
1	2	3	4	5	6	7	8	9	10

Could you tell what the group was trying to portray?

No									Yes
1	2	3	4	5	6	7	8	9	10

Was the group portrayal creative?

No									Yes
1	2	3	4	5	6	7	8	9	10

Did the group include the correct elements?

No									Yes
1	2	3	4	5	6	7	8	9	10

Would you like to see this group demonstrate their talent for you in the future?

No									Yes
1	2	3	4	5	6	7	8	9	10

Total Score _____

Group 6

Did the group take the assignment seriously?

No									Yes
1	2	3	4	5	6	7	8	9	10

Could you tell what the group was trying to portray?

No									Yes
1	2	3	4	5	6	7	8	9	10

Was the group portrayal creative?

No									Yes
1	2	3	4	5	6	7	8	9	10

Did the group include the correct elements?

No									Yes
1	2	3	4	5	6	7	8	9	10

Would you like to see this group demonstrate their talent for you in the future?

No									Yes
1	2	3	4	5	6	7	8	9	10

Total Score _____

Name _____

Date _____

Individual Work Rubric

Objectives	4 pts. Excellent	3 pts. Good	2 pts. Needs Some Improvement	1 pt. Needs Much Improvement	N/A	Pts.
Follows directions Student completed the work as directed, following the directions given, in order and to the level of quality indicated						
Time management Student used time wisely and remained on task 100% of the time						
Organization Student kept notes and materials in a neat, legible, and organized manner. Information was readily retrieved						
Evidence of learning Student documented information in his or her own words and can accurately answer questions related to the information retrieved						
*Research/Gathering information (if relevant) Student used a variety of methods and sources to gather information. Student took notes while gathering information						
Total Points (20 pts.)						

Comments:

Name: _____

Date: _____

Presentation Rubric

Objectives	4 pts. Excellent	3 pts. Good	2 pts. Needs Some Improvement	1 pt. Needs Much Improvement	N/A	Pts.
Topic/Content <ul style="list-style-type: none"> • Topic discussed completely and in-depth • Includes properly cited sources (if used) 						
Creativity/Neatness <ul style="list-style-type: none"> • Integrates a variety of multimedia effects to create a professional presentation (transition and graphics) or appropriate visual aid used • Title slide, table of contents, bibliography are included, using acceptable format 						
Mechanics <ul style="list-style-type: none"> • Grammar, spelling, punctuation, and capitalization are correct • Image and font size are legible to the entire audience 						
Oral Presentation <ul style="list-style-type: none"> • Communicates with enthusiasm and eye contact • Voice delivery and projection are dynamic and audible 						
Audience Interaction <ul style="list-style-type: none"> • Presentation holds audience’s attention and relates a clear message • Clearly and effectively communicates the content throughout the presentation 						
Total Points (20 pts.)						

Comments: