GEORGIA | PEACH STATE PATHWAYS

Career, Technical, & Agricultural Education

HEALTHCARE SCIENCE

PATHWAY: Biotechnology Research & Development

COURSE: Introduction to Biotechnology

UNIT 3: Classroom/Lab Safety

INTRODUCTION

Annotation:

In this unit students will examine the safety guidelines for classroom, laboratory, and facility setting as outlined by OSHA, EPA, and FDA. Students will review the principles of good body mechanics and apply these principles in moving and lifting. They will also research and create a safety manual to keep in their lab notebook disaster preparedness plan, practice disaster preparedness procedures. A sample Biotechnology Lab Safety Contract is included.

Grade(s):

	9th
	10th
X	11th
X	12th

Time:

10 hours

Author:

Phyllis Dumas

Students with Disabilities:

For students with disabilities, the instructor should refer to the student's IEP to be sure that the accommodations specified are being provided. Instructors should also familiarize themselves with the provisions of Behavior Intervention Plans that may be part of a student's IEP. Frequent consultation with a student's special education instructor will be beneficial in providing appropriate differentiation.

FOCUS STANDARDS

GPS Focus Standards:

HS-IBT-1. Students will demonstrate understanding of required safety practices and procedures in the classroom and laboratory environment.

a. Define health and safety regulations, including Occupational Health and Safety Administration (OSHA), Environmental Protection Agency (EPA), and Right to Know and demonstrate procedures for documenting and reporting hazards and compliance *e.g.,* CFR1910.1450.
b. Demonstrate health and safety practices, including use of Material Safety Data Sheets (MSDS), appropriate personal protective equipment (PPE) for the situation, emergency equipment, storage of chemicals, reagents and compounds, and maintenance of equipment.
c. Demonstrate disaster preparedness procedures for each emergency situation –fire prevention and the emergency evacuation plan, inclement weather, school and workplace violence, bomb threat, and biotechnology related emergencies.
d. Demonstrate knowledge of standard precautions including proper storage, handling and disposal of biohazardous materials.

GPS Academic Standards:

SCSh2 Students will use standard safety practices for all classroom laboratory and workplace investigations.

MM1P4 Students will make connections among mathematical ideas and to other disciplines.

National / Local Standards / Industry / ISTE:

UNDERSTANDINGS & GOALS

Enduring Understandings:

- Students will understand that safety precautions are important for all areas of life and should be practiced by everyone on a daily basis. It is important that safety practices are understood and exercised in the classroom, laboratory, and on the job. Guidelines have been established by various regulatory agencies to help protect the safety of people and the environment Disasters can occur that impact safety and health so it is important to know what steps to take in a disaster.

Essential Questions:

- How can accidents and injuries be avoided in the classroom and laboratory settings?
- What steps should be taken to respond to emergencies and accidents in the classroom, laboratory and workplace setting?
- How should disasters be handled?

Knowledge from this Unit:

Students will be able to:

- Describe the role of the Occupational Safety and Health Administration (OSHA), Environmental Protection Agency (EPA), and Right to Know.
- Explain appropriate health and safety practices in the classroom, laboratory, and workplace
  - Identify common hazards in the classroom and laboratory
  - Describe the purpose of and how to use the MSDS
  - Interpret abbreviations for first aid and symptoms of exposure on MSDS
  - Identify and explain the use of personal protective equipment, emergency equipment, storage of chemicals, reagents and compounds, and maintenance of equipment
  - Explain the importance of documenting and reporting hazards and compliance
  - Explain how to respond to various disasters

- Discuss safety rules for the laboratory
- Recognize the correct procedure for storing and handling hazardous materials
- Find information on the classifications of chemical hazards, what types of health hazards a chemical may pose, what levels of medical attention are required following exposure to a hazardous chemical, and what personal protective equipment is required for handling a hazardous chemical
- Locate the lab safety equipment
- Locate online Material Safety Data Sheet (MSDS) databases

Skills from this Unit:

- Correctly respond to common classroom and laboratory hazards
- Demonstrate correct application and removal of personal protective equipment
- Demonstrate procedures for documenting and reporting hazards and compliance *e.g.,* CFR1910.1450Etc.
- Use MSDS to respond to hazardous chemical incidents in the classroom and laboratory
- Perform safety inspection of classroom and laboratory for emergency equipment, storage of chemicals, reagents and compounds, and maintenance of equipment, personal protective equipment
- Demonstrate disaster preparedness procedures for each emergency situation –fire prevention and the emergency evacuation plan, inclement weather, school and workplace violence, bomb threat, and biotechnology related emergencies.
- Demonstrate knowledge of standard precautions including proper storage, handling and disposal of biohazardous materials.

ASSESSMENTS

Assessment Method Type:

X Pre-test
X Objective assessment - multiple-choice, true- false, etc.
__ Quizzes/Tests
_X_ Unit test
X Group project
X Individual project
x Self-assessment - May include practice quizzes, games, simulations, checklists, etc.
_x_ Self-check rubrics

_____
__ Self-check during writing/planning process
__ Journal reflections on concepts, personal experiences and impact on one's life
__ Reflect on evaluations of work from teachers, business partners, and competition judges
__ Academic prompts
__ Practice quizzes/tests

_____ Subjective assessment/Informal observations
__ Essay tests
__ Observe students working with partners
_X_ Observe students role playing

_____ Peer-assessment
__ Peer editing & commentary of products/projects/presentations using rubrics
__ Peer editing and/or critiquing

_____ Dialogue and Discussion
__ Student/teacher conferences
__ Partner and small group discussions
__ Whole group discussions
__ Interaction with/feedback from community members/speakers and business partners

_____ Constructed Responses
__ Chart good reading/writing/listening/speaking habits
_X_ Application of skills to real-life situations/scenarios

_____ Post-test

Assessment Attachments and / or Directions:

- **Role Play Rubric**
- **MSDS Research Chart**
- **Safety Manual Assignment**
- **Safety Exam**

LESSON PLANS

Instructional planning:

• LESSON 1 Safety in the Classroom & Laboratory

See notes before beginning lesson

1. Identify the standards. Standards should be posted in the classroom.

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b) Demonstrate health and safety practices, including use of Material Safety Data Sheets (MSDS), appropriate personal protective equipment (PPE) for the situation, emergency equipment, storage of chemicals, reagents and compounds, and maintenance of equipment.

c) Demonstrate disaster preparedness procedures for each emergency situation –fire prevention and the emergency evacuation plan, inclement weather, school and workplace violence, bomb threat, and biotechnology related emergencies.

d) Demonstrate knowledge of standard precautions including proper storage, handling and disposal of biohazardous materials.

2. Review Essential Question(s). Post Essential Questions in the classroom.
   - How can accidents and injuries be avoided in the classroom and laboratory settings?
   - What steps should be taken to respond to emergencies and accidents in the classroom, laboratory and workplace setting?
   - How should disasters be handled?

3. Identify and review the unit vocabulary. Terms may be posted on word wall.

Term 1	Term 2	Term 3
Disaster Preparedness.	Personal Protective Equipment	Fire Blanket
Emergency Evacuation Plan	ABC Fire Extinguisher	Hazard
Standard Precautions	"Right to Know Laws"	Environmental Protection Agency (EPA)
HAZMAT	Carcinogen	Permissible exposure limit
Toxicity	OSHA	FDA
APHIS	NIOSH	

4. Interest approach – Mental set Introduce lesson by showing a tornado or other inclement weather video clip such as at this website http://video.nationalgeographic.com/video/player/environment/environment-natural-disasters/tornadoes/inside-the-tornado.html

• Lesson 1-2:

A. Ask students what they would do after a discussion of their responses

a. Discuss importance of being prepared for various types of disasters- fire prevention and the emergency evacuation plan, inclement weather, school and workplace violence, bomb threat, and biotechnology related emergencies.
b. Discuss that they will be preparing a safety manual through this unit and in small groups have each group prepare a portion of the manual by listing what to do in case of inclement weather, school and workplace violence, bomb threat, fire prevention and the emergency evacuation plan. Each group should plan a role play demonstrating responding to the different disasters and prepare a brief list of what to do on one of the booklet pages-they will share their part electronically with the rest of the class for them to add to their safety manual.
c. Recap importance of disaster preparedness and have each group present their role play. Grade the students using the **Role Play Rubric**

B. Review the importance of disaster preparedness.
C. Have each group present disaster preparedness role play-use role play rubric to grade.
D. Recap lesson on disasters by reviewing the key points from the role play.

Ask students to name some of the most dangerous occupations.

• Lesson 2-2: Ask students what makes those occupations so dangerous.
   A. Dangerous equipment
   B. Many times people work alone
   C. Sometimes the noise level is too high to hear warnings or high enough to cause permanent hearing loss.
   D. Chemical splashes

E. Sometimes there is a lot of heavy work (lifting causing back and muscle problems)
F. A lot of eye hazards (ricocheting nails, grinding, dust, etc.)
G. Respiratory exposure to dusts, chemicals

5. Ask students to relate stories of on-the-job accidents about which they have personal knowledge. Get students to identify the cause of the accident and identify how it could have been prevented.

6. Tell students about unique safety hazards specific to biotechnology such as exposure to chemicals, microorganisms, drugs, spills, equipment malfunction. Discuss role of APHIS
Explain hazards in the classroom and laboratory using the multimedia presentation such as on safety http://www.chem.unl.edu/safety/hslabcon.html. This is a good presentation with many pictures.

7. Ask students to define "accident."
   A. *"An unfortunate event causing loss or injury resulting from carelessness, unawareness, ignorance, or a combination of causes.*" (Webster's Dictionary).
   B. A common quote is "Ah, it's not going to happen to me." To which a logical reply is, "That is why they call it an accident; nobody thinks it's going to happen to them." Young people seem to feel that way more often.

      Demonstration:
      a. Use the domino method outlined below to demonstrate safety prevention. The teacher will need to prepare dominos, roughly 2x6's cut into 10" lengths. Paint and label as shown on page 7.
      b. Lead the students to identify the factors that may cause an accident and possibly injury.
      - 80% of accidents are caused by unsafe acts
      - 20% are caused by unsafe conditions
      c. Factors: 3 categories are defined
         1. Background of a person
         · Personal habits
         · Inexperience
         2. Defects of Person
         · Lack of knowledge or skill
         · Improper attitude (not willing)
         · Physical deficiency (not able)
         3. Unsafe Acts and Conditions (Unlimited list)
      d. Which two of the three factors above do we have the most power to correct?
         - Unsafe acts and conditions
      e. Set up the dominos as shown in the transparency master and explain the steps.
      f. Show how all dominos fall and result in an accident by bumping the first domino over.
      g. Then remove the "unsafe acts and conditions" domino and bump the first domino over again to show how the chain of events is broken.

8. Ask students what injury they think is the leading cause of lost work time.
   A. Back problems. Eight out of 10 people in the U.S. will consult a physician for back problems sometime in their lives.
   B. Ask students if they know of some one with back trouble. Does it go away in time? Maybe, but it almost always returns. Back trouble lasts a lifetime. Be careful.
   C. What can you do to avoid back injury? Then show the overhead and explain and demonstrate.
   D. Discuss or show **Classroom and Lab Safety/Body Mechanics PowerPoint**.
   Here are some basic principles to prevent back pain injury (ask if a student would like to demonstrate correct lifting):

- Avoid lifting when possible and move objects by pushing, pulling, rolling or sliding the object.
- Use mechanical aids (hand trucks, carts, winches, forklifts, etc.)
- Request help from others when necessary.
- Lift only loads you can safely handle.
- Establish good footing- feet 8-10 inches apart.
- Keep the loads close to body.
- Bend at the hips and knees as you grasp it.
- Get a full hand grip and keep your body erect.
- Lift smoothly by straightening the legs (avoid jerky or snatching lifts.)
- Avoid the lift and twist action.
- When turning, move your feet rather than twisting your body at the waist.
- Reverse the procedure to set the object down.

Recap the principles and remind that you only have 1 back and it is important to protect it. Practice with a light load to test their understanding of proper lifting techniques by dividing into small groups and allowing them to practice or review.

9. Recap by reminding the students of the importance of safety and the agencies that help to enforce worker safety

• LESSON 3-4: MSDS

1. Review Essential Questions. Post Essential Questions in the classroom.

   - How can accidents and injuries be avoided in the classroom and laboratory settings?
   - What steps should be taken to respond to emergencies and accidents in the classroom, laboratory and workplace setting?
   - How should disasters be handled?

2. Ask students if they have ever worked with a hazardous chemical. Ask them to recall the chemical and how did they know how to handle it?
3. Understanding MSDS –Give each student a copy of Clorox MSDS

   Make sure the students understand the use of Material Safety Data Sheets (MSDS). Show students where the MSDS are kept and explain why it is important that everyone know where they are located. Lead students to identify what information is on the MSDS?

   A. Product identification
      a. Specific name and common name
      b. Precautionary labeling
      c. Safety equipment
      d. Precautionary label statements
      e. Storage color code
   B. Hazardous components
   C. Physical data
      a. Percentage of volatile components
      b. Appearance and odor
   D. Fire and explosion hazard data such as:
      a. Fire extinguishing media and method
      b. Special fire fighting procedures
      c. Toxic gases produced
   E. Health hazard data

a. Permissible exposure limit
b. Toxicity
c. Carcinogenicity
d. Effects of over exposure
e. Target organs (those most affected)
f. Medical conditions aggravated by exposure
g. Routes of entry
h. Emergency and first aid procedures

F. Reactivity data
a. Stability
b. Hazardous polymerization
c. Conditions to avoid
d. Incompatible materials
e. Decomposition products

G. Spill and disposal procedures
a. Procedures: spill or discharge
b. Procedures: disposal
c. EPA hazardous waste number

H. Protective equipment needed
a. Ventilation
b. Respiratory protection
c. Eye/skin protection

I. Storage and handling precautions
a. Transportation data and additional information

4. Show students the **Lab Safety PowerPoint**

Lesson 4

1. MSDS Computer Activity

A. Have students look up MSDS sites on the Internet (Use the OHSA website listed below for abbreviations and medical actions). Give them a copy of the **MSDS Research Chart** which will be added to their safety manual when completed. Assign at least 3 chemicals that will be used in the lab to research and complete a chart to be placed in their safety manual-select one that is flammable, damaging to skin, and requires a respirator for use

B. Recap use of Material Safety Data Sheets (MSDS)

• LESSON 5-6: Accidents and Laws

1. Review Essential Questions. Post Essential Questions in the classroom.

- How can accidents and injuries be avoided in the classroom, laboratory and workplace setting?
- What steps should be taken to respond to emergencies and accidents in the classroom, laboratory and workplace setting?
- How should disasters be handled?

1. On the Job Accidents

A. Ask students if companies should be held liable for accidents such as a customer or worker getting hurt? Under what circumstances?
Answers vary, but the conclusion should be if the employer is negligent. They are negligent if they fail to take reasonable precautions for safety of employees and customers. Many of these are complicated gray-area issues usually settled by the courts. You may wish to give the student some scenarios and ask them who is liable, if anyone. Direct them to learn more about how they can protect themselves legally in case of an accident at work.

B. Sample scenario: A customer slips on water on the floor and injures themselves.

2. Ask students to outline what should be done in case of an emergency?
    A. Notify the teachers of any injury or hazardous situation
    B. Call 911 if teacher or other authority figures are not available
    C. If someone is injured with chemicals:
        · flush area with cool water
        · send/take the chemical label and MSDS with the person
    D. In the case of volatile materials, clear everyone from the area
    E. If excessive bleeding occurs from an open wound, apply direct pressure to the wound with a dressing and bandage-Have students pair up and sanitize their hands and practice applying gloves and using gauze dressings to simulate applying direct pressure to a wound on the forearm-may want to refer to a first aid lesson

3. Safety Equipment
    Display and discuss some of the safety equipment that may be used in the laboratory.
        Examples:
            Chemical aprons
            Safety glasses
            Face shields
            Respirator
            Chemical spray suit
            Hearing protection
            Gloves

4. "Right to Know Laws"
    A. Ask the students what general safety rules should be observed in classroom and laboratory.
    B. Explain that there are laws known as "Right to Know Laws" which businesses are required to obey. These laws require that employees be made aware of hazards in the work place.
    C. Ask the students that if they had a business, what general rules of conduct would they have to protect the workers and to protect themselves from lawsuits if someone got hurt?
5. Show the **Lab Safety Picture** and complete the activity with your students as review of safety procedures.
6. Pass out the **Biotech Safety Contract** for the student's to take home and have signed.

• LESSON 7-9: Safety Manual Project and Review

1. Review Essential Questions. Post Essential Questions in the classroom.

    - How can accidents and injuries be avoided in the classroom, laboratory and workplace setting?
    - What steps should be taken to respond to emergencies and accidents in the classroom, laboratory and workplace setting?
    - How should disasters be handled?

2. Review safety rules and policies with the class from the safety contract
    A. While no human activity is completely risk free, if you use common sense and a bit of knowledge of the situation, you should encounter few problems. Sensible lab conduct won't happen by memorizing a list of rules -- although they are important and do help. A perfect score on a written driver's test does not ensure you will not have an accident. The safety rules provided apply to most classes and laboratories. For your personal safety and that of your classmates, make following these guidelines second nature in the laboratory. If you understand the reasons behind them, these safety rules will be easy to remember and to follow.
    B. Additional activities:

1. Allow students to work on **Safety Manual Assignment** during lessons 7-9. Allow students to tour the lab in small groups and locate items to be included in the safety manual. You will need to pass out a copy of the **Laboratory Safety Skills Assessment** to each student for their manual. Include **Safety Citation Card** if rules are unrelated. A **Sample Scavenger Hunt** is included that you can modify for your individual lab.
2. Post lab safety rules in a prominent location for students to read
3. Assign a safety foreman to watch for safety violations and hazardous situations.

C. Allow time to review disaster and safety lessons for exam-can use the **Safety Jeopardy** to assist with review and ask the students what they have learned about safety in the classroom and laboratory.

Answers will vary but should include:

- *Everyone must obey the rules to prevent accidents*
- *MSDS sheets explain the hazards and action to be taken upon exposure*
- *The right-to-know laws protect workers, etc.*

• LESSON 10: Safety Exam

1. Review Essential Questions. Post Essential Questions in the classroom.

    - How can accidents and injuries be avoided in the classroom, laboratory and workplace setting?
    - What steps should be taken to respond to emergencies and accidents in the classroom, laboratory and workplace setting?
    - How should disasters be handled?
2. Administer **Safety Exam**, review exam, have students sign **Safety Commitment Poster** and hang in room, Collect the students' safety manuals for a grade.

• ATTACHMENTS FOR LESSON PLANS

- **Role Play Rubric**
- **Body Mechanics PowerPoint**
- **Lab Safety PowerPoint**
- **Clorox MSDS Sheet**
- **MSDS Research Chart**
- **Lab Safety Picture**
- **Biotech Safety Contract**
- **Safety Manual Assignment**
- **Laboratory Safety Skills Assessment**
- **Sample Scavenger Hunt**
- **Safety Jeopardy**
- **Safety Exam**
- **Safety Exam Key**
- **Safety Commitment Poster**
- **NIOSH Pocket Guide to Hazardous Chemicals**

• NOTES & REFLECTION:

Before beginning this lesson, have a group of students set up the lab activity to introduce this lesson Using the attached list of NIOSH symptoms abbreviations, have students make labels for 15ml. capped tubes make up liquid using yellow, blue, green and red food coloring in water.

CULMINATING PERFORMANCE TASK

Culminating Unit Performance Task Title:

Culminating Unit Performance Task Description/Directions/Differentiated Instruction:

Attachments for Culminating Performance Task:

UNIT RESOURCES

Web Resources:

- Introduction to Biotechnology Lab Manual 6th edition www.bio-link.org/GMP/LabBook.doc
- Good general Lab Safety PowerPoint – to get to the PowerPoints go to http://www.biologyjunction.com/pwpt_biology.htm and click on lab safety, it also includes a question guide
- Lab Safety PowerPoint graphics contain young adolescents http://morrisonlabs.com/labsafegood.htm
- Safety Resource Information http://www.flinnsci.com/index.asp
- USDOL-OSHA website for Hazard Communication update http://www.osha.gov/dsg/hazcom/index.html
- OSHA/EPA Occupational Chemical Database
- OSHA/EPA Pocket guide to Hazardous Chemicals See list below or obtain from http://www.osha.gov/web/dep/chemicaldata/abbrev.asp#symptoms
- www.osha.gov
- www.usda.gov
- www.nfpa.org
- www.cdc.gov/NIOSH

Materials & Equipment:

Lab apron/lab coat/gown
Gloves –non latex
Masks
Goggles
Hair cover

fire blankets
fire extinguisher s
Various hazard signs

poster board

21st Century Technology Used: Type an "X" in the boxes to indicate 21st century technology used in this lesson.

x	Slide Show Software		Graphing Software		Audio File(s)
x	Interactive Whiteboard		Calculator		Graphic Organizer
	Student Response System		Desktop Publishing		Image File(s)
	Web Design Software		Blog		Video
	Animation Software		Wiki		Electronic Game or Puzzle Maker
	Email	X	Website		