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**BE SAFE!**



### **Unit Overview**

The role of a scientist often involves doing experimentation in a laboratory or in the field (in the world). Utmost care in designing experiments and the use of proper technique is necessary, but so is observance of proper laboratory behavior to ensure that no one suffers an injury. As a beginning scientific investigator, you need to know what behavior is proper for the laboratory so that your experience will be safe and rewarding. So much of the fun of learning science is in the doing of science in the lab!

### **Attitude is Important!**



Different events require different clothing and different attitudes. Would you dress and act the same at a formal wedding as you would at a basketball game? Of course not! For the formal wedding you would wear dress clothes and be very attentive to the ceremony. At the basketball game, you would wear comfortable leisure clothes and shout out encouragement to your team. Certain behavior is also required for the science lab in order for you to learn the most from the experience and to allow all to participate in a safe environment.

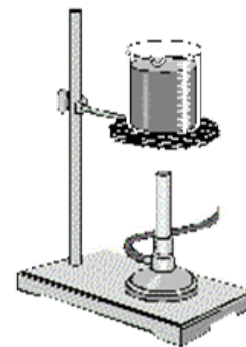
Before your first lab experience, your instructor should show you where all the safety equipment is located, and its purpose should be discussed. You should also have the opportunity to read over the procedures before beginning so you have an opportunity to have confusing parts explained. When entering the laboratory setting, have a serious attitude. Expect to enjoy the experience and do not be afraid of getting hurt or doing something wrong, just be cautious and calm. The following expectations for behavior and dress are primarily just common sense:



- 1) Wear sensible clothing. Long and flowing sleeves should not be worn. They can knock over equipment or catch fire when draped over flames. Shoes should cover most of the foot to provide more protection in case of glass breakage or the spilling of chemicals. Do not wear sandals or open-toed shoes.
- 2) Long hair should be tied back to keep it away from the work area. Never lean over open flames as hair can easily catch fire. The flame of a properly burning Bunsen burner is nearly invisible. For this reason, light the burner immediately before you need it, and turn it off as soon as you finish using it.
- 3) Rings, watches, and other jewelry are dangerous in the lab. Dangling jewelry can catch onto equipment and cause an accident. Chemicals can get under rings, bracelets, and watches and cause irritation.
- 4) **Never** wear contact lenses in the laboratory. It is nearly impossible to remove contacts after chemicals have been splashed into the eyes. The chemicals trapped under the lenses will cause greater damage to the eyes. The plastic in some lenses allows vapors to penetrate them. Excessive irritation to the eye can occur. Wear regular glasses along with safety glasses or goggles if instructed to do so. Regular glasses are not sufficient protection when goggles are required.
- 5) Goggles are required to protect the eyes if hazardous chemicals, glassware, or burners are used. Proper goggles shield the eyes from all directions. If available, waterproof aprons and gloves should also be worn for additional protection of clothing and hands.
- 6) **Never** joke around, shove, push, or make any quick movements while in the lab. Doing so can cause accidents. Equipment can be broken, and falling into equipment or flames can cause injury. If you must move about the room, do so slowly and quietly so as not to disturb others. When getting materials from the storage area, only one student should go for the group to avoid excessive movement in the lab.
- 7) Do not touch equipment or chemicals unless it is part of your procedure. They may be there for other students.
- 8) Perform only those experiments as you are instructed. If you do not understand what you are to do, ask the teacher to explain or demonstrate what to do.
- 9) Do not eat, drink, chew gum, or put on makeup in the laboratory. Contamination resulting in poisoning or skin irritation may result.
- 10) If you are aware of damaged or broken equipment, tell the teacher immediately so a replacement can be given to you.
- 11) After setting up equipment, have the teacher check it before starting the procedure. This can reduce the chance of accidents.
- 12) Read labels carefully to be sure you are using the proper substance. If you are not sure, ask the teacher. Never use more chemicals or ingredients than you are instructed to use and never put unused chemicals back into the original bottle. That can cause contamination. The extra must be disposed of as waste.
- 13) **Never** leave an experiment unattended. If you must go for materials, be sure your partner is watching the experiment.
- 14) Should an accident occur, inform the teacher immediately. If a student is injured calmly but loudly call out the teacher's name. Do not panic! Do not come in contact with another person's blood.
- 15) **Never** taste or smell any chemicals without prior permission from the teacher.
- 16) **Never** remove any chemicals or equipment from the laboratory.



- 17) **Never** place hot glassware under cold water as it may shatter. If glassware breaks, call the teacher. **Do not** pick up broken glass with bare hands.
- 18) If glassware is hot and must be moved, use tongs (beaker tongs or crucible tongs) and place on a protective pad until cool. Remember that hot glassware looks no different than cool glassware. It can quickly burn the skin. Allow several minutes for the object to cool before handling.
- 19) **Never** look into a container that is being heated and never point a test tube that is being heated in the direction of anyone. The quantity of material in a test tube is so small that it can quickly boil out and shoot across the room if heated with a burner. A much safer method of heating a test tube is to use a water bath. A water bath is a beaker of water in which the test tube is placed. The burner then heats the beaker. The warm water slowly transfers its heat to the test tube. The temperature will never become greater than that of boiling water (100°C).
- 20) If a chemical is spilled, contact the teacher immediately to receive instructions. Most chemicals used in middle school and high school labs can be washed off with running water. However, these methods should have been discussed in the lab write-up. In a few instances other methods may be needed.  
**Be sure you follow instructions.**
- 21) Keep work areas clean and tidy. Be sure you know where to dispose of all waste. Never put solids down the sink. Some chemicals may be hazardous and require special care. In that case, your teacher will have you dispose of those in a special waste container. Be sure to follow those instructions carefully. If used matches are to be thrown in the wastebasket, be sure they are thoroughly extinguished before doing so.
- 22) When you have finished the lab procedure, return the lab station to the same condition in which you found it.



## Proper Use of Lab Safety Equipment

Although the primary responsibility of operating the safety equipment in the lab belongs to the teacher, you should understand how each is to be used and where they are located.

**Eye Wash Station:** The eye wash is used to wash chemicals or particles from the eyes.

- ▶ Eyelids must be held open forcibly and kept open to ensure effective washing.
- ▶ A minimum of 15 minutes of flushing the eyes with water is needed.
- ▶ A medical professional, such as a school nurse, should then examine the eyes to see if further attention is needed.

**Safety Shower:** The safety shower is used to wash off chemicals from large areas of the body or from areas that cannot be safely rinsed at the sink. Also, clothing fires can be extinguished with a safety shower.

- ▶ A safety valve may first have to be opened before the shower can be used.
- ▶ The person should remove all clothing, jewelry, and shoes before going under the shower.
- ▶ Allow large amounts of water to flood the body for several minutes.

**Fire Blanket:** Fire blankets can be used to put out clothing fires but certain precautions must be followed.

- ▶ In using a fire blanket be sure the individual is lying on the ground before wrapping them with the blanket. **Never** wrap a student who is standing because the blanket creates a “chimney” that can bring the fire directly to the face.
- ▶ If synthetic fibers have melted, using the fire blanket could increase the severity of the burns by pressing the melted fibers against the skin. In this case, it is better to use a safety shower.
- ▶ Shock victims can be kept warm with a safety blanket.

**Fire Extinguisher:** These are used to put out fires in the lab but **never to be used on a person.**

- ▶ Fire extinguishers are classed according to the types of fires which they can extinguish;
  - Type A is for combustibles, such as wood, cloth, paper, rubber, and plastics.
  - Type B is for flammable liquids, such as oil, grease, and paint thinners.
  - Type C is for fires caused by electrical devices or equipment.
- ▶ Some extinguishers can be used for multiple purposes. Be sure you know what type is in the lab.

- ▶ In most cases, the teacher should be the one to use the extinguisher.
- ▶ The average fire extinguisher will only last about 10 seconds so do not waste it!
- ▶ Remember proper procedure with the acronym **PASS**.
  - P – pull the pin
  - A – aim the hose at the base of the fire
  - S – squeeze the handle
  - S – sweep the hose back and forth

**Fume Hood:** The fume hood is designed to remove harmful vapors during an experiment.

- ▶ When performing an experiment with a chemical known to have poisonous or carcinogenic (cancer-causing) vapors, use the hood. The fan provides ventilation to remove the vapors to the outside atmosphere.
- ▶ Whenever possible, materials should be chosen that do not possess these characteristics, especially for introductory students.



**Automatic Gas Shut-Off Valve:** This valve can be turned off to stop the supply of natural gas to all gas lines in the laboratory. This is a safety feature to cut down on unnecessary exposure to gas fumes when no burners are being used. In addition, if a fire should break out when burners are being used, shutting the valve removes fuel to feed the fire.



## Proper Use of Chemicals and Equipment

**Acids and Bases:** Strong acids and bases are very corrosive. They should be stored in a special cabinet under lock and key. This keeps them isolated so they will not be accidentally used or spilled. Only the teacher should have access to this cabinet.

- ▶ When working with acids or bases, use care not to spill them. Keep bottles tightly capped when not in use. **Goggles should always be worn.**
- ▶ Should you get them on your skin, flood the areas with a lot of running water for several minutes. Inform the teacher of the accident immediately.
- ▶ Should you get acids or bases in your eyes, be sure that someone takes you to the eyewash station immediately to begin flooding your eyes with water. Inform the teacher immediately of the accident.
- ▶ Spills on the lab station or floor can be cleaned by using a weak acid, such as vinegar, to neutralize a base and a weak base, such as baking soda, to neutralize an acid. Then, an absorbent material, such as kitty litter, can be used to absorb the liquid before disposing of it in a waste container.

**Flammable Chemicals:** Flammability is a measure of how easily a gas, liquid, or solid will ignite and how quickly the flame, once started, will spread. Special cabinets are designed for these materials to contain the flame should the substances ignite. Only the teacher should have access to this cabinet.

- ▶ When working with flammable materials, always keep them away from sources of heat.
- ▶ Spills should be quickly cleaned up. Inform the teacher so he/she can supervise the cleanup.
- ▶ Caps should be kept on the containers to avoid spills and the release of flammable vapors.



**Laboratory Burners:** Lab burners typically burn natural gas (methane) or alcohol. Proper precaution is essential for safe operation.

**Alcohol Burner:** The alcohol burner consists of a small vessel that holds the alcohol, a wick, a screw-on top which supports the wick, and a cap to prohibit evaporation of the alcohol when not in use.

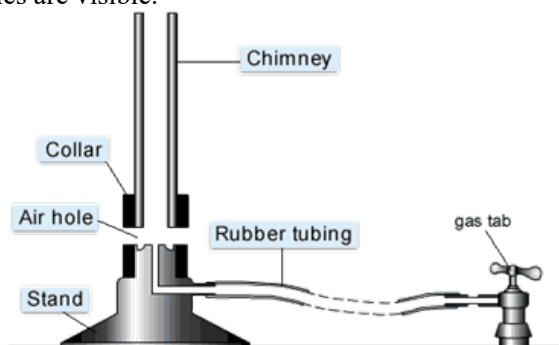
- ▶ Before lighting the burner, be sure that all flammables are away from the burner and all loose clothing or hair has been properly confined.
- ▶ Light with a match or barbecue lighter. **Do not attempt to light the burner from another lit burner or carry a lit burner to another location.**
- ▶ Avoid working over the flame.
- ▶ When finished, extinguish the burner flame with the burner cup.
- ▶ When not in use, store the capped and cooled burner in the flammable storage cabinet.



Alcohol burner

**Bunsen Burner:** The Bunsen burner uses natural gas as its fuel. It provides a very hot flame for laboratory use. The parts of the burner are listed on the diagram below. The flame is produced at the top of the chimney and is nearly invisible if properly adjusted. The collar is used to adjust the amount of air entering the chimney.

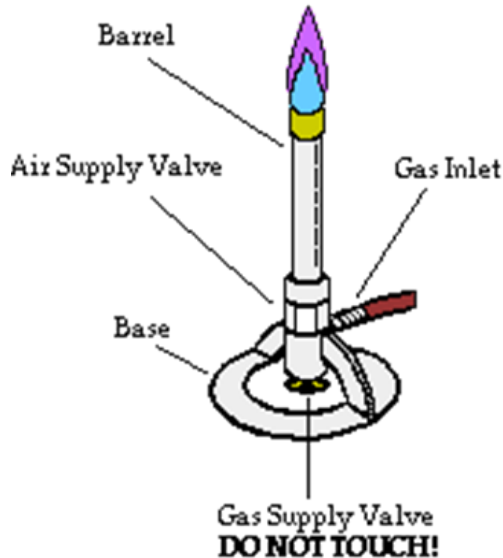
- ▶ Attach the rubber hose to the gas outlet and to the burner.
- ▶ Adjust the collar so that at least part of the air holes are visible.
- ▶ Strike a match and then turn on the gas outlet.
- ▶ Place the match at the edge of the chimney to ignite the gas.
- ▶ Once the flame is burning adjust the collar so the flame is nearly invisible with a light blue color. An orange flame is not very hot and is an indication of insufficient oxygen. Open the air vents further until a blue flame is achieved.
- ▶ A roaring sound indicates too much fuel. The gas inlet valve should be turned back.
- ▶ **The chimney of the burner should never be hot. If it is, this indicates insufficient oxygen and the production of poisonous carbon monoxide gas. Turn off the burner immediately.** Open the air vents and light again. If you cannot achieve a blue flame with the chimney remaining cool, contact the instructor for assistance.
- ▶ As with the alcohol burner, all flammables should be away from the flame and all loose hair and clothing properly confined.
- ▶ Turn off the burner immediately when it is not being used. A properly burning flame is nearly invisible and a person can accidentally reach over it or place objects over it.



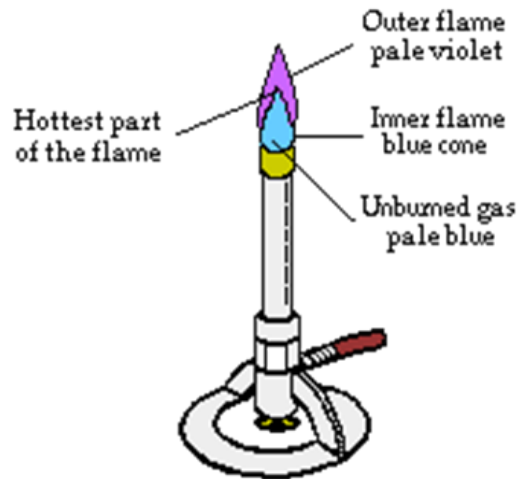
- ▶ Some burners have a valve at the base to control the amount of gas entering the chimney. If the valve exists, be sure it is open before attempting to light the burner. This allows for finer adjustment of the flame. **See Figure One below.**
- ▶ The hottest, cleanest flame is dark blue on the outside with an inner cone of light blue. The tip of the inner cone is the hottest part of the flame.

See Figure Two below.

**Figure One: A Laboratory Burner**



**Figure Two: A Properly Adjusted Lab Burner Flame**



**Dissection Equipment and Procedures:**

- ▶ Avoid contact with preservative chemicals. Wash the specimen thoroughly before beginning.
- ▶ Properly mount dissection specimen to dissecting pan. **Do not dissect while holding specimen.**
- ▶ Hold scalpel or the safety edge of a razor with extreme care.
- ▶ Cut away from your body and away from others.
- ▶ Never ingest specimen parts. Dispose of parts as directed by your teacher.
- ▶ Store dissections as directed by the teacher and clean up the lab area.
- ▶ Wash hands before leaving laboratory.





## **Unit Conclusion**

Laboratory safety is everyone's responsibility. The basic rules are mainly common sense and are designed to ensure that everyone will have a safe and productive experience in the laboratory. Responsible, mature behavior is essential, as well as knowledge of how to handle dangerous chemicals and how to operate equipment. When these guidelines are followed, the laboratory is a wonderful place to experience science at its most interesting level.