



Laboratory Safety



Safety
Manual

LABORATORY SAFETY

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Introduction

This laboratory course is designed to be performed in a non-traditional laboratory setting. Safety precautions **must** be followed to ensure that the science materials do not cause harm to the student or other members of the household. Only you, the student, can assess all the potential hazards of your laboratory setting, so it is your responsibility to take the necessary precautions. The primary danger in performing science laboratory exercises in a home setting is that young children or pets may find and want to play with laboratory equipment or materials. Many pets have an acute sense of smell and may be attracted to something in the kit. We cannot stress enough:



The following are general safety rules to follow when performing any science laboratory activity. Follow these general safety rules **and** the specific safety rules found in the Safety section of each laboratory investigation activity. Your instructor may modify these guidelines in accordance with state and/or federal law.

Laboratory Attire

Wear appropriate clothing when performing laboratory activities.

- Avoid loose or dangling clothing or jewelry that could catch on an apparatus or interfere with the lab investigation.
- Wear shoes that fully cover your feet. Do not perform laboratory activities while barefoot or wearing sandals.
- Wear clothing that covers your midriff and upper legs.
- Pull back and secure long hair.
- Even with precautions, accidental contact between chemicals and clothing may occur. Washing your clothing after the completion of laboratory activities is recommended.



Personal Protective Equipment

Wearing PPE is required in college science laboratories and is also required for most distance learning science laboratory activities. Look for the following symbols that indicate which PPE is required for the laboratory activity.



Safety Eyewear

- Wear safety goggles or glasses, as supplied, to protect against eye injury. Any time chemicals, preserved or living organisms, glassware, or heat are utilized in a laboratory activity, safety eyewear is required.
- Under some conditions, safety eyewear will begin to fog up. If this occurs, step away from your investigation and wash your hands before cleaning your eyewear.
-  [See how to properly adjust safety goggles or glasses.](http://bcove.me/dl8lun68) <http://bcove.me/dl8lun68>

Gloves

- Wear chemical-resistant gloves to protect your hands any time chemicals are used or specimens are handled.
- Wash your hands before putting gloves on and after removing them.
- If punctured or torn, gloves should be disposed of immediately.
- To limit contamination, removed gloves should not be reused.

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PPE Equipment continued

-  [See how to properly apply and remove gloves.](#) <http://bcove.me/t5xn3gm0>

Chemical Apron

- Wear a chemical-resistant apron to protect your clothing any time chemicals, cultures, or preserved specimens are used.
-  [See how to properly wear your apron.](#) <http://bcove.me/x8saft5x>



Preventing Contamination—General

- Do not use any part of the laboratory kit as a container for food.
- Do not eat, drink, or chew gum during the laboratory activity.
- Do not place pencils, pens, labels, fingers, or any other objects in your mouth while performing the laboratory activity.
- Avoid touching your face, hair, phone, or any other personal items while wearing gloves.
- Keep your work area organized to reduce confusion, chance of error, or chance of spilling.
- Put away unneeded notebooks and papers.
- Keep cuts or open wounds covered whenever using chemicals or handling specimens.
- Never return dispensed chemicals to their original containers or place chemicals in an unmarked container.
- When using biological cultures, preserved materials, or living organisms:
 - Wipe off the counter with disinfectant before and after the laboratory activity.
 - Wash your hands thoroughly with soap and water before and after the laboratory activity and at any time that you think your hands may have become contaminated.
 -  [See how to properly wash your hands.](#) <http://bcove.me/8ymgrqsz>

Preventing Contamination—Microbial Cultures

- Select a counter or other work surface that will not be damaged by bleach. Using a paper towel, wipe the work surface with surface disinfectant (10% bleach solution) before starting the laboratory activity. Leave the surface damp, and allow it to sit for at least two minutes. Then use a dry paper towel to absorb any remaining disinfectant. Repeat after you have finished the laboratory activity.
-  [See how to prepare your surface disinfectant.](http://bcove.me/q03ipzjy) <http://bcove.me/q03ipzjy>
- Make your own surface disinfectant by combining 1 part laundry bleach with 9 parts tap water.
 - Be sure to wear PPE when mixing surface disinfectant.
 - If you have any left over at the end of an activity, either dispose of it down the drain with running water, or store it out of direct sunlight in a clearly-labeled plastic container out of the reach of children and pets. (An empty bleach bottle is ideal for storing surface disinfectant.)

-  [See how to disinfect your work surface.](http://bcove.me/4vyb7mxt) <http://bcove.me/4vyb7mxt>
- Wash your hands thoroughly with soap and water before and after the laboratory activity and at any time that you think your hands may have become contaminated. It is important to wash your hands even if you wear gloves for the activity.

Note: The skin of your hands supports a rich community of microorganisms. Even washing your hands only reduces the number of microbes: It does not remove them entirely. Such organisms thrive and multiply in the warm, moist environment of gloved skin. This is why you wash your hands before putting on gloves and again after removing them.

- All biological cultures grown in Petri dishes or culture tubes should be considered harmful. Keep caps and lids on during incubation.



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Pre-Laboratory Safety Precautions

- Working alone in a laboratory is strongly discouraged but may be difficult to avoid in a distance learning class. When working alone, keep a phone nearby and have someone to call if an accident occurs.
- Identify a “lab bench” where all laboratory activities will be performed. We recommend that your lab bench be located close to a kitchen or bathroom.
 - Clear this area of all food and beverages, including drinking water.
 - Remove extraneous material not required for the laboratory activity.
- Many kitchen sinks have a sprayer that can be used as an eye wash. A bathroom shower can also be used as an eye wash and safety shower. Hazardous chemicals have been limited to small volumes to reduce the possibility of needing a safety shower or eye wash.
- Wash your hands with soap and water before starting any laboratory activity.



- When hazardous chemicals are being used, always wear appropriate safety eyewear and perform the laboratory activity near a sink sprayer or bathroom shower.

- Thoroughly read the entire lab investigation and become familiar with any specific safety issues or clean-up procedures before starting. If there are any questions about the laboratory procedures, contact your instructor.
- Assemble all laboratory equipment and materials before the activity.
- Inspect all laboratory equipment and materials before the activity.



- Check all glassware for chips or cracks. Dispose of any glassware that is cracked, chipped, or damaged.
- Clean any glassware or lab equipment with soap and water if it appears dirty or previously used.
- Set up and perform laboratory activities when children are not present. Be sure to secure animals for their own safety while laboratory activities are performed.
- Be prepared to devote your full attention to each laboratory activity. Distractions or interruptions can lead to accidents.
- Turn your cellphone to silent or vibrate to limit distractions.
- Never smoke while performing laboratory activities.
- Never perform any laboratory activity while under the influence of alcohol or drugs.

Performing the Laboratory Activity

- Never leave your laboratory experiment unattended. Monitor experiments at all times.
- If a spill occurs, most chemicals can be cleaned up immediately using paper towels and then thoroughly rinsing the spill area with water. Paper towels can then be disposed of in the trash. Chemicals requiring other clean-up procedures will be noted in specific investigations. In the event of a spilled microbial culture, cover the spill with paper towels saturated with surface disinfectant and allow to sit for at least 20 minutes before discarding.
- Never pick up broken glassware with your hands. Use a towel to pick up broken glassware and dispose of glass directly into a garbage can.
- If a candle or flame is used during the laboratory activity, the potential for a fire

- exists. Keep all flammable and combustible materials away from the flame, including paper, books, and paper towels.
- Know where your fire extinguisher is if you own one. If you do not own a fire extinguisher, they can be purchased at most home improvement or grocery stores.
- Scalpels are used in dissection activities and require special handling and disposal.
 - Never cut toward your hand and fingers holding the specimen.
 - Cut in a downward motion using steady, even pressure.
 - Always use a sharp blade.
 - Do not use a scalpel to cut through a bone or heavy cartilage.
 -  [See how to properly use a scalpel.](http://bcove.me/6ml2tlwm)
<http://bcove.me/6ml2tlwm>



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Microbiology Cleanup and Disposal

- Each laboratory activity will have specific instructions for safe disposal of every culture and/or chemical.
- Disinfect your lab bench and with surface disinfectant before beginning work. Your laboratory manual may also instruct you to disinfect other items, such as the culture tube rack and grease pencil.
- Most investigations will require you to use inoculating tools (inoculating loops, swabs, cell spreaders, and/or pipettes) in order to transfer living microorganisms from one container to another. These tools must be disinfected before disposal. You will need a small, plastic container designated for laboratory use only. A small (about 8 oz) empty water or soft drink bottle works well as long as it is **never used for water or beverage storage again**.
 - Label the container “disposal jar” and fill it about two-thirds full with 70% isopropyl alcohol (sold at drugstores as rubbing alcohol).
 - Immerse the used tools in the alcohol and let them soak for at least 30 minutes before discarding them in the household trash.
 - Used alcohol can be poured down the drain. Allow the water to run for at least 30 seconds to dilute the alcohol.
- Disinfect your lab bench with surface disinfectant after stopping work. Then wash your lab bench with soap and water to remove bleach residue.
- When you have finished working with a microbial culture and it is ready for disposal,

you will first need to disinfect the cultures in a well-ventilated area. A large disposable food storage container (with lid) works well as long as it is designated for laboratory use only and **never used to store food again**.

- Label the container “culture disinfection,” put on your PPE, and add surface disinfectant.
- Immerse each culture tube or Petri dish in the disinfectant, and remove the cap or lid.
- Allow the cultures to soak at least 24 hours before placing them in an opaque plastic bag and disposing of them in the household trash.
- Pour the disinfectant solution carefully down a drain and flush with excess water for at least 30 seconds to dilute the bleach.
-  [See how to properly disinfect and dispose of cultures and microbiology tools.](#)
<http://bcove.me/9npga4ny>
- Wash all non-disposable laboratory plastic ware with soap and water after the activity.
- Place all disposable items in the household trash.
- Put all laboratory equipment, materials, and chemicals back into the proper Carolina Distance Learning Kit box for storage.
- When finished with the above steps, wash your hands thoroughly with soap and water.
- Store the Carolina Distance Learning Kit box out of reach of children and pets when not in use.

Laboratory Cleanup and Disposal

- Each laboratory activity will have specific instructions for safe disposal of every chemical and/or specimen.
- Wash your lab bench with soap and water after the activity.
- Wash all non-disposable laboratory plastic ware and pipets with soap and water after the activity.
- Put all laboratory equipment, materials, and chemicals back into the proper Carolina Distance Learning Kit box for storage.
- When finished with the above steps, wash your hands thoroughly with soap and water.
- Store the Carolina Distance Learning Kit box out of reach of children and pets when not in use.



Culture Storage and Safety

- Lyophilized cultures are living organisms that have been lyophilized (freeze-dried) for preservation. They should be refrigerated on arrival to extend their shelf life. Keep the lyophilized cultures in a sealed, labeled plastic bag out of the reach of children.
- The microorganisms used in our Carolina Distance Learning investigations were selected because they pose low risk to students. However, improper handling may still result in infection.
- Store reactivated cultures in a draft-free, room-temperature area out of reach of children and pets. Cultures in tubes should be stored upright in a tube rack. Cultures in Petri dishes should be stored inverted (upside-down). Each culture should be clearly labeled with the scientific name of the organism and the date the culture was started.
- If a microbial culture splashes into your eyes, immediately rinse your eyes with water for at least 15 minutes. A kitchen sink sprayer or bathroom shower can be used as an eye wash. Then seek a medical professional for additional advice and treatment.
- If a microbial culture splashes onto your skin, wipe it off with a paper towel saturated with 70% isopropyl alcohol. Then wash the area thoroughly with soap and water.



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Chemical Safety

- Read and understand all labels on chemicals or biological specimens.
- If you have any questions or concerns, refer to the **Safety Data Sheets (SDS)** available at www.carolina.com.
 - The SDS lists the dangers, storage requirements, exposure, treatment, and disposal instructions for each chemical.
- Special Hazards: Most distance learning laboratory activities are designed to avoid use of dangerous and hazardous chemicals. However, some activities require these chemicals and thus necessitate additional safety precautions. These special precautions will be identified using standard pictograms that identify physical and chemical hazards on SDS and labels.



Flammable materials. These usually include alcohol or other flammable solvents. Wear safety eye wear, chemical-resistant gloves, and a chemical-resistant apron. Keep all ignition sources such as flames, pilot lights, or heat sources away from the location of the chemical. Keep the lid on the flammable liquid bottle at all times to reduce fumes and spills.



Corrosive materials. These usually include acids or bases. Wear safety eyewear, chemical-resistant gloves, and a chemical-resistant apron. Use these materials near running water that can also serve as a safety eye wash or shower if any corrosive material makes contact with your skin or eyes.

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Warnings. These usually include skin, eye, or respiratory tract irritants or substances that exert acute toxicity. Wear safety eyewear, chemical-resistant gloves, and a chemical-resistant apron. Use these materials in a well-ventilated area, such as a room with open windows, a garage, or a bathroom or kitchen with an external vent fan.



Environmental Hazards. These are exceedingly rare, and typically include chemicals that are harmful to the environment if released in quantities much larger than those available in your kit.



Health Hazards. These are chemicals that have been shown to have a chance of posing long term health risks. Typically any risk is associated with chronic exposure.



Toxicity. These are chemicals that are known to be toxic if consumed, inhaled or absorbed through the skin. Chemicals provided may have toxicity if consumed in large quantities but not with the amount provided in the kit.

- Consult your physician if you are pregnant, allergic to chemicals, or have other medical conditions that may require additional protective measures.
- Always wear safety eyewear, gloves, and apron when handling chemicals.
- Always put lids back onto chemical bottles immediately after use.

- Never ingest or taste chemicals. If this occurs, seek immediate help. Call "Poison Control" at 800-222-1222 or 911.
- Never use any chemical in the laboratory kit for any purpose other than the laboratory activity.
- Household materials supplied by Carolina Biological Supply Company (e.g., sugar, salt, Alka-Seltzer®, or Kool-Aid®) are not packaged for human consumption and should be considered hazardous.
- If a chemical splashes into your eyes, immediately rinse your eyes with water for at least 15 minutes. A kitchen sink sprayer or bathroom shower can be used as an eye wash. Then seek a medical professional for additional advice and treatment.
- [See why you should protect your eyes.](http://bcove.me/csmu7n85)
<http://bcove.me/csmu7n85>
- If a corrosive chemical splashes onto your skin, immediately wash the area with cool water for at least 15 minutes. Then seek a medical professional for additional advice and treatment. A kitchen sink sprayer or bathroom shower can be used as a safety shower.
- [See why you should wear gloves.](http://bcove.me/hp7vpnx4)
<http://bcove.me/hp7vpnx4>

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Field Work

The following are general safety rules to follow when performing any scientific field activity. Follow these general safety rules and the specific safety rules found in the Safety section of each investigational activity.



Pre-Field Work Safety Precautions

- Make sure you are healthy enough to participate in field work. If you have concerns, consult your physician before engaging in field work.
- Prepare a written safety plan. Send a copy of this plan to your instructor, and leave a copy with someone local to your area. The safety plan should include:
 - A person to contact in case of emergency.
 - Locations where you plan to work.
 - Approximate arrival and departure times/dates.
 - Addresses and phone numbers of all participants.
 - Name, address, and phone number of the nearest hospital or medical clinic.
 - A description of the activities to be performed.
 - A list indicating the cell phone carrier for each phone being taken into the field.
 - A list of potential hazards you could encounter, including possible adverse weather conditions. Discuss your plan with your instructor and have them advise you on the hazards particular to your location.
- Working alone in the field is **strongly** discouraged. Take a responsible partner into the field with you. Keep a phone nearby and have someone to call if an accident occurs.
- Choose your field locations carefully. Study a map of the area. Cell phone reception/GPS

access may be limited or unavailable in the field, so do not rely solely on them.

- Monitor weather conditions carefully. Be conscious of the possibility of flash floods, especially when working near bodies of water.
- Thoroughly read the entire investigation manual and become familiar with any specific safety issues or clean-up procedures before starting. If there are any questions about the procedures, contact your instructor.
- Assemble safety equipment.
 - First-aid kit.
 - Medications, including an epinephrine pen, for emergency treatment of insect-sting allergic reactions, if necessary.
 - Sunscreen and insect repellent.
 - Flashlight.
 - Drinking water.
 - If you will be using any chemicals in the field, make sure to pack your goggles, gloves, and apron as well.
- Assemble all field equipment and materials before the activity.
- Read Carolina's Laboratory Safety Guide for information on dealing with any chemicals/reagents you will be using in your field activity.
- Inspect all equipment and materials before the activity.
 - Check all glassware for chips or cracks. Dispose of any glassware that is cracked, chipped, or otherwise damaged.
 - Clean any glassware or lab equipment with soap and water if it appears dirty or

previously used.

- Perform field activities when children and pets are not present.
- Be prepared to devote your full attention to each field activity. Distractions or interruptions can lead to accidents.
- Turn your cell phone to silent or vibrate in order to limit distractions.
- Never perform any field activity while under the influence of alcohol or drugs.
- Obtain written permission before entering private property.
- Most of the activities in your Carolina Distance Learning Kit can be performed in relatively high-traffic areas, such as public parks and nature preserves. If you choose a more remote location or plan to work overnight,  [consult additional literature on outdoor safety, such as the USDA Forest Service web site for outdoor safety.](#) <http://www.fs.fed.us/safety/>



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Field Work continued

Field Attire

- Wear sensible clothing when performing field activities. Avoid loose or dangling clothing or jewelry.
- Wear attire that is appropriate to the climate and the activity.
- Be sensible of possible temperature fluctuations and layer your clothing appropriately. Long sleeves and long pants keep both the sun and insects away, but be conscious of the potential for overheating.
- A wide-brimmed hat and sunglasses provide good protection from the sun.
- Use sunscreen. Sunburn can occur even when it is overcast or in the winter.
- If you anticipate working in or around water, wearing a material that dries quickly can be beneficial.
- If the water you are working in is potentially contaminated, gloves and either rubber boots or waders are recommended in order to minimize contact with the water.
- Wear shoes that fully cover your feet. Do not perform field activities while barefoot or wearing sandals.
- Pull back and secure long hair.

Performing the Field Activity

- Check in regularly with the person you left your field safety plan with.
- If you have little or no cell phone service, you may wish to turn off your phone to conserve battery power. However, even if a phone cannot make a call, sometimes enough data can be transmitted for rescue workers to find you in the event you become lost, so turning the phone back on at regular intervals is advised.
- Drink plenty of water.
- Reapply sunscreen regularly.

Sample Field Safety Plan

Student Name:			Cell Number:		
Address:					
Other Participants:					
Name:			Cell Number:		
Address:					
Name:			Cell Number:		
Address:					
Contact Person:			Contact Number:		
Description of Activities to Be Performed:					
Physical Demands:					
Potential Risks: Identify potential risks.			Risk Management: How will you minimize risks?		
Itinerary					
Departure Time:				Expected Return:	
Location:			Date:		
Location:			Date:		
Location:			Date:		
Location:			Date:		
Location:			Date:		
Location:			Date:		

Laboratory Safety
Investigation Manual

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