GEORGIA | PEACH STATE PATHWAYS

Career, Technical, & Agricultural Education

HEALTHCARE SCIENCE

PATHWAY: Biotechnology Research & Development

COURSE: Introduction to Biotechnology

UNIT 6: Basic Laboratory Skills - II

INTRODUCTION

Annotation:

This unit includes lessons on identifying laboratory equipment, selecting appropriate instruments, developing basic laboratory skills, and using mathematical calculations to prepare laboratory solutions.

Grade(s):

- [X] 9th
- [X] 10th
- [X] 11th
- [X] 12th

Time:

22 hours

Author:

Debbie Grimes

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-4 **Students will demonstrate how concepts of physical science connect to biochemical applications and techniques.**

a) Calculate and prepare buffers, stock solutions, and reagents.

GPS Academic Standards:

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

a.) Follow correct procedures for use of scientific apparatus.

SCSh3 Students will identify and investigate problems scientifically.

a) Suggest reasonable hypotheses for identified problems.
b) Develop procedures for solving scientific problems.
c) Collect organize and record appropriate data.
d) Graphically compare and analyze data points and/or summary statistics.
e) Develop reasonable conclusions based on data collected.
f) Evaluate whether conclusions are reasonable by reviewing the process and checking against other available information.

SCSh4 Students use tools and instruments for observing, measuring, and manipulating scientific equipment and materials.

a.) Develop and use systematic procedures for recording and organizing information.

SCSh5 Students will demonstrate the computation and estimation skills necessary for analyzing data and developing reasonable scientific explanations.

a.) Trace the source on any large disparity between estimated and calculated answers to problems.
b) Consider possible effects of measurement errors on calculations.
c) Recognize the relationship between accuracy and precision.
d) Express appropriate numbers of significant figures for calculated data, using scientific notation where appropriate.
e) Solve scientific problems by substituting quantitative values, using dimensional analysis and/or simple algebraic formulas as appropriate.

SPS6 Students will investigate the properties of solutions.

a.) Describe solutions in terms of, solute/solvent, conductivity, concentration.

SC7 Students will characterize the properties that describe solutions and the nature of acids and bases.

MM1A1 Students will explore and interpret the characteristics of functions, using graphs, tables, and simple algebraic techniques.

MM2P1 Students will solve problems (using appropriate technology).

b.) Solve problems that arise in mathematics and in other contexts.
c.) Apply and adapt a variety of appropriate strategies to solve problems.

SB1 Students will analyze the nature of the relationships between structures and functions in living cells.

National / Local Standards / Industry / ISTE:

UNDERSTANDINGS & GOALS

Enduring Understandings:

- Working in a biotechnology laboratory requires mastery of specific laboratory techniques and skills to solve problems and find scientific solutions.

Essential Questions:

- How are math and the metric system employed in the laboratory?
- What procedures / techniques must a scientist master to work in a biotechnology laboratory?
- How are solutions prepared and labeled in a laboratory setting?

Knowledge from this Unit:

- Students will solve mathematical problems using metric conversions.
- Students will identify basic laboratory equipment and describe its function.
- Students will describe the techniques needed to work in the biotechnology field.

Skills from this Unit:

- Students will select and use laboratory equipment to perform scientific procedures.
- Students will develop skills as needed to perform laboratory testing.

ASSESSMENTS

Assessment Method Type:

_____ Pre-test
_X_ Objective assessment - multiple-choice, true- false, etc.
__ Quizzes/Tests
_X_ Unit test
_____ Group project
_____ Individual project
_____ 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
_X_ Practice quizzes/tests

_X_ Subjective assessment/Informal observations
__ Essay tests
_X_ Observe students working with partners
__ 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
_X_ Partner and small group discussions
_X_ Whole group discussions
__ Interaction with/feedback from community members/speakers and business partners

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

_X_ Post-test

Assessment Attachments and / or Directions:

Make Serial Dilutions
Prepare & Label Solutions
Unit 6 Test
Unit 6 Test KEY

LESSON PLANS

• LESSON 1: BASIC LABORATORY SKILLS – I (INTRODUCTION)

1. Review Essential Questions. Post Essential Questions in the classroom.
   - What procedures / techniques must a scientist master to work in a biotechnology laboratory?
2. Set up examples of glassware in classroom before beginning the lesson.
3. Have students view a Power Point presentation on **Basic Laboratory Skills**. View Section One only.
4. Distribute worksheet **– Identify Laboratory Glassware** and have students complete individually or in pairs.
5. Summarize or review the lesson by selecting each piece of glassware, describing its function, and having the students self-check their responses on the worksheet.
6. Set up lab, pass out the activity sheet **– Pipetting Exercise**, and have students complete. Students should self-check their pipetting skill and proficiency. Practice is important.
7. Distribute the sheet – **Practice Pipetting** and have students complete the activity in the lab. Students should practice until you and they are confident in their ability. Evaluate their results by observation.

• LESSON 2: BASIC LABORATORY SKILLS – II (MATH CONVERSIONS)

1. Review Essential Questions. Post Essential Questions in the classroom.
    - What procedures / techniques must a scientist master to work in a biotechnology laboratory?
    - How are math and the metric system employed in the laboratory?
2. Describe the metric system, its origin, its function and use the laboratory.
3. View the Power Point presentation **– Basic Laboratory Skills** – Section Two.
4. Provide examples of mathematical terms and metric conversions as needed for student understanding.
5. Put examples of formulas on the board and demonstrate solving the problems.
6. Discuss the use of the metric system in preparing solutions and making dilutions in the lab.
7. Distribute **Laboratory Math Skills Worksheet** and have students complete the worksheet.
8. You may use the **Laboratory Math Skills Worksheet KEY** to grade student work.

• LESSON 3: BASIC LABORATORY EQUIPMENT

1. Review Essential Questions. Post Essential Questions in the classroom.
    - What procedures / techniques must a scientist master to work in a biotechnology laboratory?
2. View Power Point presentation – **Laboratory Equipment**.
3. Discuss the use and demonstrate the steps for each piece of equipment.
4. Have students work in small groups (3-4 students) to become familiar with each piece of equipment.
5. Distribute handout - **Make A Poster Illustrating Laboratory Equipment** to students.
6. Discuss the objective for making the poster and help students begin project.

• LESSON 4: BASIC LABORATORY SKILLS –III (PREPARE SOLUTIONS)

1. Review Essential Questions. Post Essential Questions in the classroom
    - What procedures / techniques must a scientist master to work in a biotechnology laboratory?
    - How are math and the metric system employed in the laboratory?
    - How are solutions prepared and labeled in a laboratory setting?

2. Review concepts learned in previous lessons (1--3).
3. Set up the lab and distribute **MAKE Serial Dilutions.**
4. Evaluate students based on the individual skill demonstrated.
5. Set up the lab again and distribute the **Prepare & Label Solutions.**
6. Evaluate students based on the quality of the individual skill they demonstrate.

• ATTACHMENTS FOR LESSON PLANS

Basic Laboratory Skills
Identify Laboratory Glassware
Identify Laboratory Glassware Key
Pipetting Exercise
Practice Pipetting
Laboratory Math Skills Worksheet
Laboratory Math Skills Worksheet KEY
Laboratory Equipment
Make A Poster Illustrating Laboratory Equipment
Make Serial Dilutions
Prepare and Label Solutions
Unit 6 Test
Unit 6 Test KEY

• NOTES & REFLECTION:

The most important objective for this unit is that each student develops all the laboratory skills proficiently. Adequate practice and individual student evaluation is very important.

CULMINATING PERFORMANCE TASK

Culminating Unit Performance Task Title:

Prepare and Label Solutions

Culminating Unit Performance Task Description/Directions/Differentiated Instruction:

In the laboratory, students will prepare various solutions as indicated by the skill sheet. Specifically, they will accurately prepare and label a 20% solution of Solution A and a 16% solution of NACL.

Attachments for Culminating Performance Task:

Prepare & Label Solutions

UNIT RESOURCES

Web Resources:

Materials & Equipment:

Computer / Internet access
Multimedia Presentation Projection
Worksheets / Lab Sheets / Skill Sheets
Textbook / etc.
Laboratory Equipment (centrifuge, autoclave, pH meter, balance, etc.)

21st Century Technology Used:

x	Slide Show Software		Graphing Software		Audio File(s)
	Interactive Whiteboard	x	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		