MOSA MACK SCIENCE

Oceans and Climate Lesson 1: *The Solve*
Educator's Resource Guide

Objective

In *The Solve*, students will:

1. Work collaboratively to complete a Mind Map using new terms, definitions, and visuals comprising essential Oceans and Climate vocabulary.
2. Solve a mystery that demonstrates how objects lost at sea can travel across coastlines due to ocean currents.
3. Communicate understanding that ocean currents are impacted by a variety of factors, including the earth's rotation, wind, density of ocean water (due to temperature and salinity gradients), and land masses.
4. Communicate understanding that ocean currents move in a predictable pattern as cold water generally moves in the direction of pole to equator, while warm water moves from equator to pole.

Time Required: 45–80 minutes

Materials Required	**Safety Considerations**	**Science & Engineering Practices**
• Student Guide ○ *includes Student Agenda and Mind Map* • *Oceans and Climate* Comic Book or Motion Comic Episode • Scissors • Glue or tape	None	• Developing and Using Models • Constructing Explanations or Arguments From Evidence

Mosa Mack Mystery Episode Description

Nuclear bomb plans have been lost at sea in a cargo ship disaster! Hidden inside a shipment of plastic garden gnomes, these secret plans now float on the Pacific Ocean, waiting to be retrieved. Having spilled overboard near the Philippines, ocean currents have carried gnomes as far across the ocean as Japan and the Washington coast!

Mosa Mack is called to investigate this oceanic mystery, and she explores the dynamics of ocean water circulation in an effort to help Interpol agents recover the Air-Quote Gnome. Along her journey, Mosa learns that a variety of factors affect ocean currents and combining these factors accurately can lead to the location and recovery of the missing nuclear bomb plans.

Inquiry Scale: Leveling Information

The Solve can be completed in various settings, including presentation-style, small groups, or individually. In the case of a flipped or blended classroom, it can be completed entirely at home.

Level 1: most teacher-driven (*recommended for grades 4–5)*

Project and complete the Mind Map as a class-wide activity. This can be done digitally or on paper. Have students informally quiz each other on the vocabulary until you feel they're familiar with the terms. Use the discussion questions at the bottom of the Mind Map to have a group discussion.

Then, read through or watch the mystery twice as students follow along: once in full, and a second time along with the episode questions, pausing as needed to answer the questions as a group. Finally, have students complete the quiz online or on paper as an exit ticket.

Level 2 (*recommended for grades 5–6)*

Direct students to complete the Mind Map in small groups, either digitally or on paper. Come back as a class to review correct answers, as needed. Have students informally quiz each other on the vocabulary until you feel they're familiar with the terms. Use the discussion questions at the bottom of the Mind Map to have a group discussion.

Then, if reading the comic, assign students roles for the different characters in the comic. Read through the comic as class, with students reading out for their specific roles. Alternatively, watch the episode video. After, have students answer the episode questions in small groups, either online or on paper. Finally, have students complete the quiz online or on paper as an exit ticket.

Level 3 (*recommended for grades 6–7)*

Have students complete the Mind Map in table groups, either digitally or on paper. Have students quiz each other on the vocabulary until you feel they're familiar with the terms. In table groups, have students go through the discussion questions on their own, and review answers as a class.

Provide students with the mystery (either in comic or video form) and have students read and/or watch in small groups. Have students answer episode questions in their table groups to the best of their ability, either online or on paper. Then, as a class, review the mystery again in either format, pausing as needed to discuss questions in a think-pair-share format. Finally, have students complete the quiz online or on paper as an exit ticket.

Level 4: most student-driven *(recommended for grades 7–8)*

Have students complete the Mind Map in pairs, either digitally or on paper. Allow students to quiz each other on the vocabulary until they feel they're familiar with the terms. Have these same pairs go through the discussion questions.

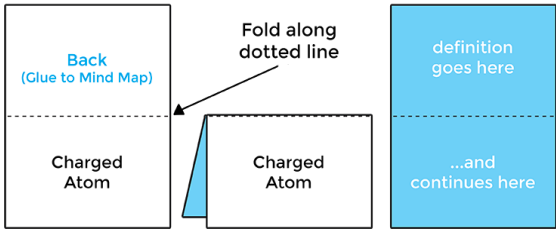
Provide students with the comic or episode and have them read and/or watch in small groups or pairs. Students answer episode questions either online or on paper. Have students review their answers with a neighboring table group. Finally, have students complete the quiz online or on paper as an exit ticket.

Agenda

I. Warm Up: Vocabulary Mind Map (15–45 minutes)

Differentiation Tip: The Mind Map can be done as a class, in small groups, individually, or completed for homework.

1. Students may complete the Mind Map **digitally**. Follow directions below. (15 minutes)
    a. Go to https://mosamack.com/home/oceans
    b. Select **Lesson 1: *The Solve***.
    c. Select **Vocabulary** and complete **Part 1:** matching terms with definitions.
    d. Complete **Part 2:** matching terms and definitions with images on a diagram.
2. To complete the Mind Map **on paper**, follow the directions below (45 minutes).
    a. Print and pass out the Student Guide: Oceans and Climate Lesson 1: *The Solve*.
    b. Introduce the warm up task: students will be making a Mind Map of the vocabulary for this Oceans and Climate unit.
    c. Model the directions carefully, emphasizing the following. Students should:
        - **cut** out the vocabulary cards on the solid lines only
        - **fold** the cards at the dotted lines
        - write the definition of the term on the inside of the card using definitions provided



    d. Students use the clues from the Mind Map images, definitions, and terms to place the cards in the correct location in the Mind Map.
    e. Check that the students have matched their cards correctly before moving on.
    f. Students use glue or double-sided tape to connect the back of the vocabulary card to the correct place on the Mind Map.
    g. Students discuss the questions with their group or as a class when they have completed the Mind Map.

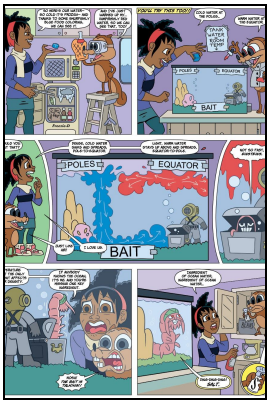
Teacher Tips:

- Since this is the first time many of the students will have seen these vocabulary terms, have students work together to use the images, definitions, and collaborative thinking to figure out where the terms go.
- Check in on student groups through this process. When you see a student or group who has placed a card in the correct place, ask a facilitating question such as, “Why do you think that term goes there?” or “What evidence leads you to believe that term goes there?” When students explain their thinking, this is a great opportunity to provide positive reinforcement. Then, encourage students to share their reasoning to the class or to other groups who may have trouble identifying the location of that specific term.

- If you do not have access to a color printer, provide students with black and white copies and project the colored version of the Mind Map at the front of the room so that students can reference both images.

II. Solve the Oceans and Climate Mosa Mack Mystery (20 minutes)

Differentiation Tip: The comic book and motion comic video can be read/watched as a class, in small groups, individually, or completed for homework. For additional support, students can read or watch the comic/episode twice: once before completing the questions, and once with teacher guidance, pausing to discuss each answer.



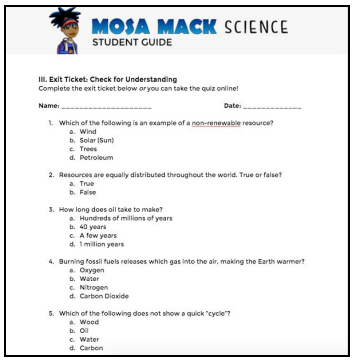
1. Read/watch the Mosa Mack Mystery on Oceans and Climate.

2. Students answer the questions in their Student Guide as they read/watch. Encourage students to cite the specific page numbers/time codes in the Comic Mystery to promote writing with supporting evidence. Answers can be found in the key below.

III. Exit Ticket: Check for Understanding (10–15 minutes)

Differentiation Tip: This can be done in groups, pairs, individually, or more formally as a quiz online.

1. Students complete the exit ticket to check for understanding. This can be done online by selecting the **Quiz** button in Lesson 1 or on paper in the Student Guide. Answers are in the key below.


MOSA MACK SCIENCE
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III. Exit Ticket: Check for Understanding
Complete the exit ticket below or you can take the quiz online!

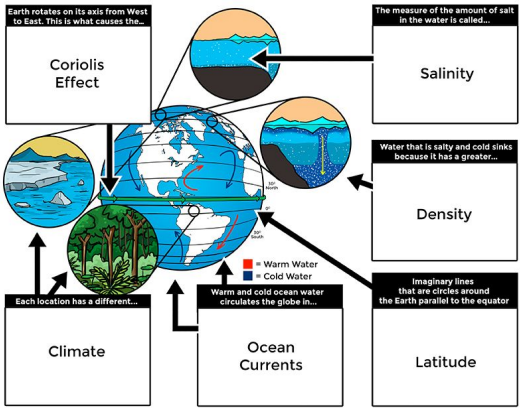
Name: _____ Date: _____

1. Which of the following is an example of a non-renewable resource?
   a. Wind
   b. Solar (Sun)
   c. Trees
   d. Petroleum
2. Resources are equally distributed throughout the world. True or false?
   a. True
   b. False
3. How long does oil take to make?
   a. Hundreds of millions of years
   b. 40 years
   c. A few years
   d. 1 million years
4. Burning fossil fuels releases which gas into the air, making the Earth warmer?
   a. Oxygen
   b. Water
   c. Nitrogen
   d. Carbon Dioxide
5. Which of the following does not show a quick "cycle"?
   a. Wood
   b. Oil
   c. Water
   d. Carbon

Answer Key

Mind Map

Mind Map Discussion Questions



a. Why do you think temperature differs so greatly at the equator and polar regions on the earth? What could account for such drastic differences? *Temperature differs so greatly at the equator and polar regions on the earth due to the intensity of sunlight that hits the earth in each location. Sunrays hit the earth more directly and with greater intensity at the equator than at the poles, thus warming regions along equatorial latitudes.*

b. Do warm ocean currents tend to move toward the equator or away from the equator? What about cold ocean currents? Why do you think this is so? *Warm ocean currents tend to move from the equator toward the poles. Cold ocean currents tend to move from the poles toward the equator. The movement of ocean water is due to a variety of factors, including density and salinity differences, winds, and the Coriolis effect.*

Episode Questions

1. What are Mosa, Billy, and Dullis trying to find in the ocean and why? *Mosa and her crew were trying to locate the Air-Quote gnome, which contained nuclear bomb plans. This gnome had been lost at sea when shipping containers on a cargo ship were knocked overboard during a thunderstorm. (comic pgs. 1-2)*

2. How is an ocean current similar to a rollercoaster? *Ocean currents move throughout the ocean in many directions. As explained by Dot, ocean currents twist and turn, rise and drop in the ocean just like a rollercoaster. (comic pg. 4)*

3. How did Mosa discover that wind moves water? Explain her experiment below. *Mosa conducted an experiment using a tank full of water, pepper flakes, and a straw. In her experiment, Mosa sprinkled pepper flakes onto the surface of the water and Billy blew air through a straw over the surface of the water. The team discovered that air moved the water and they observed the pepper flakes moving in the direction of the wind. (comic pg. 6)*

4. Why does cold water sink while warm water floats along the surface? Explain. *Cold water sinks because it is more dense than warm water. Cold water molecules are packed closer together making the water "heavier." Warm water molecules are spread farther apart, making the water "lighter" in comparison. (comic pgs. 6-7)*

5. Mosa believes that ocean currents help to regulate the climate of the earth. Explain why. *As Mosa is reflecting on her maps, she realizes that if it wasn't for ocean currents and winds, heat would only remain at the equator while cold temperatures would only remain at the poles. Even though the equator does absorb more heat while the poles remain cold, ocean currents and wind help to distribute this heat energy across the planet acting as a global "heater" and "air conditioner." (comic pg.10)*

6. How do landmasses impact the direction of ocean currents? *Landmasses deflect ocean currents. Once ocean currents reach a landmass, they will curve around the landmass. The shape of the land changes the direction of the current. (comic pg. 11)*
7. Explain why wind and ocean currents curve and do not travel in a straight line. *Ocean currents curve due to deflection from landmasses and the Coriolis effect. The earth rotates faster at the equator than it does at the poles, which creates winds and ocean currents that curve. (comic pgs. 12-13)*
8. What did Mosa figure out? How was she able to locate the Air-Quotes Gnome? *After reviewing all of her ocean data, Mosa discovered how ocean currents move and the existence of the North Pacific Gyre. Knowing the direction of the North Pacific Gyre and the location of the last gnome collection point allowed Mosa to accurately predict where to find the Air-Quote Gnome—off the coast of Hawaii. (comic pg. 14)*

Quiz:

1. Floating gnomes moved across the ocean from one location to the other due to:
    a. Landmasses
    b. Cargo ships pushing the gnomes
    c. Ocean currents
    d. Evaporation
2. Which of the following accurately describes the direction of warm ocean currents?
    a. Equator-to-pole
    b. Pole-to-equator
    c. Pole-to-pole
    d. Equator-to-equator

3. Density of ocean water is affected by which of the following?
    a. Amount of salt in the water
    b. Temperature of the water
    c. Wind patterns over the water
    d. Both A. and B.

4. If a ball was thrown from the North Pole to the equator, it would not travel in a straight line. This is because:
    a. The earth rotates faster at the equator than at the poles
    b. The earth rotates faster at the poles than at the equator
    c. The earth does not rotate at all
    d. The ball would hit into a landmass and change direction once thrown

5. All of the following can affect ocean currents except:
    a. Wind
    b. Landmasses
    c. Rotation of the earth
    d. Buoyancy