

Sun-Earth System Lesson 1: *The Solve* Educator's Resource Guide

Objective

In *The Solve*, students will:

1. Solve a mystery to find out why Colorado and New Zealand have different weather on the same day.
2. Create a Mind Map to explore relationships among complex Sun-Earth System vocabulary.
3. Communicate understanding that seasons differ across the globe because of the tilt of the earth and thus the angle at which the sun hits the earth at given times.

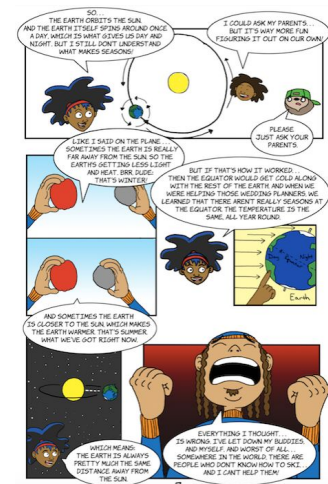
Time Required: 40-75 minutes

Materials Required	Safety Considerations	Science & Engineering Practices
<ul style="list-style-type: none"> • Student Guide (<i>includes student agenda and Mind Map</i>) • Sun-Earth System Comic Mystery • Scissors • Glue or tape 	None	<ul style="list-style-type: none"> • Developing and using models • Constructing explanations or arguments from evidence

Sun-Earth Comic Mystery Description

When Neve and his ski instructor friends step off the plane in New Zealand, they're expecting a snowy landscape. Instead, they find themselves surrounded by people in bikinis enjoying the summer sun. Neve and his jobless friends begin to panic!

They call Mosa Mack to help them figure out how it could possibly be summer in New Zealand when it was just winter in Colorado. Mosa and her team soon find that the answer is not as simple as it seems and they must prove a series of guesses wrong before they get to the right theory.



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*)

View the animated mystery twice: once in full, and a second time along with the discussion questions, pausing the video as needed to answer the episode questions as a group. 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. Finally, have students complete the quiz digitally or on paper as an exit ticket.

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

View the animated mystery in full. Afterwards, have students work through the episode questions to the best of their ability in small groups. Play the mystery a second time, pausing the video to discuss each question. 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. Finally, have students complete the quiz digitally or on paper as an exit ticket.

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

Provide students with their student URL and have students view the animated mystery in small groups. Have students play the animated mystery once in full and then answer episode questions in their table groups to the best of their ability. Then, as a class, project the mystery, pausing, as needed, to discuss episode questions in a think-pair-share format. 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. Finally, have students complete the quiz digitally or on paper as an exit ticket.

Level 4 (*recommended for grades 7–8*)

Provide students with their student URL and have students view the animated mystery and complete episode questions in pairs. Have students review their answers with a neighboring table group. Have students complete the Mind Map in pairs, either digitally or on paper. Have students quiz each other on the vocabulary until they feel they're familiar with the terms. Have these same pairs go through the discussion questions. Finally, have students complete the quiz digitally or on paper as an exit ticket.

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Agenda

I. Solve the Sun-Earth System 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 Sun-Earth System.
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.

II. Vocabulary Mind Map Activity (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 the directions below. (15 minutes)

- a. Go to <https://mosamack.com/home/sun-earth-system-solar-system-gravity>
- 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: Sun-Earth System Lesson 1: *The Solve*.
- b. Introduce the warm up task: students will be making a Mind Map of the vocabulary for this Sun-Earth System 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

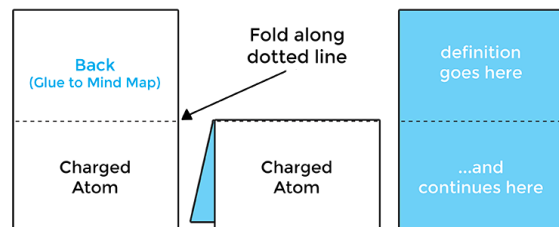
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STUDENT GUIDE

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 it 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



- 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.

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- 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.

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.

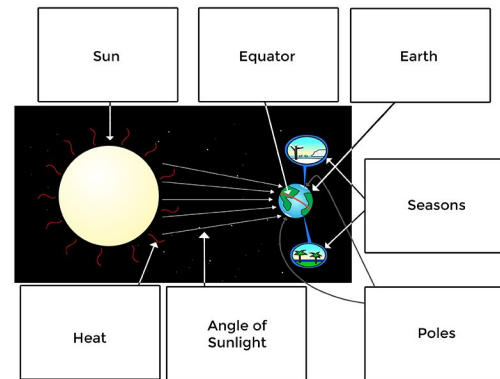
1. Students complete the exit ticket to check for understanding. This can be done online by selecting the **Quiz** button in Lesson 1 or on paper in the Student Guide. Answers are in the key below.

Answer Key

Mystery Questions

1. When Neve tells Mosa the earth is flat, what example does she use to prove to him that the earth is actually round? (Page 4) *Mosa points out that the cruise ship gradually becomes more visible because the ship is moving toward them along the curve of the earth.*
2. Neve later believes that New Zealand's winter is caused by the sun circling to the other side of the earth? Why is this incorrect? (Page 5) *Billy and Dullis point out that this would mean that one whole side of the earth doesn't have sun for an entire season. In fact, we have sun and no sun every single day, no matter what season it is.*
3. After watching Billy (the squirrel) spin the earth ball on his fingertip, Neve gets a new idea. What is Neve's new idea to explain why we have night and day? (Page 5) *Neve's new idea is that the earth spins once every day, which creates night and day.*
4. What does Emma (the little girl) add to their theory about the orbits of the earth and the sun? (Page 5) *She tells them the sun does not orbit the earth; rather, the earth orbits the sun.*
5. Neve initially thinks that the varying distance between the Earth and Sun causes seasons. But Mosa knows this isn't right. How does she use her knowledge of the equator to prove Neve wrong? (Page 7) *Mosa reasons that if the Earth moved farther and closer to the Sun like Neve is suggesting, then areas at the equator would get colder and warmer too. But areas at the equator stay about the same temperature throughout the year.*
6. Why is it warmer at the equator and colder at the poles? (Page 8) *At the equator, the sun is hitting the earth straight-on, while at the poles, it is hitting at an angle.*
7. Fill in the blanks with "more" or "few": In the summer there are _____ daylight hours at the poles. In the winter, there are _____ daylight hours at the poles. (Page 9)
More; few
8. What general rule does Emma (the little girl) come up with about the North and South? (Page 9)
They have opposite seasons!
9. What did Mosa figure out? Why do we have seasons? And if it is summer down in New Zealand, where can they go to find winter? (Answer Page) *The earth is tilted on its axis, which causes one of the hemispheres to be more exposed to direct sunlight than the other hemisphere at different times of the year. This causes these regions to be heated differently and causes seasons! Thus, if they are looking for winter, they should head back to the Northern Hemisphere.*

Mind Map



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Quiz:

1. Which of the following is evidence that the earth is round?
 - a. Neve's example with his magazine and apple.
 - b. A ship slowly appears on the horizon as it approaches.**
 - c. Earth's oceans are very deep
 - d. Both a. and c.
2. The sun orbits around the earth. True or false?
 - a. True
 - b. False**
3. As the earth orbits the sun, it gets closer to the sun at times. This is what causes summer. True or false?
 - a. True
 - b. False**
4. How are the poles different from the equator?
 - a. The poles are colder than the equator
 - b. The sun hits the poles at an angle, while the sun hits the equator head-on
 - c. There is great variation in daytime and nighttime hours at the poles, which is not true for the equator
 - d. All of the above**
5. The Northern and Southern Hemispheres always have opposite seasons. True or false?
 - a. True**
 - b. False
6. What is the best explanation for seasons?
 - a. The sun orbits the earth
 - b. The earth spins once a day, causing day and night
 - c. The earth is tilted, causing incoming sunrays to hit the rounded surface of the earth at different angles in opposite hemispheres**
 - d. The earth is farther away from the sun at times and closer at other times