

Safety and the Material Safety Data Sheet

Strand	Scientific Investigation
Topic	Examining material safety data sheet (MSDS) in relation to laboratory safety issues and procedures
Primary SOL	BIO.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which h) chemicals and equipment are used in a safe manner.

Background Information

Teachers and school administrators want to create the safest possible learning environment for all students; consequently, they are dedicated to the premise that no action will be taken that might jeopardize the safety or health of any student. A safe environment can be maintained through following these steps: 1) anticipate hazards, 2) recognize hazards, 3) eliminate hazards, and 4) control hazards. Each step can be approached by focusing on categories of hazards found within the school environment. The science lab contains more potentially hazardous materials and equipment than students encounter elsewhere.

Safety should not be a once-only lesson; rather, it should be an ongoing thread that runs through all instruction at all levels. Common sense and informed caution go together to make the lab a safe place. Students need to know how to prevent accidents and how to deal with them when they occur. Ongoing safety instruction should be a part of all class, field, and lab activities.

One of the essential tools available to laboratory science teachers is the Material Safety Data Sheet (MSDS), which provides teachers, students, and emergency personnel with the proper procedures for handling a particular substance. The information on a MSDS not only improves lab safety, but also enhances understanding of chemicals used in the lab.

Materials

- Various lab chemicals
- Several MSDSs for chemicals that are used in the lab or that are encountered in daily life
- Sample Chemical-Safety Chart (attached)
- Safety equipment (e.g., aprons, goggles, gloves, fire extinguishers, fire blanket, safety shower, eye wash, broken-glass container, fume hood)

Vocabulary

fume hood, LD₅₀/TLV, Material Safety Data Sheet (MSDS)

Student/Teacher Actions (what students and teachers should be doing to facilitate learning)

Before undertaking this lesson, locate MSDSs for your classroom chemicals (obtainable on the Internet). Organize them in a binder, and place it in an accessible location for quick reference.

1. Supply students with a sample MSDS. Explain why formatting safety information in a standard, universally accepted way facilitates speed and clarity of communication, especially in emergency situations. Inform students that when dealing with chemicals in

science, a standard way of recording and communicating information is a MSDS, or Material Safety Data Sheet. Reading and understanding it helps us prepare for safe use, storage, and disposal of chemicals used in laboratory investigations.

2. Have students select a chemical that has been or will be used in class. Alternatively, select a number of chemicals that students encounter in their daily lives. Have students research the MSDS for each chemical selected.
3. Instruct students to prepare a demonstration of their understanding of the content of the MSDS(s). This demonstration can take the form of charts, one for each chemical selected, which show the following:
 - Name of chemical
 - Synonym(s)
 - Formula
 - Physical properties (2)
 - Chemical properties (2)
 - LD₅₀/TLV
 - Special precautions
 - Storage and/or disposal methods
 - Sources of information

Distribute copies of the attached Sample Chemical-Safety Chart for students to use as a model.

4. Display and have students identify the following safety equipment: aprons, goggles, gloves, fire extinguishers, fire blanket, safety shower, eye wash, broken-glass container, fume hood, and any other safety equipment they will use. Direct students to describe and then demonstrate proper use of the equipment, as appropriate, in the course of completing laboratory or field investigations.
5. Have students prepare a skit or instructional video and/or poster in which an “accident” is enacted and the proper safety response is demonstrated according to the MSDS.

Assessment

- **Questions**
 - Why is it imperative to format safety information in a standard, universally accepted way?
- **Journal/Writing Prompts**
 - Explain why safety procedures should *always* be followed and *never* ignored. Include an example of the possible consequences of not following safety procedures.
- **Other**
 - Have each student and parent read and sign the Parent-Student Safety Contract, as provided by the school.
 - Hold periodic “safety drills,” and record students’ responses.

Extensions and Connections (for all students)

- Have students research the four-colored, diamond-shaped shipping-hazard and transportation-code symbol seen on the sides of trucks on the highway.
- Have students decipher and explain the numerous acronyms found on each MSDS.

- Have students research chemical structures and names that could be signs of a hazard (e.g., ring structures like benzene, alcohols).

Strategies for Differentiation

- Pair students, and have them compare and contrast the properties of their chemicals.
- Allow students to choose the chemicals they research.
- Provide students with the name of a chemical, an empty chart, and the answers in random order, and have them put the answers in the proper spaces in the chart.
- Provide students with five completed charts that lack the names of the chemicals. Also, provide a list of five chemicals, and direct students to match the chemicals with the charts and justify their reasoning.

Sample Chemical-Safety Chart

Name of chemical	HYDROGEN PEROXIDE
Synonym(s)	Hydrogen peroxide solution
Formula	H ₂ O ₂
Physical properties (2)	B.P. 106°C; colorless
Chemical properties (2)	Soluble in water; bitter taste
LD₅₀/TLV	TWA 1ppm
Special precautions	Store in cool place away from sunlight, organics, and reducing agents
Storage and/or disposal	Store in cool place, tightly closed; beware of bulging containers
Sources of information	CBS MSDS and Fisher MSDS