

Lab Safety

Intended for Grade: Seventh

Subject: Science

Description: This project describes several major lab safety rules, safety symbols, and safety hazards that are present in a science lab and why they are important. The rules and symbols, along with proper waste disposal methods are discussed in a PowerPoint presentation. This project also contains hands-on activities demonstrating lab safety and proper waste disposal techniques.

Objective: The student will be able to recognize laboratory safety violations and hazardous waste disposal violations.

Mississippi Framework addressed:

- Science Framework 4c: Investigate and research environmental concerns of the land, water, and air.

National Standards addressed:

- Content Standard A: Science as Inquiry
- Content Standard D: Earth and Space Science
- Content Standard F: Science in Personal and Social Perspectives

Materials:

- Lab Safety PowerPoint presentation
- One Lab Safety Symbols handout per student

Activity 1:

- All safety equipment that is present in the classroom

Activity 2:

- One Lab Safety Scenario handout per student
- At least two adults, other than teacher
- Yellow plastic caution tape
- One beaker (can have more for display)
- One broken beaker
- Two flasks (can have more for display)

- One Bunsen burner with paper flame
- One can colorless soda
- One small bottle white vinegar
- One small box baking soda powder
- One mortar and pestle
- One thermometer
- One ring stand, ring, and wire gauze
- Food (for display)
- Whipped cream for safety victim
- Red cake icing
- One lab coat per safety expert
- Safety goggles/glasses - one per student entering the accident scene and safety expert
- One pair of gloves per student entering the accident scene
- One pair of gloves per safety expert
- One disposable camera (display only/optional)
- One notebook for safety expert (optional)
- One walkman with headphones (display only/optional)
- One bottle blue food coloring

Activity 3:

- One Lab Safety Stations handout per student
- One bunsen burner with a paper flame attached
- One stoppered test tube filled with green water
- One wire test tube holder
- Two flasks containing yellow and green water
- One bottle each of yellow and green food coloring
- Safety symbol labels to put on flasks (these can be cut out of the Lab Safety Symbols handout and taped on the flasks)

Background:

Laboratory safety is an important aspect of any lab based science class. Safety rules and symbols are important so that students do not injure themselves or their classmates. Practicing lab safety with a hands-on scenario will better prepare students if an accident does occur. Most lab students do not think the rules are important until something does happen and they have to take action. They must remember what they learned about lab safety and how to handle an accident. The students will be more prepared if they have the chance to practice lab safety in an improvised situation.

Another important aspect of lab safety is the disposal of hazardous and biological waste. There are several procedures for disposing of waste. Some waste can be washed down the drain, but other waste is an

environmental threat. Material Safety Data Sheets (MSDS) are valuable resources to have in a science lab. The MSDS lists all the hazards and proper waste disposal techniques associated with each chemical. These can be obtained free of charge via the Internet. Several chemical compounds are extremely hazardous and should not be washed down the drain. If disposed of improperly, these chemicals can seep into the ground water, lakes, rivers, and oceans killing several plants and animals. If the chemicals get into the drinking water, they can cause serious health problems in people.

One of the major ecosystems in this area that could be greatly affected by hazardous waste is the Mississippi River. In the upper part of the river, the Minnesota Department of Natural Resources warned people not to eat fish from the river. The upper river is severely polluted because of the release of toxic chemicals from industries. The pollution is somewhat diluted farther down the river, but there are also more industries that add to the pollution. There are standards to regulate the release of toxic chemicals, but some industries still manage to overlook the standards. In Lafayette county, the five major pollutants are methanol, formaldehyde, glycol ethers, copper, and lead compounds. Industries are not the only source of pollution. Pesticides from farming, household cleaning supplies, universities with science labs, and numerous others are also major sources of land, water, and air pollution. A great website to visit is www.scorecard.org. This site allows one to type in their zip code and see how their community ranks in land, water, and air pollution, compared to other areas in the United States. For example, in 2002, Lafayette county ranked among the dirtier 30% of all counties in the U.S. in terms of air release of recognized carcinogens from factories, power plants, and other industrial companies. In 1999, Lafayette county ranked average (in the 50% range) of all counties in the U.S. in terms of volatile organic compound emissions. Average in this case means it was not ranked in the dirtiest counties, or cleanest counties, it is in the middle of the two. To learn more about pollution in your area, go to the above website.

Procedure:

Show attached Lab Safety PowerPoint presentation before the activities. The PowerPoint presentation is an overview of lab safety rules, symbols, and waste disposal. Give the students the Lab Safety Symbols handout after they see the PowerPoint presentation.

Activity 1 – Scavenger Hunt

1. Give each student a blank piece of paper.
2. Tell them to stay in their seat and draw the layout of the lab including doors, benches, and all other furniture in the room.

3. Allow the students to walk around the lab and find all the safety equipment such as eyewash, safety shower, fire extinguishers, and all other safety equipment present in the lab. They should draw the safety equipment on their paper and clearly label everything.
4. Tell them to have a seat when they are finished.
5. Once everyone is in their seat, the teacher should walk around the room and point out all of the equipment so that no one misses anything.

Activity 2 – Lab Safety Scenario

This activity came from: Turner, B. and K.K.Shamsid-Dean. 2005. Good, Messy, Frothing Fun. Teaching Problem-Based Lab Safety. *Science Scope*. April/May: 10-13.

1. Everything should be ready before the students enter the room. The accident scene should be taped-off with yellow plastic caution tape.
2. Setting the Accident Scene:
 - A. The Victim: Have one person lie on the floor pretending to be unconscious. He/she should be wearing shorts, sandals, no goggles, gloves or other safety equipment. He/She should have a Walkman or other distractive object in one hand and a broken beaker, half filled with a blue liquid, in the other hand. The hand with the beaker should be covered in the red cake icing so it looks like blood. The person should have foam coming out of his/her mouth using whipped cream.
 - B. The Lab Bench next to victim: Set out a beaker filled with a colorless soda, a flask filled with colorless vinegar, another flask filled with water mixed with blue food coloring, one thermometer, and one mortar and pestle containing baking soda powder. Place a Bunsen burner with a paper flame and ring stand along with food on the lab bench. Set the beaker filled with the colorless soda on the ring stand and place the Bunsen burner under the beaker to look as if it is being heated.
 - C. Safety Expert: He/she should be observing the scene, writing notes (pretend) on a notebook, and taking pictures (optional). He/she should be wearing a lab coat, safety goggles/glasses, gloves, long pants, and closed-toed shoes.
3. Have an actual story of the events that caused the accident so that students can ask yes or no questions to the safety expert later. It can be like this: The victim was working with alcohol, vinegar, and an unknown blue liquid. He was trying to figure out what the blue liquid was and he tested the temperature. He then poured a small amount of it from the flask into a beaker. He smelled the liquid in the beaker and the vapors made him a little dizzy and he dropped

- and broke the beaker. He bent over to pick the beaker up and cut his hand. The chemical in the flask got into his body through the large cut and poisoned him. He started coughing up white foam, which was from the chemical reacting with his body fluids.
4. Arrange the students' desk in a half circle facing the accident scene.
 5. Place a Lab Safety Scenario handout on each desk.
 6. Have the students enter the room and sit down without touching anything on display.
 7. Tell the students to observe the scene and answer question one on the handout. Give them about 10 minutes to do this.
 8. Allow the students to tell some of the facts that they wrote down for question one. Once they have covered most of the facts tell them to answer question two.
 9. Allow two to four students to step into the scene and explore it further. They must wear safety goggles/glasses and gloves. All safety precautions must be taken, such as the proper technique of smelling an unknown liquid by fanning the vapors to the nose and the handling of hot substances. The temperature of the two clear liquids (to see if the bubbling one is boiling) should be investigated. The safety expert can help guide the students to smell the liquids and test the temperature of the liquids.
 10. Have the students tell their classmates what they discover in the scene such as the contents in the beakers.
 11. After the students have explored the scene allow the class to ask yes or no questions to the safety expert while they are working on question three.
 12. Have several of the students read their answer to question three to the rest of the class.
 13. Tell the students to complete question four and discuss their answers with the teacher or safety expert.
 14. Have three students to come up to the safety victim and tell him one thing each that he could have done to prevent the accident. This will wake the victim up. An alternative to this is for the safety expert and a helper, to drag the victim out of the room.

Activity 3 – Lab Safety Stations

1. Set up three or more separate safety violation stations on lab benches or tables.

Station 1: Have someone performing an experiment with several safety violations. He/she should have on a baggy long sleeve shirt and working with a Bunsen burner. A flame made of paper should be placed on the Bunsen burner to appear as if it is burning. The person should have

his/her shirtsleeve over the flame. The person should wear shorts, sandals, and no safety goggles.

Station 2: A second station should have someone heating a stoppered test tube (containing green water) using a Bunsen burner with paper flame. A test tube holder should be used to hold the test tube. The test tube should be pointed at the students while pretending to heat. The person should not have on goggles. He/she should be wearing a lab coat, long pants, and sandals.

Station 3: Someone should be pouring chemicals (water with food coloring) down the drain. The containers should be labeled with safety symbols such as poison, irritant, or environmental safety symbol. The students should be able to recognize the symbols and know what to do if they see them. The person with the chemicals should not be wearing gloves, but should have on safety goggles/glasses, lab coat, shoes, pants and all other proper safety clothing.

Note: These stations can be changed based on available materials in the lab. These stations can be setup with someone acting out the violations or as if someone left the lab and spilled chemicals and broke glassware.

2. Split the students into groups and have each group go to a different station.
3. Give each student a Lab Safety Stations handout.
4. Give the students eight to ten minutes at each station to identify all the safety violations.

Evaluation:

For **Activity 1**, the students should have a correctly labeled drawing identifying all safety equipment assigned by teacher. **Activity 2** and **3** can be evaluated by the completion of the handouts for each activity and the student/teacher discussion during each activity.

Extended Activities:

Have students look at cleaning supplies at home and write down some of the warning labels and symbols on the containers.

Assign a chemical to each student and have them find a Material Safety Data Sheet for the chemical using the Internet.

Have the students make safety symbols for the classroom/lab using poster board.

Sources:

Turner, B. and K.K.Shamsid-Dean. 2005. Good, Messy, Frothing Fun. Teaching Problem-Based Lab Safety. *Science Scope*. April/May: 10-13.

Curan, David. 2004. Chemical Safety Symbols Explained. Accessed 2005 June 19.
<http://wwwgeocities.com/david_charles_curran/safety/chemical_safety_symbols_4.html>.

Free Weird Science Clipart. Accessed 2005 June 18.
<http://chemistry.about.com/gi/dynamic/offsite.htm?zi=1/XJ&sdn=chemistry&zu=http%3A%2F%2Fwww.angelfire.com%2Fscifi%2FWeirdImages%2Ffree_clipart_icons_gifs_cartoon_science.html>.

2001 Science Education Centre. Making School Laboratories a Safe Place, Educators Guide. Accessed 2005 June19.
<<http://www.sec.org.za/lab/labsafe.htm>>.

2004 March. Laboratory Safety Symbols. Accessed 2005 June 19.
<<http://mywebpage.netscape.com/mrshigginschms/labsymbols.html>>.

2004 Environmental Defense and GetActive Software. Scorecard, The Pollution Information Site. Accessed 2005 June26.
<www.scorecard.org>.

2003 Mississippi Corridor Neighborhood Coalition Resources Frequently Asked Questions. Accessed 2005 June 26. <<http://www.mcnc-mpls.org/faq.asp>>.

2004 The Concise Biotech Dictionary. Accessed 2005 June20.
<<http://www.thebiotechdictionary.com>>.

Cushman, David. 2003 May. Safety Symbols used on this Website. Accessed 2005 June 25.
<<http://website.lineone.net/~dave.cushman/safetysymbols.html>>.

Safety goggles and fume hood photos. SMC Safety Rules. Accessed 2005 July 7. <<http://homepage.smc.edu/chem10/SafetyRules.html>>.

Bradley Corporation. Accessed 2005 July 7.
<<http://www.bradleycorp.com/sweets/guidelines/emrgency.htm>>.

2005. Fire Safety and Fire Extinguishers. Accessed 2005 July 8.
<<http://www.ilpi.com/safety/extinguishers.html>>.

Fire Blanket Photo. Accessed 2005 July 9.
<<http://www.chem.unl.edu/safety/hslab8.html>>.

Prepared by:

Emily Rowland
NSF NMGK-8
University of Mississippi
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Lab Safety Scenario

Name _____

1. Using complete sentences, describe the scene you are looking at in your classroom. Include as many facts as you can.

2. Draw a map of the scene as if you were looking down on it from above. Label people, glassware, etc.



3. Describe what you think happened. What facts and observations led you to these conclusions?

4. How could this accident have been prevented? What advice would you offer the victim?



Lab Safety Stations

Group _____

For each station use complete sentences to answer the following:

What safety violations do you see? Describe each one.

How could the violation be fixed?

What could happen if the violation is not fixed?

Station 1

Station 2



Station 3

Lab Safety Symbols



Corrosive – A substance that can destroy or burn living tissue and can eat away at other materials.



Toxic/Poison – A substance that can lead to death if inhaled, ingested, or absorbed by the skin.



Flammable – A substance that can burn if exposed to an open flame.



Environmental – Substances that are harmful to the environment. They must be disposed of properly, not washed down the drain.



Explosive – A substance that may explode if exposed to heat, flame, or other substance. Noise or movement can also trigger an explosion.



Irritant - A substance that causes inflammation upon contact with skin or mucous membranes.



Biohazard – A substance that is biological in nature, capable of self-replication, and can infect other biological organisms.



Electrical – This is a warning that high voltage electricity is present, so take the proper precautions.