

STEM Learning Module Template

PISA Team:

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Strand(s): Membranes

Grade(s): 4th

Key Science Terms: Bioengineer, engineer, habitat, membrane, rain forest, canopy, technology, amphibian, rate, function, human-made, natural, basic need, biological, model, organism, pore, semi-permeable, design, goal, redesign, teamwork, test

Key Science Concepts:

- * Bioengineers look to nature to help them design solutions to problems.
- * Membranes regulate the movement of substances into and out of an organism.
- * Different organisms meet their basic needs in different ways.
- *Engineers (especially bioengineers) often examine organisms and other parts of the natural world when they are designing technologies
- *Human-made technologies and things found in the natural world can have similar functions
- *Some substances can pass through membranes into organisms or parts of organisms.
- *The properties of a membrane determine what materials are able to move through it.
- *Engineers use a series of guiding steps called the Engineering Design Process to “Ask”, “Imagine”, “Plan”, “Create”, and “Improve” technologies.
- *A successful model membrane design will allow water through at a slow rate so that the water supply will last for an extended period of time.
- * By looking at organisms and systems in the natural world, bioengineers are able to inform their designs.

NJCCC Standards:

STANDARD 5.1 (SCIENTIFIC PROCESSES) ALL STUDENTS WILL DEVELOP PROBLEM-SOLVING, DECISION-MAKING AND INQUIRY SKILLS, REFLECTED BY FORMULATING USABLE QUESTIONS AND HYPOTHESES, PLANNING EXPERIMENTS, CONDUCTING SYSTEMATIC OBSERVATIONS, INTERPRETING AND ANALYZING DATA, DRAWING CONCLUSIONS, AND COMMUNICATING RESULTS.

STANDARD 5.5 (CHARACTERISTICS OF LIFE) ALL STUDENTS WILL GAIN AN UNDERSTANDING OF THE STRUCTURE, CHARACTERISTICS, AND BASIC NEEDS OF ORGANISMS AND WILL INVESTIGATE THE DIVERSITY OF LIFE.

5E's	Procedure	Assessment	Materials/Handouts
Engage Days/Hours: <u>2/2</u>	Key Questions: What is a membrane? Key Concepts: *A membrane is a very thin structure through which substances can move based on their size, shape, concentration, and electric charge, as well as other factors. Procedure: Day 1 <ol style="list-style-type: none">1. Administer pretest.2. Students will draw a picture to illustrate their understanding of a membrane in their BB.3. Model the Personal Vocabulary	Pretest: Students will draw a picture of where they think substances can enter and exit a body. Support their illustrations with one sentence. Bioengineering Booklet (BB): - - KWL chart (What do I Know? What do I want to know? What did I Learn?)	Attach all assessments Attach all handouts Bioengineering Booklet (BB – science journal)

Collection Form and guide students as they complete it.

Personal Vocabulary Collection Form

Day 2

1. Students will split up into groups to observe the features of various raisins.
2. Student will record their findings of the various raisins on the chart paper.

- *Raisins
 - dry
 - in water for 24 hours
 - in sand and water for 24 hours
 - in water for 3 hours

- *Containers
- *Marker
- *Chart paper
- *Masking Tape
- *Exploring Membranes: Raisin Skin worksheet (EIE 3.1)

Explore

Days/Hours:
1/1

Key Questions: What is a bioengineer?

Key Concepts:

*A bioengineer is someone who combines his or her knowledge of science, math, and living things to design technologies that solve problems in nature or use natural materials to solve man-made problems.

Bioengineering

Booklet (BB): -

- **KWL chart**
(What do I Know? What do I want to know? What did I Learn?)

Procedure:

- 1) Use demonstration cards to convey concept of the similarities between natural characteristics and man-made items. (EIE 2-1 through 2-3)
- 2) Pass out one "Biology Meets Technology Playing Card" (EIE2-4 and 2-5) to each student.
- 3) Have them find their partner

* Technology Match up! (EIE 2-6)

Demonstration Cards (EIE 2-1, 2-2, & 2-3)

Playing Cards (EIE 2-4 & 2-5)

Technology Match-Up! (EIE 2-6)

and explain their similarities.

Explain

Key Questions:

How does a frog use a membrane?

Days/Hours:

1 / 1

Key Concepts:

*Frogs take in water by absorbing it through their skin membranes.

Procedure:

1. Students will complete the first 2 items on the “List, Group, Label, and Write” worksheet

“List, Group, Label, and Write” worksheet

“List, Group, Label, and Write” worksheet by Dr. Aldridge

2. Teacher will read aloud the story Juan Daniel’s Futbol Frog

Juan Daniel’s Futbol Frog story

3. Discuss the story and have them split up into groups to complete 4, 5, and 6 of the “List, Group, Label, and Write” worksheet.

Homework:
Vocabulary
Definitions 1-3

Elaborate

Key Questions:

What are the steps to the Engineering Design Process?

Days/Hours:

4/4

How would you be able to design a membrane that will allow water through at a slow rate so that the water supply will last for an extended period of time?

Key Concepts:

The five steps to Engineering Design are:

- 1) Ask
- 2) Imagine
- 3) Plan
- 4) Create

*Engineering Design
Process Chart (EIE 4-1
and
4-2)

5) Improve.

Procedure:

Day 1

1) Introduce the steps of the Engineering Design Process by building a structure out of playing cards. Have the students orally go through the steps.

Oral description of the application to the design process.

*Deck of playing cards
*masking tape the length of teacher's arm
* beanie baby

2) The students will break up into groups and build an index card structure using the E.D.P.

*Poster of Engineering Design Process on display in the classroom.

3) Math geometry lesson- Students will draw the model of the playing card structure the team has designed and label angles (right, obtuse, acute)

* Geometry angle drawings

Day 2

3) Introduce the "Designing a Model Membrane" project.

4-4 worksheet

4) Have the students in groups, and brainstorm the types of materials on the 4-4 worksheet.

Sponges
Cheesecloth
Cotton balls
Aluminum foil
Felt

4-5 worksheet

Day 3

5) Brainstorm model membrane design. (4-5)

Masking tape
Pitcher of water
Screen
Re-sealable plastic container

4-6 worksheet

Day 4

6) After the students have come up with their plans, they will draw a diagram of their model membrane. (4-6)

Scissors
Paper towels
Measuring cups

7) Build the model membrane.

8) Allow time for redesigning/improvements.

Evaluate

Days/Hours:
1/1

Key Questions:

How did I use the Engineering Design Process to design my model membrane?

Key Concepts:

I **asked** what my problem is and what the constraints are. I have **imagined** a possible solution by brainstorming. I **planned** by drawing a diagram. I **created** by following my plan. I **improved** my project by testing it out.

Procedure:

1. Students will present their projects and describe how they used the EDP.
2. Administer post test.

Oral presentations with completed project making connections to the EDP.

Post test

*Completed projects

*The Engineering Design Process Chart

*Evaluating Student Learning: A Rubric for Lesson 4 (4-12)

Post test

Timeline: Create a timeline for this project.

Engage:

10/1 - Pretest, Bioengineering booklet, Personal Vocabulary Collection Form
10/2 – Raisin experiment

Explore:

10/3 – Introduce the concept of bioengineering, playing card match up activity, technology match up

Explain:

10/4 – List, Group, Label, and Write worksheet, read aloud Juan Daniel's Futbol Frog

Elaborate:

10/5 – Introduce the steps of the Engineering Design Process, index card activity
10/8 – Introduce the Designing a Model Membrane project, brainstorm and test materials
10/9 – Brainstorm model membrane design
10/10-Build a model membrane and make improvements

Evaluate:

10/11 – Presentations, post test
