

SAFETY FIRST!

The Chemical Educational Foundation (CEF) hopes you and your students will enjoy the lessons in the *You Be The Chemist* Activity Guide, but before the fun begins, remember... Safety First! Chemistry can be one of the most exciting and intriguing subjects to an inquisitive young mind. For the chemistry experience to be truly enjoyed, safety should be an essential component of all science lesson plans. Students should learn the importance of classroom, laboratory, and general chemical safety at an early age. CEF encourages you to reinforce the importance of safety before every lesson.

Science activities are diverse, often require several steps, and can be more difficult to supervise than other instructional activities. As the teacher, you should perform each lesson first before assigning it to your students. A practice run will allow you to become more comfortable with teaching the lesson, enable you to better supervise and instruct your students, as well as help you recognize potential risks that could exist as students learn new skills and work with new materials.

Below are suggestions on how better to prepare your students for safety in the chemistry classroom and lab. While some of the instructions may not apply to your grade-level, it is never too early to teach your students about the importance of classroom and lab safety while conducting experiments!

To ensure everyday safety in your classroom, create and post a safety plan specific to your classroom environment, complete with evacuation procedures. To reinforce the safety rules, engage the students in a discussion or activity about safety. At the elementary level, something as simple as a poster contest, in which the winning posters are displayed, is an easy and creative way to reinforce the rules. At the middle school level, group activities that involve safety scenarios or question-and-answer sessions will help reinforce the rules. Most importantly, educators should always model appropriate behavior by obeying safety rules and procedures in class.

In your safety discussion, be sure to stress that horseplay in the classroom or lab is dangerous and will not be tolerated. Emphasize the importance of understanding how to safely store, handle, and use chemicals before performing any lessons. Explain that this information can be found in many places, such as simply reading the warning label on the container. Product container labels include key warnings about storage, handling, and, if necessary, first aid and other emergency information. Another information source is the Material Safety Data Sheet (MSDS), which is available for most chemicals. The MSDS contains more detailed information about chemical characteristics, hazards, emergency information, storage and handling precautions, and disposal information.

You should also educate students about proper personal protection, such as wearing aprons, gloves, and safety goggles when performing any experiment.

On the following pages is a list of general classroom and lab safety tips for you to discuss with your students. Be safe and have fun!

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- **Love Your Labels** – Make sure that all chemicals and storage areas in your classroom or lab are clearly labeled. Chemicals should never be stored in an unlabeled container, even for a short period of time.
- **No ABCs with Chemical Storage** – While storing chemicals in alphabetical order may be convenient, doing so may not be safe. Chemicals should be stored only by reactivity risk and compatibility.
- **A Partnership with MSDS** – A container of chemicals in your lab should always have a partner in your filing cabinet: A Material Safety Data Sheet (MSDS). Make certain all involved have easy and immediate access to your MSDS file.
- **Wear That Apron** – Most lab accidents are caused by spilled liquids. A nonabsorbent apron will direct liquid towards the floor, away from you. Do not use cloth aprons in the lab.
- **Protect the “Corner” of Your Eyes** – Eye protection should be provided and worn by teachers and students when performing lab activities. Regular eyeglasses provide insufficient protection. Proper lab glasses protect both the front and sides of the eyes. More than 50% of lab eye injuries occur to the sides of the eyes. It’s those hazards, just out of normal view – to the sides of the eyes – that often do the most damage!
- **Wash Up** – Students should wash their hands with soap and water after completing an experiment. They should avoid touching their eyes and mouth until after they have washed their hands.
- **Chemists Have No Taste** – As a rule of thumb, chemists never use their sense of taste in the lab.
- **Smell It Properly** – Chemists never hold a chemical bottle under their nose to test for an odor. The proper method is called wafting. Hold the open bottle at least 18 inches from your nose. Use your free hand to “fan” vapor over the bottle opening towards your nose. You will thereby safely inhale only a slight amount of chemical vapor.
- **Tie Back That Hair** – Long hair in a chemistry lab can create a safety problem, especially around flames or caustic chemicals. Keep rubber ties, caps, or other hair accessories available for temporarily securing longer hair.
- **Ban All Food** – Food should not be stored or consumed in a lab setting. Even in harmless situations, eating food in a lab sets a poor safety example.
- **Neutralizers** – When planning to use hazardous chemicals, even in diluted form, a chemist will always prepare, beforehand, an appropriate neutralizing chemical and keep it handy.
- **Eye Wash Times Three** – When working with chemicals, a chemist always makes provisions for an eye wash. If you do not have access to a professional eye wash station or wash bottle, keep on hand a supply (300-500 mL) of distilled water in a sterilized container.

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- **No Bag, No Sag** – Loose clothing can create a hazard in a lab setting. Sleeves and shirt tails can interact with lab ware to create a spill.
- **Turn Your Head to Talk** – Many heated lab vessels have been shattered by a tiny speck of saliva accidentally emitted as a chemist talks while working.
- **Splash Guard** – Chemists must always prevent water from splashing out of the lab sink. When filling a beaker or other open-mouthed vessel in a lab sink, turn on the water first, and then bring the beaker mouth into the stream. This action prevents splashing.
- **Acid to Water** – A chemical rule of thumb when diluting acids and other active chemicals: Always add acid to water ... NEVER add water to acid.
- **Watch Where You Point** – When opening chemical containers or heating lab vessels, always keep in mind the direction of the container's mouth. Point the opening away ... away from you, away from others, and away from points of safety concern.
- **Stay Out of the Sun** – Direct sunlight can not only initiate the decomposition of many chemicals, it can also affect lab ware, stoppers, tubing, labels, etc.
- **Amber Bottles** – You may notice that some chemicals are stored in amber or dark brown glass bottles. Amber glass is used to filter out ultraviolet (UV) light. Some chemicals will readily decompose in the presence of UV light. Keep chemicals in the same type of container in which they arrived from the manufacturer.
- **Lab Ware Not Glassware** – Do not substitute common glassware for lab ware. Household bottles and jars are usually made of common flint glass. They are unsuitable for heating chemicals over open flames or high temperature heaters. Their ability to resist thermal shock is very limited. Most common glassware will shatter when heated. Most lab ware is made of borosilicate glass, which has a much greater resistance to thermal shock.
- **Stir Silently** – During manufacture, lab glassware is specially heated at the factory to create a completely smooth and nonporous surface. This surface provides no pores or pits in which chemicals can “hide.” To avoid creating chemical hiding places, do not strike, scrape, or touch the interior surface of the vessel with a hard instrument when stirring the contents of the vessel. Otherwise, you may create microscopic nicks and scratches that will hold contaminating chemicals.
- **Preheating Procedure** – Although lab glassware is usually made of thermal shock-resistant borosilicate glass, it is not immune to shattering if experiencing radical temperature change. Do not thrust a room-temperature vessel into a burner flame. Swirl the vessel as you slowly bring it into the heat source in several stages.
- **Tilt That Test Tube** – When heating a solution in a test tube, avoid holding the tube vertically in a flame. The hot liquid near the bottom of the tube can create a “geyser” effect and suddenly push liquid out of the tube. To avoid such action, chemists always tilt a test tube 30 degrees from vertical when heating.

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- **Burner Flames** – A properly adjusted burner flame of natural gas or propane is pale and light blue in color. In a brightly lit room, the flames are often difficult to see. When not in direct use, either extinguish the flame or adjust the airflow to create a bright yellow and easily visible flame.
- **Burner Temperature** – A typical Bunsen burner flame has a temperature of approximately 950°C. When substituting a propane torch for a Bunsen burner, remember that the torch flame is approximately 1500°C.
- **Boiling to Dryness** – When using lab glassware, avoid boiling liquids to the point at which the container is completely dry. A small amount of boiling liquid can create a “spot” of relatively cool glass. The tension between the cool spot and the surrounding hot glass could cause the vessel to crack or shatter.
- **Wire Gauze** – Place a piece of heavy gauge wire screen or wire gauze between a glass vessel and a burner flame or heat source. The screen conducts heat, creating a spread of heat over the entire undersurface of the vessel. This trick helps prevent breakage from thermal shock.

CHEMICAL DISPOSAL

It is unlikely that any waste generated in elementary-level chemistry activities will be harmful to the environment. However, discussing safe disposal teaches students about environmental health and safety.

Disposal from middle school laboratories may vary. Before handling or moving a chemical for disposal, be sure to refer to the MSDS for disposal precautions.

For more information, contact your school district’s safety coordinator.