Lab Safety Rules

Unit: Occupational Skills

Problem Area: Safety

Lesson: Lab Safety Rules

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

- **1** Describe basic and personal safety concerns and rules.
- **2** Describe chemical and fire safety rules.
- **3** Describe equipment safety and handling rules.

Resources. The following resources may be useful in teaching this lesson:

E-unit(s) corresponding to this lesson plan. CAERT, Inc. <u>http://www.mycaert.com</u>.

- "Lab Safety," Ehs.stonybrook.edu. Accessed Oct. 25, 2019. <u>https://ehs.stonybrook.edu/programs/</u> laboratory-safety/lab-safety-guide
- "Laboratory Safety," Osha.gov. Accessed Oct. 20, 2019. <u>https://www.osha.gov/SLTC/laboratories/</u> index.html
- "Laboratory Safety Guidance," Osha.gov. Accessed Oct 25, 2019. <u>https://www.osha.gov/Publications/</u> <u>laboratory/OSHA3404laboratory-safety-guidance.pdf</u>
- "Lab Training Requirements," *Essr.umd.edu.* Accessed Oct. 20, 2019. <u>https://essr.umd.edu/form-lab-training-requirements</u>

"Occupational Safety and Health," Cdc.gov. Accessed Oct. 25, 2019. https://www.cdc.gov/niosh/



Equipment, Tools, Supplies, and Facilities

- ✓ Classroom resource and reference materials
- ✓ Computers with printers and Internet access
- ✓ Copies of sample test, lab sheet(s), and/or other items designed for duplication
- ✓ Materials listed on duplicated items
- ✓ Overhead or PowerPoint projector
- ✓ Visual(s) from accompanying master(s)

Key Terms. The following terms are presented in this lesson (shown in bold italics):

- ► amp
- ► ampere
- flame retardant
- fume hoods
- inert chemical
- Iab
- Iab coat
- Material Safety Data Sheets
- safety
- safety goggles

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations.

Create awareness in the students about how important safety is in the lab; show examples of some of the dangers in the lab and what could happen if safety is not a high priority. Focus on safety first in all situations.

CONTENT SUMMARY AND TEACHING STRATEGIES

Objective 1: Describe basic and personal safety concerns and rules.

Anticipated Problem: What are basic and personal safety concerns and rules?

- I. Basic and personal safety concerns and rules
 - A. Basic safety concerns are the primary responsibility of all students and instructors.
 - 1. All measures must be taken prior to any activity to ensure the safety of everyone in the lap.

- 2. Authorization is required before any use of machines or equipment; there are no exceptions.
 - a. Ensure the completion of all safety training before beginning any lab work.
 - b. A *lab* is a place equipped for experimental study in a science or for testing and analysis. A research laboratory broadly is a place providing opportunity for experimentation, observation, or practice in a field of study.
 - c. **Safety** is the condition of being safe from undergoing or causing hurt, injury, or loss.
 - d. It is required to learn how to use all the safety equipment and know where it is located.
 - e. All activity that is being performed must be approved by an instructor.
- 3. Never work alone in the lab.
- 4. No food or drink is allowed in the lap for safety reasons.
- 5. Ensure the work area is completely clean before any activity begins.
- 6. Always completely clean up after working and know the proper procedures to clean up after any accidents or spills.
- 7. Read all directions for the machine being used.
 - a. The directions must be followed exactly as stated.
 - b. Clarify any unclear directions with you instructor before any work is done.
- 8. Ensure knowledge of the exact activity being performed and the proper steps are known before any work starts.
 - a. Read through all the directions of an assignment several times.
 - b. Write down in order all the steps that are required for a project and review them.
- 9. The only activity allowed in the lab is specifically what has been given and instructed to perform.
 - a. Always act in a responsible manner.
 - b. Do not walk around the lab and distract other students.
 - c. Never interfere with someone else's work.
 - d. Always be aware of others working and the surroundings.
 - e. Report immediately any unsafe activity.
- 10. Know the exact procedures for a fire drill or if the room needs to be evacuated.
 - a. Know what specific equipment needs to be turned off or shut down in the case of an emergency.
 - b. Know what materials or chemicals must be contained if the room needs to be evacuated.
- 11. Know all emergency procedures and the location of eye washes, showers, exits, and any emergency call box.
- 12. Always use the fume hood when using any material or process that causes fumes.
 - a. *Fume hoods* capture, contain and remove through exhaust systems hazardous chemicals.

- b. Ensure you know how to operate the fume hood.
- c. Know how to use the power supply and the distance to the work must be located near the hood to ensure chemicals are exhausted.
- B. Personal protection and dress code rules are mandatory to follow; they ensure a safe working environment.
 - 1. Always wear a lab coat or apron when performing any lab work. A *lab coat* is a lightweight, usually white coat, worn to protect clothing when working in a lab-oratory.
 - 2. Wear appropriate safety goggles or glasses at all times as required. **Safety goggles** are forms of protective eyewear that usually enclose or protect the area surrounding the eye in order to prevent particulates, water or chemicals from striking the eyes.
 - 3. Secure all loose items and personal accessories.
 - a. Always tie back hair to prevent contact with equipment or chemicals.
 - b. Do not wear loose clothing; long sleeves should be tight and located within the lab coat.
 - c. Remove or tie back any jewelry.
 - 4. Open shoes are not allowed in the lab; shoes must cover feet completely.
 - 5. Shorts or skirts are not allowed in the lap.
 - 6. Always wear appropriate gloves relative to the activity.
 - a. Glove selection is noted on machine instructions and on Material Safety Data Sheets (MSDSs.)
 - b. *Material Safety Data Sheets* are product guides that give safety information and precautions about a material.
 - c. Safety gloves include: latex, rubber, neoprene, insulated and fire retardant gloves.
 - d. *Flame retardant* is a substance that is applied to fabric, wood, or other material in order to make it resistant to catching fire.
 - e. Ensure that there are no holes or tears in gloves and all clothing.

Teaching Strategy: Many techniques can be used to help students master this objective. Have the students read through all the equipment procedure and safety precautions provided by the manufactures. They should take notes. Then give each student one of the equipments in the lap and give a presentation to the class about personal safety. Use VM–A, and VM–B.

Objective 2: Describe chemical and fire safety rules.

Anticipated Problem: What is chemical and fire safety rules?

- II. Chemical and fire safety rules
 - A. Chemical, fire safety and heat prevention policies must be followed at all time.
 - 1. Ensure the entire work area is completely clear when using any chemicals, equipment or material that creates heat or requires a fire
 - 2. Do not heat or apply flame to any material or chemical unless you have been specifically instructed.
 - 3. Do not use a heat or a flame source without being instructed how to ignite it and extinguish it in an emergency.
 - a. Never leave any heat source or fire unattended.
 - b. Keep clothing and skin a clear distance from any flames or heat sources.
 - c. Never allow a liquid that is in a closed container to be exposed to heat; it can expand and explode.
 - d. Always be aware of any ignition sources in the lab including electrical equipment.
 - 4. Always wear flame retardant gloves and fabric when working with flames.
 - 5. Use the appropriate gloves or clamps if you are using equipment and materials that have been heated.
 - 6. Always were goggles when using a heat source.
 - 7. Check all electrical cords and gas supplies to make sure they are in good working condition. Immediately report any irregularities, do not try to fix the problem without consulting an instructor.
 - 8. Know exactly where all fire suppression devices and fire extinguisher are located.
 - B. Chemical and material safety rules must be memorized and followed at all times.
 - 1. Properly dispose any item used that produces hazardous waste according to its waste disposal guidelines.
 - a. Read all the material and chemical guidelines provided by the manufacture.
 - b. Consult the instructor if the guidelines are not clear or present.
 - c. Never let a chemical come in contact with skin.
 - 2. Ensure one knows where the fire extinguisher is and have direct access to it if the materials or chemicals are flammable.
 - 3. Never mix chemicals unless specifically instructed to do so.
 - 4. Some materials and chemicals are poisonous and give off toxic fumes.
 - a. Always read the manufactures precautions and warning provided on the label.
 - b. Never attempt to inhale fumes.
 - b. Do not touch or taste any materials or chemicals.

- c. Materials and chemicals can potentially be very harmful.
- d. Consult the instructor about the dangers off all materials and chemicals being used including inert chemicals.
- e. An *inert chemical* is one that is stable and un-reactive under specified conditions.
- f. Inert materials and chemicals have little or no ability to react with other materials and chemicals.
- 5. Read the label of all chemical containers several times before opening or removing its contents to ensure safe handling.
- 6. Keep combustible materials away from open flames.
- 7. Do not pour any material or chemical down the drains. Sinks and drains in the lab are only for clean water.
 - a. Never allow chemicals to mix in a sink or drain or waste bin.
 - b. Ensure proper waste disposal of all materials and chemicals.

Teaching Strategy: Many techniques can be used to help students master this objective. Have the students read through all the safety procedures and guidelines provided by the manufactures of all materials and chemicals located in the lab. They can write them down and then have an open question and answer discussion with the class. Use VM–C, and VM–D.

Objective 3: Describe equipment safety and handling rules.

Anticipated Problem: What are equipment safety and handling rules?

- III. Equipment safety and handling rules
 - A. Electrical equipment safety rules are followed at all times.
 - 1. Know the type and all precautions of any batteries being used.
 - a. A shorted battery can cause burns and even explosions in some types of battery cells.
 - b. Properly dispose all batteries.
 - 2. Always check the equipment for heat; even if it has been turned off for awhile it can still be hot enough to cause a burn.
 - 3. Ensure all power is turned off on all equipment and the source disconnected before any repairs are to be made.
 - 4. Do not operate electrical equipment if clothes or skin are wet.
 - a. This includes connecting or disconnecting the equipment.
 - b. Do not engage any electrical equipment if there is water on the floor or a leak.
 - 5. Always be aware of the electric cord.
 - a. Do not pull on the cord.
 - b. Ensure the cord is not a tripping hazard.

- c. Ensure the correct cord, power source and allowable amps or ampere are being used for the equipment.
- d. An *amp* or *ampere* is the base unit of electric current in the International System of Units.
- e. It is a measurement of the electromagnetic force between electrical conductors carrying electric current.
- 6. Ensure there are no metal articles, including watches, or metal rulers when using electrical equipment.
- 7. Never use the electrical equipment to shock someone.
- B. Safe equipment handling must be practiced in all labs.
 - 1. Read the manufacture's safety guidelines before the use of any equipment.
 - 2. The equipment should only be used according to the manufactures instructions.
 - 3. Proper training is required before for the setup of any equipment.
 - 4. Memorize and follow the proper clean up and shut down of the equipment before beginning any work.
 - 5. Ensure the proper hand and eye protection is being worn according to the manufactures instructions if the equipment requires chemicals or abrasive materials
 - 6. Thoroughly inspect the equipment before use.
 - 7. Ensure there are no unnecessary items, chemicals, or materials on the equipment.
- C. Lasers can potentially by harmful; one must always follow safety precautions and lab rules.
 - 1. Certified training must be completed before the operation of any laser device, including laser cutters.
 - 2. Never look into the laser beam.
 - 3. Always were approved goggles.
 - a. Laser light can scatter in the room.
 - b. A shiny surface can cause the light to reflect and accidently shine in one's eyes.
 - c. Appropriate stops and guards should be used to keep the light from spreading out into the room.
 - 4. Inform everyone in the room when the laser is in operation.
 - 5. Always stand the designated area when operating the laser.
 - 6. Always keep the laser below chest level.
 - 7. Ensure ones head is not near or at the same level as the light source.
 - 8. Shut down and turn off the laser equipment before any contact is made with it.

Teaching Strategy: Many techniques can be used to help students master this objective. Go through all the safety procedures provided by the machine manufacturer and have the students write them down and take notes. Give oral questions to the

students and have them discuss their answers to engage the whole class. Use VM–E, and VM–F. Assign LS–A. Have a class discussion about how important safety is and how some machines and chemicals can be very dangerous.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Questions at the ends of chapters in the text book may also be used in the Review/Summary.

Application. Use the included visual master(s) and lab sheet(s) to apply the information presented in the lesson.

Evaluation. Evaluation should focus on student achievement of the objectives for the lesson. Various techniques can be used, such as student performance on the application activities. A sample written test is provided.

Answers to Sample Test:

Part One: Matching

- 1. c
- 2. f
- 3. d
- 4. e
- 5. a
- 6. b

Part Two: Completion

- 1. stable
- 2. enclose or protect
- 3. experimental study
- 4. completed
- 5. heat
- 6. fume hood

Part Three: Short Answer

Answers should include five of these seven lab rules:

- 1. Certified training must be completed before the operation of any laser device, including laser cutters.
- 2. Never look into the laser beam.
- 3. Always were approved goggles.
- 4. Inform everyone in the room when the laser is in operation.
- 5. Always stand the designated area when operating the laser.
- 6. Always keep the laser below chest level.
- 7. Ensure ones head is not near or at the same level as the light source.

 Name _____

Sample Test

Lab Safety Rules

Part One: Matching

Instructions: Match the term with the correct definition.

- a. Material Safety Data Sheets d. amp or ampere
- b. lab coat
- c. fume hoods

- e. flame retardant
- f. safety
- 1. capture, contain and remove through exhaust systems hazardous chemicals
- 2. the condition of being safe from undergoing or causing hurt, injury, or loss
- 3. the base unit of electric current in the International System of Units
- 4. a substance that is applied to fabric, wood, or other material in order to make it resistant to catching fire
- 5. product guides that give safety information and precautions about a material
- 6. a lightweight, usually white coat, worn to protect clothing when working in a laboratory

Part Two: Completion

Instructions: Fill in the blank space with the correct word.

- 1. An inert chemical is one that is ______ and un-reactive under specified conditions.
- 2. Safety goggles are forms of protective evewear that usually the area surrounding the eye in order to prevent particulates, water or chemicals from striking the eyes.
- 3. A lab is a place equipped for in a science or for testing and analysis.



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- 4. Certified training must be ______ before the operation of any laser device, including laser cutters.
- 5. Always check the equipment for ______; even if it has been turned off for awhile it can still be hot enough to cause a burn.
- 6. Always use the ______ when using any material or process that causes fumes.

Part Three: Short Answer

Instructions: Answer the following.

List five safety and lab rules for lasers.



SAFETY EQUIPMENT



CHEMICAL AND FLAME HOOD



LAB CHEMICAL STORAGE



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SAFETY GLASSES



LASER CUTTER



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LS-A

Name

Lab Machine and Product Safety

Purpose

The purpose of this activity is to develop knowledge of lab safety.

Objective

Develop and demonstrate knowledge of lab safety.

Materials

- Iab sheet
- pen and paper
- various machines in the lab or work stations
- product safety guidlines

Procedure

- 1. Your instructor will assign a specific lab machine or work station for your study.
- 2. You may also be given specific product and safety guidelines for your assigned machine or product.
- 3. Review all the steps and guidelines for the machine or product you were assigned.
- 4. Next write down and list in order the steps and guidelines you learned about its use.
- 5. These need to be listed in the exact order they are performed, from the initial set up to final clean up.
- 6. Then list out the emergency procedures you learned in case of a fire or spill or other hazard.
- 7. Present your work to the class explaining the steps and guidelines you learned.
- 8. Turn your work in to the instructor.



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