GEORGIA | PEACH STATE PATHWAYS

Career, Technical, & Agricultural Education

HEALTHCARE SCIENCE

PATHWAY: Biotechnology Research & Development

COURSE: Introduction to Biotechnology

UNIT 5: Basic Laboratory Skills -I

INTRODUCTION

Annotation:

This unit includes lessons on the scientific method, microscopy, cellular design and function, and standard laboratory operating procedures.

Grade(s):

X	9th
X	10th
X	11th
X	12th

Time:

16 hours

Author:

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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-2 **Students will understand the basis for biotechnology products and how much such products affect the quality of life.**

e) Demonstrate the ability to follow Standard Operating Procedures (SOP).

HS-IBT-5 **Students will compare and contrast common organisms used in biotechnology and apply concepts related to the manipulation of living organisms to develop products or procedures.**

a) Distinguish between prokaryotic cells, eukaryotic cells, and non-living entities such as viruses.

GPS Academic Standards:

SCSh 1 Students will evaluate the importance of curiosity, honesty, openness, and skepticism in science.

a.) Exhibit the above traits in their own scientific activities.
b.) Recognize that different explanations often can be given for the same evidence.
c.) Explain that further understanding of scientific problems relies on the design and execution of new experiments which may reinforce or weaken opposing explanations.

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

a) Follow correct procedures for use of scientific apparatus.
b) Demonstrate appropriate technique in all laboratory situations.

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) Develop reasonable conclusions based on data collected.
e) 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.

SCSh7 Students will communicate scientific investigations and information clearly.

a) Write clear, coherent laboratory reports related to scientific investigations.
b) Write clear, coherent accounts of current scientific issues, including possible alternative interpretations of the data.
c) Use date as evidence to support scientific arguments and claims in written or oral presentations.

MM1P1 Students will solve problems (using appropriate technology).

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

Nature of Science

SCSh7 Students analyze how scientific knowledge is developed.

a) The universe is a vast single system in which the basic principles are the same everywhere.

b) Universal principles are discovered through observation and experimental verification.
c) From time to time, major shifts occur in scientific view of how the world works.
d) Hypotheses often cause scientists to develop new experiments that produce additional data.
e.) Testing, revising, and occasionally rejecting new and old theories never ends.

SCSh8 Students will understand important features of the process of scientific inquiry.

a.) Scientific investigations control the conditions of their experiments in order to produce valuable data.
b.) Scientific researchers are expected to critically assess the quality of data including possible sources of bias in their investigation' hypotheses, observations, data analyses, and interpretations.
c.) Scientists use practices such as peer review and publication to reinforce the integrity of scientific activity and reporting.
d.) The merit of a new theory is judged by how well scientific data are explained by the new theory.
e.) The ultimate goal of science is to develop an understanding of the natural universe which is free of biases.
f.) Science disciplines and traditions differ from one another in what is studied, techniques used, and outcomes sought.

UNDERSTANDINGS & GOALS

Enduring Understandings:

- Working in a biotechnology laboratory requires mastery of basic laboratory techniques, observing standard laboratory protocol, and scientific documentation skills.

Essential Questions:

- What is the role of the scientific method in biotechnology?
- Why is using aseptic technique in a laboratory setting important?
- What procedures / techniques must a scientist master to work in a biotechnology laboratory?
- How are cellular components alike yet different in plants, animals, and bacteria?
- What is the importance of a standard operating procedure in a biotechnology laboratory?

Knowledge from this Unit:

Students will:

- Identify cell types while using a microscope.
- Describe the components of the scientific method.
- Discuss the standard operating procedure as used in a laboratory.

Skills from this Unit:

Students will:

- Use a microscope to identify cell types.

- Apply the scientific method to basic research.
- Apply aseptic technique when performing laboratory techniques.
- Write an SOP.
- Develop a laboratory notebook.

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:

Cell Lab Evaluation
Demonstrate Using A Microscope
Develop a Laboratory Scientific Notebook
Unit 5 Test - Basic Laboratory Skills
Unit 5 Test - Basic Laboratory Skills KEY

• LESSON 1: THE SCIENTIFIC METHOD

1. Identify the standards. Standards should be posted in the classroom.
2. Review Essential Question(s). Post Essential Questions in the classroom.
    - What is the role of the scientific method in biotechnology?
3. Identify and review the unit vocabulary. Terms may be posted on word wall.
4. View **The Scientific Method** Power Point. Discuss each slide and give examples of each step in the process.
5. Have students use the **Scientific Method Graphic Organizer** to take notes from the power point presentation.
6. Have students think of similar examples and uses of the Scientific Method.
7. Distribute copies of the **Scientific Method Worksheet** to students.
8. Have students work in small groups (3-4 students) and perform the **Penny Experiment**.
9. Discuss the results from previous activities and indicate how the Scientific Method might be utilized in future units of study.

• LESSON 2: ASEPTIC TECHNIQUE IN THE LABORATORY

1. Review Essential Questions. Post Essential Questions in the classroom.
    - Why is using aseptic technique in a laboratory setting important?
2. Lead a general discussion / review of aseptic technique and general laboratory safety:

    Ask students to give examples of:
    - Poor aseptic technique
    - Good aseptic technique
    - Safety equipment used in the lab
    - Infection control techniques, etc.
3. Show Power Point Presentation on **Aseptic Technique**.
4. Distribute copies of the **Aseptic Technique – Graphic Organizer** to students
5. Discuss the importance of using the personal protective devices and allow students to practice their use.
6. Describe the use of a laminar flow hood and the biohazard hood in the laboratory.

7. Demonstrate how to use an autoclave in the lab setting.

• LESSON 3: CELLULAR DESIGN & FUNCTION

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

   - How are cellular components alike yet different in plants, animals, and bacteria?
   - What procedures / techniques must a scientist master to work in a biotechnology laboratory?

2. Ask students what they know / remember about the three cell types (brainstorm activity). What are cells? What are organelles? What are the differences in each type? Etc.

3. View the Website - www.cellsalive.com Display the Website for the class to view or view optional power Point Presentation **The Cell**.

4. Have students participate individually or in small groups with cell activities on Website.

5. Distribute copies of **Cell Anatomy & Physiology.**

6. Discuss the cell types, the organelles, and the differences between cell types.

7. Have students complete the "Function of the Organelles" section only. The remainder will be completed in the next lesson.

• LESSON 4: CELL MICROSCOPY

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

   - What procedures / techniques must a scientist master when working in a biotechnology laboratory?

2. View the Power Point presentation **Using a Microscope**.

3. Discuss the purpose and the different types of microscopes.

4. Distribute copies of the work sheet **Microscope – Label The Parts** and have students complete while viewing the power point presentation. Discuss the function of each part of the microscope.

5. Demonstrate using the microscope and review what the students have learned.

6. Have students practice using the microscope with prepared slides.

7. Distribute work sheets **Cell Lab**; **Cell Anatomy & Physiology** (Plant, Animal, & Bacteria) to students.

8. Set up equipment and supplies for this lab and have students work in pairs or small groups (3-4 students).

9. Students should complete activities and drawings as indicated on the worksheet.

10. Review information the students are responsible for learning.

11. Evaluate students using the **Cell Lab Evaluation** form.

• LESSON 5: STANDARD OPERATING PROCEDURE

1. Review Essential Questions. Post Essential Questions in the classroom.
    - What is the importance of a standard operating procedure in a biotechnology laboratory?
2. View the Power Point **Standard Operating Procedure** and explain the SOP process.
3. Explain the importance of following an established procedure when working in a laboratory.
4. Distribute copies of the **SOP Record Activity – 1** to students.
5. Explain the procedure for this activity and have students complete it as outlined.
6. Choose several completed SOP Record - Lab Activity sheets, and have one student read the directions and another student complete the activity as outlined by the completed form. Evaluate the success or failure of the directions and the success of the activity. Discuss why following directions exactly is so important in biotechnology.
7. Distribute copies of **SOP Record Activity – 2** and allow students to complete.
8. Evaluate students' understanding by observation of individual performance.

• LESSON 6: SCIENTIFIC NOTEBOOK

1. Review Essential Questions. Post Essential Questions in the classroom.
    - What is the importance of a standard operating procedure in a biotechnology laboratory?
2. View the Power Point **Scientific Notebook**
3. Distribute copies of the **Scientific Notebook Guidelines** and discuss those guidelines.
4. Discuss the importance of recording all procedure data and results in the notebook as well as verification of that data.
5. Give students a scenario and have them record it in their scientific notebook.

• ATTACHMENTS FOR LESSON PLANS

The Scientific Method
Scientific Method Worksheet Graphic Organizer
Graphic Organizer – Scientific Method
Penny Experiment
Aseptic Technique
Aseptic Technique – Graphic Organizer

The Cell
Cell Anatomy & Physiology Worksheet – Plant, Animal & Bacteria
Using a Microscope
Microscope – Label The Parts
Cell Lab: Cell Anatomy & Physiology – Plant, Animal & Bacteria
Standard Operating Procedure
SOP Record – Laboratory Activity – 1
SOP Record Activity – 2
Scientific Notebook Guidelines
Unit Test Basic Lab Skills Test
Unit Test Basic Lab Skills Key
Laboratory Notebook Grade Sheet
Cell Lab Evaluation
Cell Lab
Demo Using a Microscope Skill
Scientific Notebook

- **NOTES & REFLECTION:**

It is important that students understand the procedure for setting up and properly maintaining a scientific laboratory notebook.

CULMINATING PERFORMANCE TASK

Culminating Unit Performance Task Title:

Develop a Laboratory Notebook

Culminating Unit Performance Task Description/Directions/Differentiated Instruction:

Set up and utilize a laboratory notebook to record laboratory procedures, data, and laboratory results.

Attachments for Culminating Performance Task:

Laboratory Notebook Grade Sheet

UNIT RESOURCES

Web Resources:

www.cellsalive.com

Materials & Equipment:

- Computer / Internet access
- Multimedia Presentation projector
- Worksheets / Lab Sheets / Skill Sheets
- Textbook, etc.
- Laboratory Equipment (microscope, 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		