

THE BLACK PEARL: TEACHER GUIDE

Subject: Biology

Grade Level: High School

Case Summary

The Black Pearl, Jack Sparrow's famous vessel, has sunk to the bottom of the ocean. Distraught, Captain Jack Sparrow has come to your class to beg for assistance from your group of scientists. Of course, Jack wants his ship back; however, will the ship be able to recover from its time on the ocean floor and remain intact? Use your scientific expertise in osmosis, hypertonic, hypotonic, and isotonic solutions, as well as cell parts, to help the pirate and you may receive treasure in return.

Credits

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Learning Objectives

1. Students will understand and identify cell parts, specifically the cell membrane and the phospholipid bilayer.
2. Students will interpret the effects of water on cells using their knowledge of osmosis, solutions, and the cell membrane/phospholipid bilayer.
3. Students will analyze the importance of the cell maintaining homeostasis.
4. Students will design a lab test to determine the effects of wood having been waterlogged, using their knowledge of cell parts, homeostasis, osmosis, and solutions.

Georgia Performance Standards

SCSh1. Students will evaluate the importance of curiosity, honesty, openness, and skepticism in science.

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.
- c. Follow correct protocol for identifying and reporting safety problems and violations.

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.

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.
- b. Use technology to produce tables and graphs.
- c. Use technology to develop, test, and revise experimental or mathematical models.

SCSh6. 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 data as evidence to support scientific arguments and claims in written or oral presentations.
- d. Participate in group discussions of scientific investigation and current scientific issues.

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

- a. Explain the role of cell organelles for both prokaryotic and eukaryotic cells, including the cell membrane, in maintaining homeostasis and cell reproduction.
- b. Explain the impact of water on life processes (i.e., osmosis, diffusion).

SCSh. Students will enhance reading in all curriculum areas by:

- a. Building vocabulary knowledge
- b. Demonstrate an understanding of contextual vocabulary in various subjects.
- c. Use content vocabulary in writing and speaking.
- d. Explore understanding of new words found in subject area texts

Assessment

Students will be assessed based on four pieces of data:

- Students will be assessed on their experiment's design (rubric included)
- Students will be assessed on their conclusions in the form of a written letter (rubric included)
- Students will be assessed on a ticket out the door which will determine their knowledge of osmosis (TOD included)
- Students will complete peer evaluations following group sharing

Implementation Strategy

Day 1:

- Warm up-5 minutes
- Introduction to Osmosis- 20 minutes (may be switched with PBL introduction)
- Introduce the PBL and put students into groups- 20 minutes (may be switched with Introduction to Osmosis)
- Students brainstorm and complete box chart-10 minutes
- Students begin to design their experiments in groups- 30 minutes
- Questions and review- 10 minutes

Day 2:

- Warm up/osmosis review-10 minutes
- Complete waterlogged lab in groups (in folder)- 60 minutes
- Students record conclusions-10 minutes
- Students complete short osmosis assessment (ticket out the door)- 10 minutes.

Day 3:

- Warm up- 5 minutes
- Students independently write letter to Jack explaining their conclusions, the experiment they conducted, and that his ship will be unable to be recovered based on their findings- 60 minutes.
- Students share conclusions (share their letters) in groups; students will complete peer evaluations- 20 minutes
- Conclude and review- 5 minutes

Facilitator Guide:

- What is the relationship between the cell membrane and homeostasis?
- What would happen if something were submerged in water for a long period of time?
What about at the cellular level?
- How would you solve Jack's problem based on what you know about the cell membrane, osmosis and solutions?
- What would you recommend Jack do in this situation?

Resources:

<http://hamptonroads.com/2011/01/experts-race-clock-preserve-nc-shipwreck>

Understanding Waterlogged Wood (Better for Teachers)

<http://www.nara.accu.or.jp/elearning/2004/waterlogged-woods.pdf>

Restoring the Charles W Morgan – the last wooden whaling ship

<http://www.youtube.com/watch?v=S47Yi3iRBh4&list=PL22AA710488CD330E>

The Vasa

<http://www.youtube.com/watch?v=x45l1WMZOXA>

The Black Pearl: Scene 1

It is a regular spring morning in your absolute favorite class, Ms. Story's Biology course. You and your classmates have just finished learning about the cell membrane, which is made up of the phospholipid bilayer, and how it maintains homeostasis for the cell. You were excited to learn about osmosis and how water moves into and out of the cell, based on the type of solution the cells are submerged in. Confident in your knowledge, you are putting your new notes away and getting ready for some daily work, when suddenly.....

The door to the classroom swings open, blown by a mysterious, salty, warm wind. The scent of the sea, adventure, and rum fills the classroom. Puzzled, you stare at the door to the room, wondering what could be causing these strange conditions on a cool Georgia morning. In swaggers Captain Jack Sparrow.

"Yoho scientists! I have a use for you. Alas, my beloved ship, The Black Pearl, came under attack in the Atlantic Ocean...now the only thing I care about in this world lies at the bottom of the sea" Jack says, striding confidently into the classroom. " She has been sleeping on sea floor for 250 years."

"Jack," Ms. Story says calmly, "We are all very sorry about your ship, obviously, but how could we help you with this? We are nowhere near the coast, and besides, we don't even have a ship to raise yours with. What could we do?"

Jack smiles at the class broadly. "While sailing the seven seas I have heard tales of the young minds at work in this class. I need you young scallywags to figure out if I were able to raise The Pearl, would I still be able to save her? Would she be fit to sail?"

"Well, Jack...there are a lot of variables..." said Ms. Story doubtfully, "but I think my class can take the case. These old land lubbers can solve any problem with science!"

"Excellent!" exclaims Captain Jack "send me a message in a bottle when you've reached your conclusions...I'll be awaiting your good news." Jack jubilantly leaves the room, confident that your class can solve his puzzle and determine whether or not his ship will be sailable. You're now on the case.

Box Chart: The Case of The Black Pearl

Big Idea: What is the topic all about? What must I know and be able to communicate to others? What are the key concepts I need to know, understand, and apply?

Essential Question: What questions do I need to answer to help me understand the big idea and make connections to the real world? What questions will get me thinking about key concepts and big idea of the lesson? How can I use my prior knowledge to answer questions?

Problem: What is the questions you need to answer? What is the problem you want to solve? What are you trying to find out?

Hypothesis: What is your prediction about the problem? What do you think is going to happen?

Questions to Consider

What would you ask in an interview with waterlogged wood conservator?

How would you solve Jack's problem using your knowledge of osmosis and solutions?

What way would you design an experiment to determine if the Black Pearl will still be sailable when it is brought up?

Propose a method in which you can determine what happened to Jack's ship after it sunk.

Form a hypothesis: Knowing what you know about osmosis and solutions, do you think Jack's ship is salvageable. Why or why not?

Assesignments

- Rubric for letter in folder
- Rubric for lab design in folder
- Ticket out the door assessment in folder
- Peer evaluation document in folder