AS FAR AS I CAN SEA (1 HOUR)

Addresses NGSS
Level of Difficulty: 3
Grade Range: 3-5

OVERVIEW

Topic: **Ocean mapping**

Real World Science Topics:

- An exploration of methods used to map the ocean
- An exploration of creating maps

Objective

Students will gain an understanding of how scientists map the coastline and floor of the ocean.

Materials Needed for Student Activity

Materials Needed for Each Group

- prepared map of the classroom
- shoebox, with a number written on the lid (a different number on each box)
- modeling clay
- ruler
- 2 pieces of cardboard
- 1 pen or sharpened pencil
- 1 unsharpened pencil

Teacher Notes

Use your discretion on the best way to conduct this activity based on the individual level of your class. For some of the younger, you may wish to perform some or all of the steps of the activity, encourag-ing children to make predictions and observations. If the group is older or more advanced in their abilities, students can take a more hands-on role in performing the related tasks. Use your knowledge of each class to determine what the best option is for your particular group.

Please note: The use of clay may lead to some messes, so it is recommended that you cover any workspaces with newspaper and have paper towels on hand for cleanup once the activity is completed.

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Teacher Preparation

Mark off the north and eastern walls in the classroom using a compass. The northern wall should be marked as Wall A, while the eastern wall is Wall B.

Prepare a gridded map of the classroom on a piece of paper. This can be a simple line drawing of the classroom that identifies walls, windows and doors. Include grid lines and a scale, but do not include any measurements on the map. Once the drawing is complete, make photo copies so each student group can receive their own map.

Teacher Demonstration Using a large shoe box marked off with gridlines, refer to the map of the ocean used in the **Warm-Up Activity** to create a landscape with molding clay that matches the ocean map. This can also either be done ahead of time and used as an example, or done during class as a demonstration (see Step 7).

NGSS Three-Dimensions

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Obtaining, Evaluating, and Communicating Informatoin		

STEPS FOR *AS FAR AS I CAN SEA*

1. Warm-Up Activity:

Show students two maps of the same ocean. The maps should show different things. Try to locate a simple map of the coastline, which should be easily recognizable to students, as well as a bathymetric map. A bathymetric map is used to illustrate the topography of the ocean's floor, and students will have likely never seen one before. Ask students to describe what they think each map is supposed to show. Point out some prominent places on the maps (on a map of the Atlantic Ocean, for example, direct students to the United States). For each place, ask students to think about how they would describe that location. If they were talking to a friend, how would they tell their friend to locate the place? Briefly explain the latitude and longitude grids and explain that they are a grid system, similar to an address. While we can find places by looking for their addresses, everything also has a location on the grid system. Ask students if they think things in the oceans have addresses. Explain that since the ocean doesn't have streets or cities we can find, we can use the latitude and longitude grids to locate things there as well as all over the world. Explain that students will be using a similar grid system to locate things in the classroom.

2. Divide students into groups of 4.

Distribute the materials needed for the rest of this lab now.

3. Hand out a copy of the classroom map and a handout sheet to each group. Explain to students that they will be using this grid to map the important objects in the classroom, the same way we use latitude and longitude to map the ocean. Have each group select four important features that are not located along the walls of the classroom (think desks, bookshelves, chairs).

4. Using Walls A (the northern side of the classroom) and B (the eastern side of the classroom) as markers, students should locate their objects.

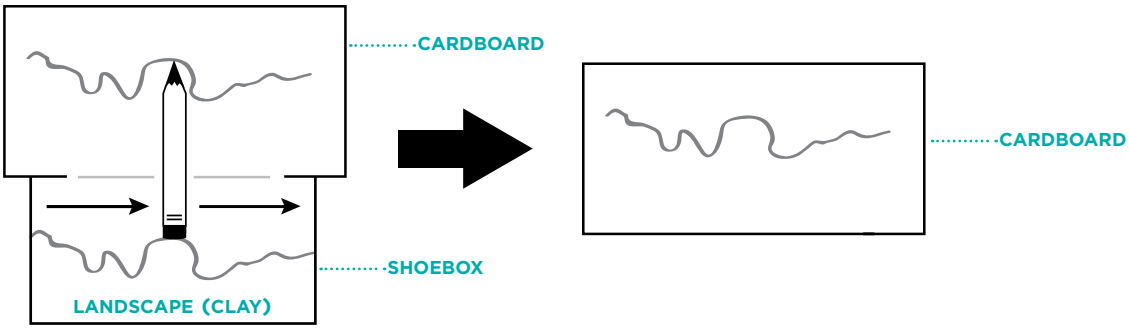
Students should then measure the distance to each of the four objects from the two perpendicular walls and record this data on the handout. Once they have recorded this information, they should return to their desks and use this information to place the location of these objects on the gridded classroom map, converting their measurements to fit the scale. If the teacher's desk is three feet from the corner window, they should mark it as 3 grid blocks from the window on their map. If they need help, draw a grid on the chalkboard and use a sample measurement from one of the students in order to demonstrate how to use grid coordinates to draw a map.

5. **Teacher Demonstration** Using a large shoebox marked off with gridlines, refer to the map of the ocean used in the **Warm-Up Activity** to create a landscape with molding clay that matches the ocean map. This can also be done ahead of time.

6. A student from each group should use a ruler to draw a grid map on the bottom of the group's shoebox. The grid should match the grid on the map of the classroom.

7. Now, have each group of students use the maps they made of the classroom to create a similar landscape on the bottom of their shoeboxes with their clay.

   Students should use the gridlines as accurately as possible. Once students are done creating their landscape, supply them with a piece of cardboard. Have one student hold the piece of cardboard on top of the box. Another group member should use a pencil and slowly move it along the landscape without digging into it. A third member of the group should mark where the top of the pencil is along the cardboard. This will provide a detailed profile of the landscape for reference.

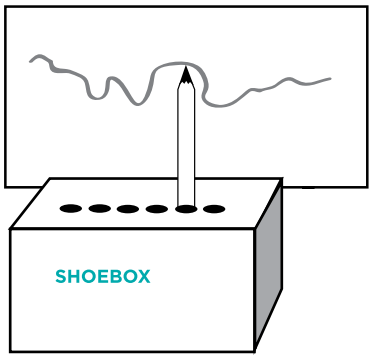


This diagram shows the setup needed to make the profile with the box lid off, and the resulting cardboard profile diagram.

9. Next, students should note where they took their profile and place the lid back on the box. After drawing a line on the top of the box in the same place they took their profile, students should use a pen or pencil and poke a series of holes an inch apart along the line they marked off. (The holes should match up with the same line by which the profile was made).

10. Students should write the names of their group's members on their shoebox and record their box number on their cardboard profile before passing their box to another group. Every group should have a new box.

11. Next, without removing the lid, groups should use an unsharpened pencil to measure the profile of the new landscape along the same line. Have one student hold a piece of cardboard on the top of the box next to the series of holes. This will be used to record the profile. Another student should then put the pencil in the hole and push down until it hits the clay (the "bottom of the ocean floor"). A third student should then place a mark on the cardboard at the top of the pencil. Have them repeat this for all of the holes. When they are finished they should have a profile of the new clay landscape in the box. They should record the new box number on their second profile.



12. Collect the shoebox landscapes and profiles from each group. Discard the lid from the shoeboxes and share each box with the classroom before revealing the two profiles created for each box. Allow students to discuss the landscapes and profiles before returning them to the groups (the box can return to the original group). Now, ask students to answer the questions in the handout regarding their profiles.

13. Wrap-up Activity:

Lead a discussion of how these two mapping techniques could be used to produce the two maps that were shown at the beginning of class. First, discuss how a map could be produced using a grid. Encourage students to think about what kind of grid could be used on a map of the Earth. Show them the map again and explain to them that cartographers have created a grid system based on two lines – the equator and the prime meridian. The lines function like the walls did in the activity. Then ask them how they think that people measure the depth of the ocean. Guide them towards the idea that at one time people used a technique a lot like the one used in class. In shallow water areas they may even have used a stick. In deeper areas they used a weight tied to a rope.

As Far As I Can Sea Extension Activity

Students that are interested in maps can practice drawing a second map. Distribute the Extension Activity handout and instruct students to create a new map that includes the list of features at the top of the page. Students should draw a map of an imaginary land, and (if covered in the lesson) incorporate a grid system that will allow them to name the locations of the assigned features.

Why is it important for scientists to map the ocean?

Scientists, mariners, and others have many reasons for mapping the ocean. The most important is to ensure that ships do not run aground and are able to find their way to ports. Beyond, that geologists may want to map the ocean floor to look for signs of fossil fuels, or to decipher how the Earth's surface has evolved over time. Climatologists and marine scientists need to know what the ocean looks like in order to map the currents that affect sea life and weather patterns around the world. Telecommunications companies lay extremely long cables on the ocean floor. Environmental scientists may want to track oil spills and other pollution throughout the world's oceans.

How do scientists create maps of the ocean floor?

For centuries, mariners used techniques to map the ocean floor so that they could make sure their ships (and later, submarines) wouldn't get grounded on the bottom of the ocean. The simplest and oldest method was to hang a rope with a heavy weight off the edge of the boat. The rope was marked with evenly spaced markings, like a giant tape measure. Mariners simply marked how deep the water was at a spot and plotted that on a map. This is similar to the technique that students will use to plot the profile of an imaginary landscape.

Scientists now use more up-to-date techniques. One method is sounding. In this method a ship emits sound waves and then measures how long it takes for those sounds waves to bounce off of the bottom of the ocean and be picked up by a microphone. Since the sound waves travel at a constant rate, the depth is easily calculated from the time is takes for the echoes to be picked up on the microphone. Other modern techniques involve using satellites to measure large swaths of the ocean more quickly.

Key Vocabulary

grid: a framework of crisscrossing lines

bathymetry: the measurement of the depth of a body of water

equator: an imaginary line around the middle of the Earth that runs halfway between the north and south poles

prime meridian: an imaginary line that wraps all around the globe east to west

latitude: the distance north and south of the equator

longitude: the distance east and west of the prime meridian

cartographer: someone who produces maps

Record your measurements in the table below.

Name of Object	Distance from Wall A	Distance from Wall B	Notes
[Answers will vary.]			

How did your profile match up with the more accurate profile drawn by the group who created the landscape?

My profile was close, but there were some places where it was not accurate.

What are some possible sources of errors in your profile?

At one point my profile shows the landscape being deeper than it really was. This may have been because the pencil got stuck too far into the clay.

How was this like measuring the ocean bottom in real life?

The bottom of the ocean is very deep, so you cannot see it. This is a lot like the box with the top on it.

AS FAR AS I CAN SEA STUDENT HANDOUT

Name:

Date:

Record your measurements in the table below.

Name of Object	Distance from Wall A	Distance from Wall B	Notes

How did your profile match up with the more accurate profile drawn by the group who created the landscape?

What are some possible sources of errors in your profile?

How was this like measuring the ocean bottom in real life?

AS FAR AS I CAN SEA
EXTENSION ACTIVITY HANDOUT

Name:

Date:

Practice drawing your own map. Include the following features:

- A lake
- A forest
- A bridge
- A house
- A library
- A school