

DOING SCIENCE SAFELY

Performance Standard 13A.D

Students will explore the applications of the principles of safety in activities within and beyond the classroom accordingly:

- *Knowledge*: Describe preventative measures and precautions related to appropriate safety rules, procedures and ways to use science equipment and materials and other actions within and beyond the classroom.
- *Application*: Create a poster which outlines specific safety precautions and responses for situations within and beyond the classroom and specifically with science equipment and materials in a safe and proper manner.
- *Communication*: Apply the appropriate procedures for dealing with potential causes of accidents at school, home and in the community.

Procedures

1. ***In order to know and apply accepted practices of science (13A)***, students should experience sufficient learning opportunities to develop the following:
 - Describe safety procedures and ways to use equipment and materials in a safe and proper manner when engaging in science activities.
 - Use equipment and materials in a safe and proper manner when conducting science activities.

Note to teacher: This standard encompasses the procedures for the safe use of science materials and equipment in the classroom, which should be embedded in all classroom activities. Extensions of this understanding of safe responses to classroom situations should apply to situations beyond the classroom activities.
2. Have students review and discuss the assessment task and how the rubric will be used to evaluate their work.
3. Embed this activity into all existing assignments in which the topic of safety can be addressed. A performance contract in which each student pledges to perform all activities safely could be incorporated into the introduction to science at the beginning of the school year; a sampler contract is attached. An additional criterion in all performance assessments could be added to indicate that each student fulfilled the contract during the scientific inquiry or technological design investigation. Another option could be a brief video-tape made of each student practicing an appropriate safety procedure from an array of several safety procedures from which to choose. Work sheet safety reminders are included.
4. To reinforce the emphasis on safety procedures and safe responses, assign students to create classroom posters which creatively reminds all students how to prepare, use and clean-up specific equipment properly (thermometers, glassware, heat and/or electrical sources, computer probe-ware, etc.), how to respond in threatening situations (fire in the classroom, hallway, home, or playground, or weather extremes such as icy conditions, extended heat or cold, flooding, etc.) or how to respond to ingestion or inhalation of dangerous chemicals, etc. Students should explain their 'safety rules' to the classroom. Periodically, review these posters and their possible extensions to more current situations the children are facing.
5. Evaluate each student's work using the Science Rubric as follows and add the scores to determine the performance level:
 - *Knowledge*: The descriptions of safety procedures and ways to use equipment and materials in a safe and proper manner when engaging in science activities were complete and correct.
 - *Application*: The creative poster displays of safety procedures to additional situations were thorough and appropriate.
 - *Communication*: The explanations of the safety procedures to remember were well-detailed, thorough and accurate.

Examples of Student Work not available

Time Requirements

- One class period for introduction; one class period for poster creation; one class period for presentations of posters; periodic review of safety principles throughout the school year with emphasis as needed for extensions to safety responses in threatening situations.

Resources

- Poster paper with markers, etc.
- Safety Contract, Precaution Symbols, Safety Rules
- Science Rubric

* Full version of the Guidelines for Science Safety in Illinois schools is available at:

<http://www.isbe.state.il.us/secondaryed/Science%20Education/Guidebook%20Science%20Safety/science%20education.htm>

A full chapter for Elementary Science Safety is included.

* The materials for the safety precautions and symbols were developed through ISBE Scientific Literacy funding in 1998, for the Secondary Foods Sciences Project.

SAFETY REALLY RULES !!!

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Safety Contract for _____ Classroom

_____ **School**

School Year: _____

I agree to follow the safety rules set for my classroom.

I understand that my safety and the safety of my classmates depend on following these rules.

I will be careful to ask questions first when I am unsure.

I will follow the rules for preparation, use and clean-up of science equipment and materials.

I will try to anticipate where and how possible accidents could occur in our classroom, playground, school and home, and try to prevent the accident.

I will think ahead.

Signed

_____ **Date: _____**

STUDENT GUIDELINES -



ELECTRICAL SAFETY: This symbol alerts students to use electrical safety practices with electrical equipment throughout this laboratory experience.

- Electrical equipment should be handled with dry hands. Remember to keep work areas dry also.
- Pull plugs, not cords, when inserting and removing electrical plugs. (*Keep one hand free when plugging and unplugging appliances - your body is an excellent conductor of electricity.*)
- Do not overload electrical circuits.
- Keep electrical cords away from traffic paths.
- Report damaged electrical equipment immediately. Look for things such as frayed cords, exposed wires, loose connections. **DO NOT** use damaged electrical equipment.
- Avoid putting electrical equipment or cords too close to a heat or water source.
- Inspect electrical equipment for proper grounding.
- Unplug electrical equipment that is not in use; store in proper and safe location.
- Do not touch metal conductors.



CHEMICAL SAFETY: This chemical safety symbol warns students that substances/chemicals used in the laboratory experience are dangerous and require safe handling practices.

- Never eat or bring food into the laboratory or work space.
- **DO NOT** eat or drink any substances tested unless expressly permitted to do so by a knowledgeable adult.
- Never taste or inhale chemicals.
- Label all bottles and apparatus containing chemicals.
- Read labels carefully; unused chemicals should be returned to properly labeled containers.
- Avoid chemical contact with skin and eyes. *Wear goggles, aprons, and gloves.*
- Do not touch chemical solutions.
- **DO NOT** touch your mouth to pipette; use a suction bulb.
- Wash hands before and after using solutions.
- Wipe up spills thoroughly; report to the teacher.
- **DO NOT** use laboratory glassware and containers for eating or drinking. These items should be stored separately from kitchen containers.
- Always add strong acids to water instead of adding water to the acids.
- Dispose of chemicals according to all local, state, and federal laws.
- Clean up all residue and dispose of properly.
- **DO NOT** dispose of materials in sink unless instructed to do so.
- *IF* mercury thermometers are used and *IF* one is broken - **DO NOT** play with the mercury. Notify your teacher for proper disposal.



PERSONAL AND CLOTHING SAFETY: This clothing safety symbol warns that laboratory conditions require certain precautions that are to be taken to protect clothing.

- Locate exits, fire blanket and extinguisher, master gas and electricity shut offs, eye wash and first aid kit.
- Make sure there is adequate ventilation.
- *DO NOT* horseplay.
- *KNOW* the hazards of the experiment and anticipate dangers.
- Wear an apron or lab coat during laboratory experiences.
- *DO NOT* wear jackets and open shoes in the laboratory; confine loose clothing, hair and jewelry.



EYE/VISION SAFETY: This symbol represents the need for eye protection during the laboratory experience.

- When instructed, approved safety goggles should be worn.
- *KNOW* where and how to use the eye wash station and equipment.
- Contact lens wearers should inform their teacher for special precautions.



FIRE SAFETY: The symbol alerts students that safety precautions must be taken when working with heat and fire.

- *KNOW* location and use of fire blankets, extinguisher, and the master gas and electricity shut offs.
- Use goggles, apron and gloves when working with boiling liquids.
- Keep your face away from test tubes and beakers.
- Never leave hot plates, ranges, or Bunsen burners unattended.
- Use tongs and dry, heat-resistant mittens/pot holders.
- Turn off hot plates, ranges, Bunsen burners and gas when you are done.
- Keep flammable substances away from heat.
- *USE* only heat-resistant glassware.
- Test tubes with heated substances should *ALWAYS* be pointed away from people.
- Heat only chemicals and substances specified by laboratory procedures and under the supervision of the teacher.



HAND SAFETY AND PROTECTION: This symbol alerts the student that precautions need to be taken to protect the hands.

- Use tongs or clamps while heating and handling hot containers.
- Handle heated glassware with caution; it appears the same, cool or heated.
- Wear gloves as needed to protect hands.
- Observe the following rules when using knives and other sharp instruments:
 - Use knives and other sharp or pointed instruments with caution.
 - Carry with tips and points pointing down and away.
 - Always cut away from your body.
 - Never try to catch falling sharp instruments.
 - Take sharp instruments by the handles.



GLASSWARE SAFETY: This symbol indicates safety precautions that should be used when handling glassware.

- Use only alcohol thermometers, not mercury.
- Clean glassware before and after use. Use only dry glassware.
- Check glassware for scratches, cracks, and sharp edges.
- Return broken or cracked glassware to your teacher.
- Clean up broken glassware immediately using a damp paper towel. If the broken glassware is hot, allow it to cool before clean-up.
- Avoid putting hot glassware on an unprotected surface or in cold water.



PERSONAL HYGIENE AND SAFETY: This water symbol will alert students to personal hygiene and safety.

- Begin all labs by washing hands with soap and water.
- Assume all microorganisms are infectious; wash hands after handling.
- Keep your hands away from your face and mouth.
- Wash hands thoroughly with soap and water after handling food, chemicals, containers and supplies.



WASTE DISPOSAL: This symbol represents the proper and safe disposal of wastes and/or chemicals.

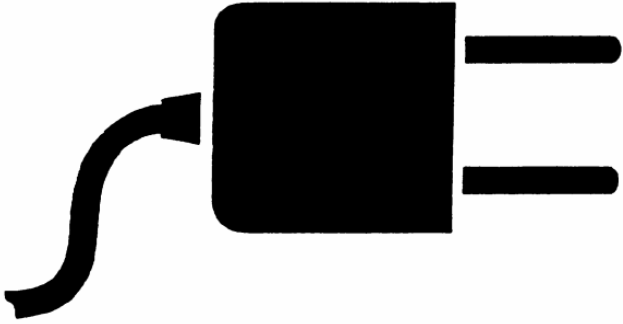
- All chemicals and wastes must be disposed of according to local, state, and federal laws.
- Clean up residue and place in container for proper disposal.
- DO NOT dispose of materials in sink unless instructed to do so.
- Thoroughly clean your work area and glassware.
- Be careful not to return chemicals or contaminated reagents to the wrong containers.



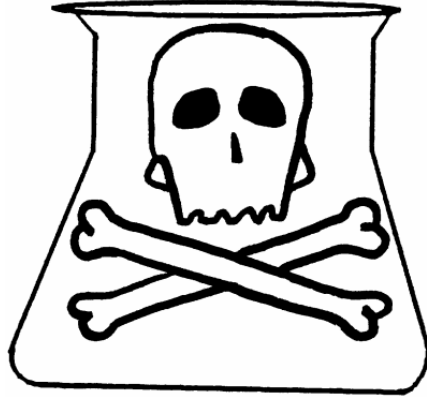
EQUIPMENT USE AND SAFETY: This symbol requires that the equipment be handled safely and used properly. Instruction on the proper use of the equipment may also be implied.

- Know how to properly and safely use the equipment required for a laboratory experiment.
- Observe safety precautions required of lab equipment.
- Set up equipment far from the edge of the table, desk, or counter.
- DO NOT use reflected sunlight to illuminate your microscope.

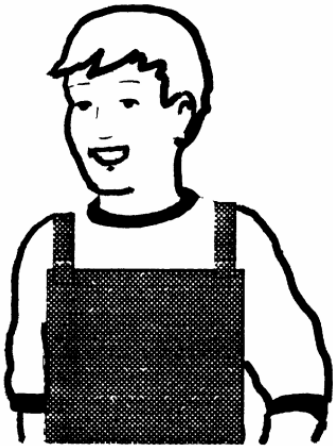
SAFETY PRECAUTION SYMBOLS



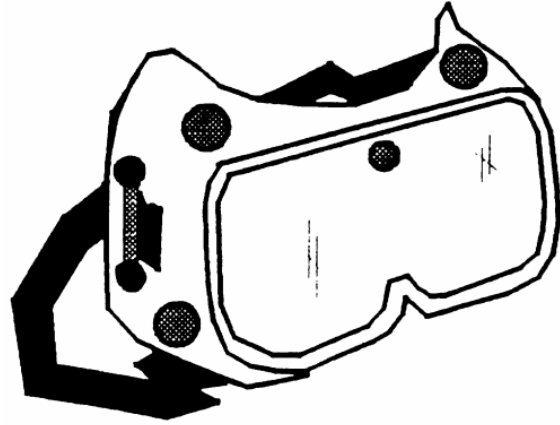
Electrical Safety



Chemical Safety



Personal and Clothing Safety



Eye/Vision Safety

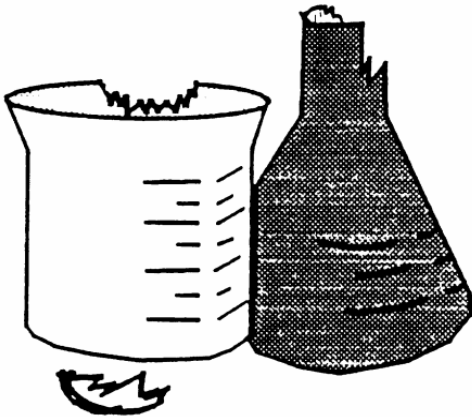
SAFETY PRECAUTION SYMBOLS



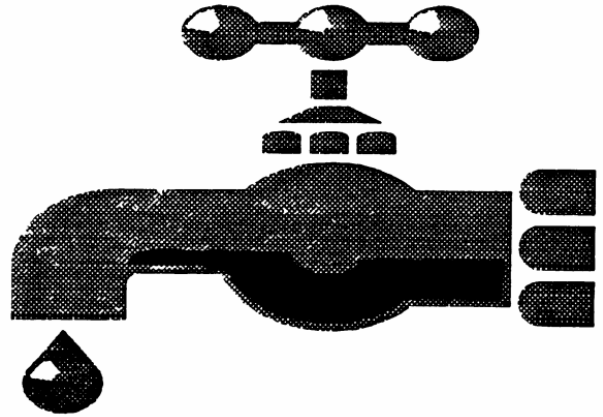
Fire Safety



Hand Safety and Protection

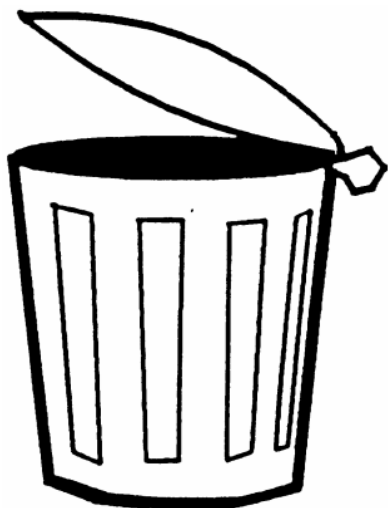


Glassware Safety



Personal Hygiene and Safety

SAFETY PRECAUTION SYMBOLS













Waste Disposal



Equipment Use and Safety

This 'safety precautions bar' may be used in its entirety or applicable pieces for each investigation. Students should be asked to initial the boxes after they have considered the symbolized safety precaution for the investigation.

Safety Precautions

SAFETY RULES

Working in a science laboratory is normally very safe. To ensure your personal safety and the safety of others, you need to reduce the risks associated with laboratory work. Risk in the science lab can come from either physical or chemical hazards. By examining these hazards, you will understand why the following rules have been developed for working in scientific laboratories.

Chemical hazards result from exposure to hazardous chemicals from absorption through skin or eye contact, inhalation, ingestion, or injection. Physical hazards include falls, cuts, eye injury, electrical shock, and fire.

1. **Protect your eyes.** Appropriate eye protection must be worn **at all times** in the laboratory. Chemical splash goggles provide maximum protection from splashes. Contact lenses should not normally be worn unless approved by your teacher. Unventilated goggles are essential if contact lenses are to be worn.
2. **Wear appropriate protective clothing.** Chemicals can burn or irritate the skin. Some chemicals are readily absorbed through the skin and enter your body. Your clothing should cover your legs to the knees. Shorts are not appropriate for the laboratory. Laboratory coats or aprons can protect good clothing. Loose clothing should not be worn because it may dip into chemicals or fall into a flame and catch fire.
3. **Wear shoes that cover your feet.** Sandals and open-toed shoes do not protect your feet from broken glass that is frequently found in science laboratories. Also, leather shoes protect your feet from chemical spills, canvas shoes do not.
4. **Do not apply cosmetics, eat, or drink in the laboratory.** These activities are ways by which you can accidentally ingest harmful chemicals.
5. **Do not taste any chemical.**
6. **Do not smell chemicals directly.** Smell a chemical only if your teacher specifically tells you to do so, then use your hand to fan the vapor to your nose.
7. **Do not pipet solutions by mouth.** Use a rubber suction bulb or other device to fill a pipet.
8. **Wash your hands with soap and water before leaving the laboratory.** This rule applies even if you have been wearing gloves.
9. **Know the hazards of the materials being used.** Read labels carefully to make sure you are using the right chemical. Know how to interpret data from a MSDS. Remember that hot and cold glassware look the same, so allow ample time for cooling.
10. **Tie back loose hair.** Dangling hair can fall into a Bunsen burner and catch on fire or can fall into a chemical solution.
11. **Know the safety equipment.** Know the location of eyewash fountains, safety showers, fire blankets, fire extinguishers, first-aid kits, and emergency exits. Know how to respond in case of an emergency. Know how to use the safety equipment.
12. **Carry out only the experiments assigned by your teacher.** Never perform unauthorized experiments.
13. **Never remove chemicals from the laboratory.**
14. **Never work in the laboratory unless authorized to do so by your teacher.** Never work alone in the laboratory. In case of a problem, you may need another person to prevent injury or even save your life.
15. **Never engage in horseplay, games, or pranks in the laboratory.** Remember that the laboratory is a place for serious work. Careless behavior can endanger yourself and others and will not be tolerated.
16. **Demonstrate safe behavior.** Obey all safety instructions given by your instructor or found in your experimental procedure. Clean up spills immediately if you know how. If you are uncertain how to clean up a spill or if a large spill occurs, notify your instructor immediately. Before leaving the laboratory, return equipment and chemicals to their proper places. Clean up your work area.
17. **Dispose of all waste materials according to your teacher's instructions.**
18. **Report any accidents or unsafe conditions to your teacher immediately.**