

1.1 Safety in the Science Classroom

Safe practice in the science lab includes knowing how to behave safely during lab activities and what to do in an emergency. Lab safety rules restrict certain kinds of activities, such as horseshplay or eating during a lab. But they also make it possible for you to safely carry out investigations that contain an element of risk. Warning labels are used on commercial, industrial, and home products that contain hazardous chemicals. Several labelling systems are used, including the Workplace Hazardous Materials Information System (WHMIS).

Words to Know

hazard symbol
WHMIS

Welcome to the science laboratory! In this unit, you will gain experience observing and controlling changes in matter. Experimenting is a central part of science, and no study of chemistry is complete without it (Figure 1.1). In all activities, you must make safety the first priority. Remember to stay alert in experiments and watch out for your safety and the safety of others.

Make Safety Your First Priority

You need to be careful and considerate in the laboratory. But more than good behaviour is required. To be able to work safely and with confidence, you must have the right kind of knowledge, an awareness of what is happening, and an ability to act.

You need to know safety rules *before* you start a science activity. This knowledge helps you prevent accidents. For example, to prevent broken glass or a chemical damaging your eyes, wear safety eyewear.

Know and follow the safety rules in your lab and know what to do in an emergency. General rules about safety are explained in this section. Your teacher will help you apply the rules to your science classroom.

You need to be aware of safe procedures *while you are doing* your lab activity. Be careful of what you are doing and also of what others are doing.

Figure 1.1 Many discoveries in chemistry are based on experiments done in laboratories.



You can put your knowledge and awareness to good use by acting to prevent or deal with an accident. Most accidents can be prevented. When you spot an emergency, first call out a general warning loud and clear, such as “Fire!” or “Help!”—and then take action.

In an emergency, *you do not need permission* to use emergency equipment—just recognize the emergency and take action. Always act first to protect yourself and others from harm. To do this, you need to know where the emergency equipment is in your lab and how to use it. Your teacher will show you.

Did You Know?

Accident rates for workers in British Columbia are highest for young and newly hired employees. This is because safe skills need to be learned and practised until they become second nature.

1-1A Science Lab Safety

Think About It

Safe lab procedures include anticipating dangers and recognizing them when they occur. In this activity, you will identify unsafe practices shown in the illustration. Some are obvious, while others are more subtle. Try to find as many as you can.

What to Do

1. Work with a partner. Identify as many unsafe practices as you can find in the illustration.

2. Make a three-column table. In the first column, list the unsafe practices you have identified. In the second column, list an injury that might occur as a result of each practice. In the third column, suggest a safer, better way to carry out each procedure.

What Did You Find Out?

1. Share your observations with your class.
2. Add to your list any observations another group made that you had not already identified.



Rules to Help You Stay Safe

Rules for safe conduct in the lab are based on common sense and knowledge of safe lab practices and procedures. Keep in mind that careful and orderly behaviour is not just good manners, it protects you and others from dangerous situations that might occur.

Here is a list of safety rules that apply to all lab work in science.

Safety Rules for the Science Lab

General

1. Always work under supervision and only on approved activities. Never change a procedure without your teacher's permission.
2. Make sure you know the procedure and have read it over before you start an experiment.
3. Make sure you know how to use your lab equipment properly before you start an experiment.
4. Always use appropriate protective equipment, such as a lab apron or protective eyewear. Tell your teacher if you are wearing contact lenses.
5. Do not wear loose clothing, sandals, or open-toed shoes.
6. Do not eat, drink, or chew gum in the laboratory.
7. Never engage in horseplay.
8. Know the location and use of all emergency equipment and emergency exits (Figure 1.2).
9. In case of an emergency, follow procedures your teacher has taught you. Use whatever emergency equipment is appropriate to respond to the emergency. Act immediately to protect people first and then equipment.

Glassware

10. Never use broken or chipped glassware. Dispose of it in a "sharps" bucket or as your teacher directs. Use clean glassware, and after use wash it, or put it in an approved place to soak.

Chemicals

11. Know the safety precautions and hazards for all chemicals you are using before you start your lab.
12. If you come in contact with a substance, wash the affected area immediately and thoroughly with water. If you get anything in your eyes, do not touch them. Wash them immediately and continuously for 15 minutes and inform your teacher.



Figure 1.2 Know when to use a fire alarm. Know where the fire extinguisher is in your classroom.

13. Hold containers away from your face when pouring liquids.
14. Read labels on containers. Never use a chemical from a container that does not have a readable label. Take it to your teacher.
15. When in the lab, never put anything in your mouth such as fingers, equipment, hair, pencils, or chemicals that you are working with, even if they are food items.
16. Never return a chemical to its original container. Doing this could contaminate the original stock.
17. Never put any chemical down the sink or into the garbage without permission.
18. Clean up any spills according to your teacher's instructions.
19. If you are asked to smell a substance, never smell it directly. Hold the container at arm's length and waft fumes toward you. Gradually bring the container closer to your nose until you can smell the fumes safely (Figure 1.3).



20. When diluting a concentrated acid with water, add the acid to the water, not the water to the acid. This prevents sudden overheating of the water.

Hot Plates and Open Flames

21. Handle hot objects carefully. Be especially careful with a hot plate even if it looks as though it has cooled down.
22. Know how to light and operate a Bunsen burner.
23. Tie back long hair and avoid fuzzy clothing and long sleeves when you are in an area with open flames.
24. Never leave an open flame unattended, even for a moment. Assign someone else to watch it, or turn the flame off.

Electrical Equipment

25. Make sure your hands are dry when touching electrical cords, plugs, or sockets.
26. Pull the plug, not the cord, when unplugging electrical equipment.
27. Report frayed cords and any other damaged equipment to your teacher.
28. If any electrical component becomes hot during an activity, disconnect the circuit immediately.

Figure 1.3 Never smell anything in the lab directly. Always waft the fumes toward your nose.

Reading Check

1. What do you need to know before you start a science activity?
2. What should you do if you begin using a piece of glassware and then discover it has a small chip or nick in it?
3. Explain what is incomplete about the following rule: Never taste a chemical.
4. What should you do with a chemical container that has a label you cannot read?
5. Describe the safe way to smell a substance.

WHMIS Symbols

An important safety step when using any chemical, whether around the home, in the lab, or in the workplace, is to check the warning symbols on the container. The **Workplace Hazardous Materials Information System (WHMIS)** is used to ensure that everyone has access to appropriate safety information about any hazardous substance they may encounter that is manufactured and sold. In this system, eight symbols provide easy-to-read warnings. A chemical container may have one or more of the symbols shown in Figure 1.4.



Figure 1.4 WHMIS symbols

Other Safety Hazard Symbols

Many products ranging from household cleaners to spray paints are labelled with another type of safety **hazard symbol** (Figure 1.5). You may have noticed these symbols on products used at home in the laundry room or with garden equipment. Each hazard symbol provides two kinds of warnings:

- whether the hazard is the container or its contents, shown by the shape of the border
- the type of hazard—explosive, corrosive, flammable, or poisonous—shown by an image at the centre of the symbol







The Borders	The Hazards
 <p>Dangerous Container The border that looks like a traffic yield sign means that the <i>container</i> is dangerous.</p>	 <p>Explosive This symbol means that the container can explode. If it is punctured or heated, pieces can cause serious injuries, especially to the eyes.</p>
 <p>Dangerous Product The border that looks like a traffic stop sign means that the <i>contents</i> of the container are dangerous.</p>	 <p>Flammable This symbol means that the product will catch on fire easily if it is near sparks, flames, or even heat.</p>
	 <p>Corrosive This symbol means that the product inside the container will burn the throat or stomach if swallowed and will burn skin or eyes on contact.</p>
	 <p>Poisonous This symbol means that the product will cause illness or death if you eat or drink it. For some products, just smelling or licking them is enough to cause serious harm.</p>

Figure 1.5 Watch for these symbols on products you use at home as well as those you see in the lab.

Reading Check

1. What does WHMIS stand for?
2. Name the hazard that each WHMIS symbol below identifies.

(a)



(b)



(c)



3. Identify each of the following hazard symbols.

(a)



(b)



(c)



Explore More

There is a Material Safety Data Sheet (MSDS) for every chemical used in school classrooms. Find out what an MSDS is. Read the MSDS for bleach or another chemical of your choice. Start your research at www.bcs9.ca.

1-1B Safety Guidelines for Your Lab

Think About It

In this activity, you will select a safety rule listed on pages 10 and 11 or one provided by your teacher and create a poster illustrating the rule. Share your poster with your classmates and then develop safety guidelines customized for your classroom.

What to Do

Part 1

1. Select a safety rule. Think about a way to show the rule visually, such as using an image similar to direction signs in airports or using a short phrase.
2. On a sheet of paper, draw a poster that has strong visual impact and will be a good reminder of one particular rule. Make sure the poster can be read from at least 3 m away.
3. Present your poster to the class, explaining the rule and your choice of illustration.

Part 2

4. Work in pairs or small groups to develop a set of safety guidelines that could be used as a safety contract for the students in your classroom. Your guidelines should incorporate the following.
 - information from the class posters and *BC Science 9*
 - information specific to your class about location of safety equipment and procedures for evacuation
 - other information to ensure safe and responsible ways of working in your class
5. Share your contract with several other groups.

What Did You Find Out?

1. How could you improve your safety poster?
2. (a) How could you improve your safety contract based on what other groups have included in their contracts?
(b) Make your refinements and sign your contract.