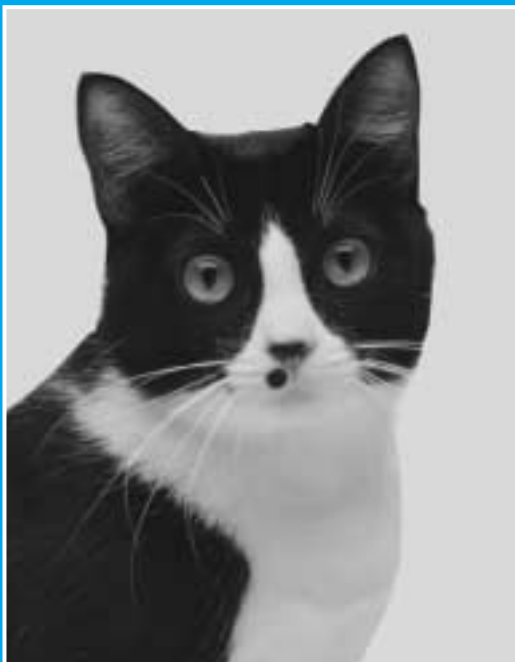


Safety in the Elementary (K-6) Science Classroom

Second Edition



Foreword

Science education in the elementary school is crucial to the education of our children. Hands-on science activities encourage students to become active participants in learning about the world around them. This booklet is designed to assist elementary science teachers with one of the special aspects of teaching science, that of making the experimental environment safe for the students. As Chair of the Committee on Chemical Safety of the American Chemical Society, I would like to thank the Committee Members who prepared the first edition of this booklet in 1993, Jack Breazeale (who chaired the subcommittee), Robert Alaimo, Patricia Redden, Jay Young, Maureen Matkovich (ACS staff liaison), and, especially, Beverly DiMaio of the Horry County School District, South Carolina. Their hard work is gratefully acknowledged. This second edition contains updated references and graphics but essentially has the same text as the first edition.

Diane G. Schmidt, Chair
Committee on Chemical Safety
April 2001

Disclaimer

The materials contained in this pamphlet have been compiled by recognized authorities from sources believed to be reliable and to represent the best opinions on the subject. This pamphlet is intended to serve only as a starting point for good practices and does not purport to specify minimal legal standards or to represent the policy of the American Chemical Society. No warranty, guarantee, or representation is made by the American Chemical Society as to the accuracy or sufficiency of the information contained herein, and the Society assumes no responsibility in connection therewith. This manual is intended to provide basic guidelines for safe practices. Therefore, it cannot be assumed that all necessary warning and precautionary measures are contained in this document and that other or additional information or measures may not be required. The American Chemical Society does not warrant that the recommendations contained in these materials meet or comply with the requirements of any safety Code or regulation of any state, municipality, or other jurisdiction. Users of this pamphlet should consult pertinent local, state, and federal laws and legal counsel before initiating any safety program.

Introduction

Science is safe as long as teachers and students are aware of potential hazards and take necessary and appropriate precautions and safety measures. If students can take responsibility for being safety conscious, they will be better prepared and better disciplined for the higher-level sciences.

Objectives of This Booklet

1. To make teachers aware of the potential hazards that exist in an elementary science classroom.
2. To help teachers organize their classes so that injuries can be prevented.
3. To help teachers evaluate safety aspects of an experiment or science activity and become aware of hazards that may exist.
4. To make students aware of the importance of safety in the classroom.

Safety through Organization

Many potential hazards can be eliminated if the teacher has an organized and disciplined classroom. To do this, the teacher needs to perform the experiment before assigning it to the students. Then, as a result of the prior performance, the teacher will be familiar with the activity, will have the materials ready to distribute to the students, will be ready to supervise the students' activities, will have a plan for collecting materials after the activity, and will be able to instruct the students in what is expected of them.

Helpful suggestions can be found in several resources. The teacher's edition of the textbook being used should have safety information on the activities. The state department of education should have publications available to assist with matters of safety and disposal. Many science supply houses offer safety and disposal publications. Expert advice can be obtained from organizations such as the American Chemical Society, the Laboratory Safety Institute, the National Association of Biology Teachers, and the National Science Teachers Association. If a college or university is nearby, members of the science faculty are usually willing to assist in safety matters. (Addresses and telephone numbers of the organizations listed above appear at the end of this publication.)

Eye and Personal Protection

1. Teachers should always wear chemical splash-proof safety goggles when working with chemicals, as should students working or watching in the area. Child-sized goggles are available from science materials suppliers.



2. Teachers and students should wear safety goggles whenever there is a possibility of flying objects or projectiles, such as when working with rubber bands.
3. Safety goggles used by more than one person should be sterilized between uses. One possible method of sterilization is to immerse the goggles in diluted laundry bleach followed by thorough rinsing and drying.
4. Proper precautions must be taken when using sharp objects such as knives, scalpels, compasses with sharp points, needles, and pins.
5. Students should not clean up broken glass. Teachers should use a broom and dustpan without touching the broken glass. Broken glass must be disposed of in a manner to prevent cuts or injury to the teacher, students, and custodial staff.
6. Teachers may decide to wear a laboratory apron or smock to prevent soiling or damage to clothing; if so, students should be similarly attired.
7. When working with hot materials, noxious plants, or live animals, teachers and students should wear appropriate hand protection.
8. Teachers and students should wash their hands upon completion of any experimental activity or at the end of the instructional session.

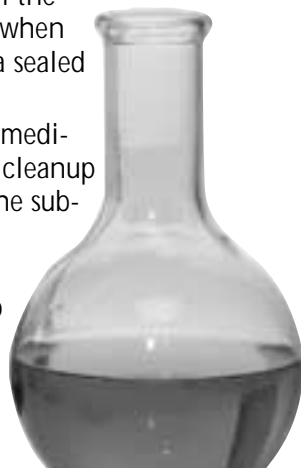
Safety with Fire and Heat Sources

1. Teachers should never leave the room while any flame is lighted or other heat source is in use.
2. Never heat flammable liquids. Heat only water or water solutions.
3. Use only glassware made from borosilicate glass (Kimax or Pyrex) for heating.
4. When working around a heat source, tie back long hair and secure loose clothing.
5. The area surrounding a heat source should be clean and have no combustible materials nearby.
6. When using a hot plate, locate it so that a child cannot pull it off the worktop or trip over the power cord.
7. Never leave the room while the hot plate is plugged in, whether or not it is in use; never allow students near an in-use hot plate if the teacher is not immediately beside the students.
8. Be certain that hot plates have been unplugged and are cool before handling. Check for residual heat by placing a few drops of water on the hot plate surface.
9. Never use alcohol burners.
10. Students should use candles only under the strict supervision of the teacher. Candles should be placed in a "drip pan" such as an aluminum pie plate large enough to contain the candle if it is knocked over.

11. The teacher should wear safety goggles and use heat-resistant mitts when working with hot materials. All students near hot liquids should wear safety goggles.
12. The teacher should keep a fire extinguisher near the activity area and be trained in its use.
13. The teacher should know what to do in case of fire. If a school policy does not exist, check with local fire officials for information.

Procedures for Using Dangerous Materials

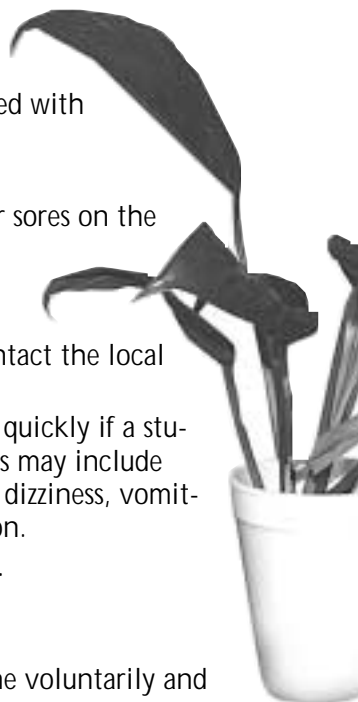
1. Use only safety matches. Even safety matches should be used only with direct teacher supervision.
2. Use only nonmercury thermometers. Mercury from broken thermometers is difficult to clean up, and the vapors from spilled mercury are dangerous. Remember that thermometers are fragile; when students are handling them, supervise them so that the students won't use the thermometers as a stirring rod or allow them to roll off the table.
3. Store batteries with at least one terminal covered with tape. Batteries exhibiting any corrosion should be discarded. Because the contents of batteries are potentially hazardous, batteries should not be cut open or taken apart. Check to see if batteries can be recycled in your area.
4. Never tell, encourage, or allow students to place any materials in or near their mouth, nose, or eyes.
5. Materials may include household chemicals. Before using household chemicals or other materials, study the label carefully to learn the hazards and precautions associated with such materials. Similarly, study the labels of chemicals purchased from a scientific supply house. The commercial suppliers of laboratory chemicals will furnish Material Safety Data Sheets (MSDSs) that describe the hazards and precautions for such materials in detail. These MSDSs should be on file in the school district office, and copies should be available in the classroom.
6. Do not touch "dry ice" (solid carbon dioxide) with the bare skin. Always wear cotton or insulated gloves when handling dry ice. Do not store or place dry ice in a sealed container.
7. Liquid spills can be slippery. Clean up any spill immediately and properly as soon as it occurs. Follow the cleanup instructions given on the label or the MSDS for the substance.
8. Do not mix or use chemicals in any manner other than that stated in the approved procedure. At no time should a teacher undertake a new procedure



without prior and full investigation of the chemical and physical properties of the materials to be used and of the outcomes of the proposed procedures. When planning to undertake a new procedure, it is a good practice to consult with a professional who is familiar with any potential problems.

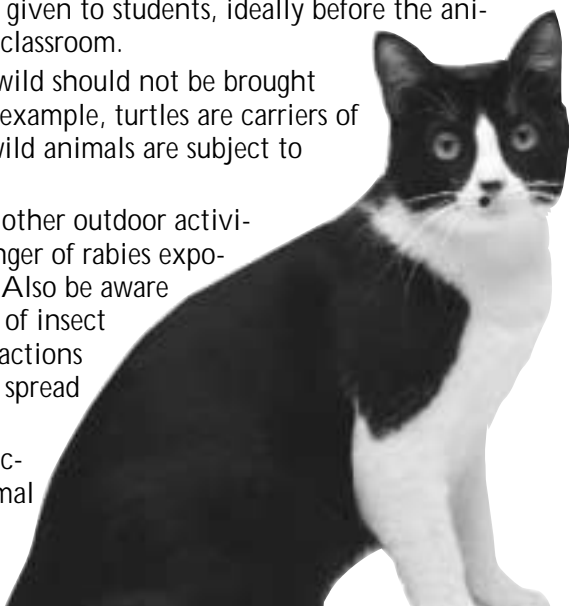
Safety with Plants

1. Wash hands after working with seeds and plants. Many store-bought seeds have been coated with insecticides and/or fertilizers.
2. Never put seeds or plants in the mouth.
3. Do not handle seeds or plants if there are cuts or sores on the hands.
4. Some 700 species of plants are known to cause death or illness. Be aware of plants in the local area that are harmful. For more information, contact the local county agricultural agent.
5. Be aware of the signs of plant poisoning and act quickly if a student exhibits such signs after a lesson. Symptoms may include one or more of the following: headache, nausea, dizziness, vomiting, skin eruption, itching, or other skin irritation.
6. Be particularly alert to plant safety on field trips.



Safety with Animals

1. All handling of animals by students must be done voluntarily and only under immediate teacher supervision.
2. Students should not be allowed to mishandle or mistreat animals.
3. A safety lesson should be given to teach the students how to care for and treat the animal. A safety lesson on proper care and treatment of the animal should be given to students, ideally before the animal is brought into the classroom.
4. Animals caught in the wild should not be brought into the classroom. For example, turtles are carriers of salmonella, and many wild animals are subject to rabies.
5. On field trips or during other outdoor activities, be aware of the danger of rabies exposure from wild animals. Also be aware of the potential hazards of insect bites, such as allergic reactions to bee stings or diseases spread by ticks or fleas.
6. At no time should dissection be done on an animal.



corpse unless it was specifically purchased for that purpose from a reliable supplier.

7. Any animal species that has been preserved in formaldehyde should not be used.

Emergency Procedures

1. Establish emergency procedures for at least the following: emergency first aid, electric shock, poisoning, burns, fire, evacuations, spills, and animal bites.
2. Evaluate each experimental procedure in advance of classroom use so that plans may be made in advance to handle possible emergencies.
3. Be sure that equipment and supplies needed for foreseen emergencies are available in or near the classroom.
4. Establish procedures for the notification of appropriate authorities and response agencies in the event of an emergency.

Disposal

Except for the disposal procedures described in the textbook in use, it is unlikely that any of the wastes generated in elementary science activities will be harmful to the environment. If the teacher has any questions concerning waste disposal, the science supervisor for the school or school district should be consulted.

Safety Awareness of Students

Safety instruction should begin at the earliest possible age. Students can begin to learn the importance of safety in the classroom, laboratory, and life in general at the elementary school level. The teacher must set the rules, but the teacher should also explain to the students why the rules are necessary. The students must also realize that anyone who does not follow the rules will lose the privilege of taking part in the fun, hands-on activities.

To reinforce the rules, teachers should engage the students in a discussion or activity. One activity could be a poster contest. The winning posters could be displayed in the room and used throughout the year to stress safety and enforce the safety rules.

General Safety Rules for Students

Always review the general safety rules with the students before beginning an activity.

1. Never do any experiment without the approval and direct supervision of your teacher.
2. Always wear your safety goggles when your teacher tells you to do so. Never remove your goggles during an activity.
3. Know the location of all safety equipment in or near your classroom. Never play with the safety equipment.
4. Tell your teacher immediately if an accident occurs.
5. Tell your teacher immediately if a spill occurs.
6. Tell your teacher immediately about any broken, chipped, or scratched glassware so that it may be properly cleaned up and disposed of.
7. Tie back long hair and secure loose clothing when working around flames.
8. If instructed to do so, wear your laboratory apron or smock to protect your clothing.
9. Never assume that anything that has been heated is cool. Hot glassware looks just like cool glassware.
10. Never taste anything during a laboratory activity. If an investigation involves tasting, it will be done in the cafeteria.
11. Clean up your work area upon completion of your activity.
12. Wash your hands with soap and water upon completion of an activity.



Resources

American Chemical Society
Chemical Health and Safety
Referral Service
1155 Sixteenth St., NW
Washington, DC 20036
(800) 227-5558, ext. 4513
LIBRARY@acs.org
chemistry.org

American Chemical Society
Committee on Chemical Safety
1155 Sixteenth St., NW
Washington, DC 20036
chemistry.org/committees/ccs

National Association of Biology
Teachers
12030 Sunrise Valley Dr.
Suite 110
Reston, VA 20191
(703) 264-9696
www.NABT.org

National Science Teachers
Association
1840 Wilson Blvd.
Arlington, VA 22201-3000
(703) 243-7100
www.NSTA.org

Laboratory Safety Institute
192 Worcester Rd.
Natick, MA 01760
(508) 647-1900
www.labsafety.org