



# The Impact of the Sun and Moon on Tides

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### Focus on Inquiry

The student will use models to demonstrate the relative positions of the Earth, Sun, and Moon and their impact on tides.

### Lesson Content Overview

Students will explain the impact and relative positions of the Earth, Moon, and Sun on tides.

<b>Duration</b> 45 minutes	<b>Setting</b> Classroom	<b>Grouping</b> Partners, Whole Class	<b>PTI Inquiry Subskills</b> 1.3, 4.1, 4.3, 5.2, 5.3, 5.5, 5.8
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Lesson Components	Estimated Time	Inquiry Subskills Used	Technology Used	Level of Student Engagement	Brief Description
<i>Engage</i>	5 minutes	5.2	Video, Simulation	2	Students watch video clip of tides on Earth.
<i>Explore</i>	10 minutes	1.3, 4.1	n/a	3	Students model the impact of the Moon and the Sun on tides.
<i>Explain</i>	10 minutes	1.3, 4.3, 4.1	EdPuzzle	2	Students answer questions during EdPuzzle activity.
<i>Expand</i>	10 minutes	1.3, 5.3, 5.8, 5.9, 5.5	Simulation	3	Students create their own 2D models of neap and spring tides.
<i>Evaluate</i>	10 minutes	4.3	n/a	2	Student will complete 4 question exit ticket.

**Level of Student Engagement**

1	Low	Listen to lecture, observe the teacher, individual reading, teacher demonstration, teacher-centered instruction
2	Moderate	Raise questions, lecture with discussion, record data, make predictions, technology interaction with assistance
3	High	Hands-on activity or inquiry; critique others, draw conclusions, make connections, problem-solve, student-centered

#### Next Generation Science Standards – Inquiry

NGSS Practice 2: Developing and Using Models  
 NGSS Practice 6: Constructing explanations  
 NGSS Practice 7: Engaging in arguments from evidence  
 NGSS Practice 8: Obtaining, Evaluating and Communicating Information



#### Next Generation Science Standards – Earth Science

MS-ESS1-2. Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.



#### Florida Science Standards – Nature of Science

SC.8.N.3.1 Select models useful in the investigations



#### Florida Science Standards – Earth Science

SC.8.E.5.9 Explain the impact of objects in space on each other, including: 1. the Sun on the Earth, including seasons and gravitational attraction; 2. the Moon on the Earth, including phases, tides, and eclipses, and the relative position of each body.



## Materials and Advance Preparation

### Materials List

#### Class set:

- 1 Hula Hoop (optional)

#### Student materials:

- Colored Pencils (optional)
- Paper

### Blackline Masters

1. **Checking for Understanding: Tides**

### Advance Preparation

1. Gather materials
2. Connect internet connected computer to projector
3. Make copies of Checking for Understanding

## Lesson Information

### Learning Objectives

1. The student will be able to use the models in this activity to demonstrate the relative positions of the Earth, Sun, and Moon and their impact on tides.

### Prior Knowledge Needed by the Students

- SC.4.E.5.3 Recognize that Earth revolves around the Sun in a year and rotates on its axis in a 24-hour day.
- SC.4.E.5.4 Relate that the rotation of Earth (day and night) and apparent movements of the Sun, Moon, and stars are connected.
- SC.6.P.13.2 Explore the Law of Gravity by recognizing that every object exerts gravitational force on every other object and that the force depends on how much mass the objects have and how far apart they are.

### Background Information

Tides are the cyclical rising and falling of water caused by the gravitational pull of the Moon and the Sun. The gravitational pull of the Moon causes high tides on that, and the opposite side, of the Earth. The gravity of the Moon pulls the Earth, causing the water to bulge on both the closest and the farthest sides of the Earth. Low tides occur between the high tides. The Sun also has a gravitational effect on the Earth's tides, and even though it has more mass than the Moon it is farther away. When the Moon and the Sun are in alignment, they create extremes in tides called spring tides. When the Moon and the Sun are 90 degrees from each other, they create the least difference between high and low tides called neap tides.

## Lesson Procedure

### Engage

1. To introduce lesson, show students the following video of tides and ask them to make observations during the following video.  
<https://edpuzzle.com/media/560ab54e335733912fdd5892>
2. Tell students to "Share your observations back and forth with your partner."
3. Then ask some students to share with the group what they observed.
  - What did you observe?
    - *Possible student response: The Moon, Earth, Sun, water*

4. Ask the students “What do you think is causing the water to change?” *Possible student answers: gravity, Sun, Moon.*
5. Show students one or both of the following simulations  
<http://astro.unl.edu/classaction/animations/lunarcycles/tidesim.html>  
<http://www.schoolsobservatory.org.uk/astro/esm/tidesim>
  - “Can you identify the different parts of this model?”
    - *Possible student response: The Moon, Earth, Sun, water*

## Explore

1. You will be modeling the impact of the Sun and the Moons on tides with the students’ movement. Create or bring students to a wide open area that they can sit students in a tight circle.
2. Have one student walk around the class around the outside and have students lean outwards towards this student to model the Moon pulling on the water on Earth. Optional: Put a hula hoop for students to hold in center to represent the Earth.
  - What is (student walking around) representing in this model?
    - *Possible student response: The Moon*
  - What are you representing?
    - *Possible student response: Water*
  - What is the hula hoop (or open space) representing?
    - *Possible student response: Earth*
  - What is different from the model we saw in the simulation?
    - *Possible student response: It had the Sun, it the water bulges on two sides of the Earth.*
3. Add in student suggestions to the model, include how the Earth bulges on both sides and Sun interacts with tides.
4. During activity, have students pause and describe the model when the Moon is aligned with the Sun and 90 degrees from the Sun. Once the students describe the model at this time, then provide them with the terms neap and spring tide. **(PTI 1.3, 4.1)**

## Probing Questions during activity

- If the Moon is pulling on one side, how is the other side affected?
  - *Possible student response: It also bulges on that side*
- Why does the Sun not move when we’re modeling this? Or Why is the Sun a fixed point?
  - *Possible student response: The Sun does not revolve around the Earth*
- What’s pulling you back?
  - *Possible student response: Gravity of the Sun and the Moon*
- What is causing the bulge?
  - *Possible student response: Gravity pulling on the water*
- What do you notice when the Sun and the Moon are both pulling on the same side?
  - *Possible student response: High high tide, low low tides.*

## Explain

1. Play the following EdPuzzle. <https://edpuzzle.com/media/560aaff3543e97fc2e87637c>
2. Have students answer questions in EdPuzzle with their shoulder partner. After they share, have one student share their answer with the class to make sure students receive feedback on their discussion.
  - What factors are involved in creating tides on Earth?
    - *Possible student response: Gravitational pull of the Sun and Moon*
  - What do you think is causing the water to be pulled towards the Moon?
    - *Possible student response: Gravity*
  - Based on your observations of the diagram, describe what is happening during high tide? How is it different than low tide?
    - *Possible student response: During high tide, the Moon is near the high tide or opposite of Earth of the high tide. During low tide, the Moon is at a 90 degree angle from the low tide.*
  - What is the difference between a spring tide and a neap tide?

- Possible student response: Spring tide is when the Sun and Moon are aligned creating high high tides, and low low tides. Neap tide is when the Sun and the Moon are at a 90 degree angle. (PTI 1.3, 4.3, 4.1)

## Expand

1. Play model on smartboard or screen for students:  
[http://Sunshine.chpc.utah.edu/Labs/Tides/tides\\_simulator.html](http://Sunshine.chpc.utah.edu/Labs/Tides/tides_simulator.html)
2. Ask students to create a 2D models of the Earth, Moon, Sun, and when a neap tide and a spring tide occur. Keep simulation running while students work.
  - Using your model, what would a spring tide look like? (extreme high and low tides)
    - Possible student response: Where Moon is aligned with the Sun
  - Using your model, what would a neap tide look like? (least extreme tides)
    - Possible student response: Where the Sun is at a 90 degree angle from the Sun
  - Why do we have two high tides and two low tides every day?
    - Possible student response: The Earth rotates through the high tide twice
  - How would tides be different if the Moon revolved around Earth twice a month, instead of once a month?
    - Possible student response: There would be more spring and neap tides (PTI 1.3, 5.3, 5.8, 5.9, 5.5)

## Evaluate

### FORMAL EVALUATION

#### Blackline master #1

### INFORMAL or OPTIONAL EVALUATIONS

1. Students will be evaluated on their model and a 5 question quiz.

### WRAP UP.

Bring the lesson to a conclusion by reviewing evaluation or having students share their models.

## Supplementary Resources

### Students

StudyJams. <http://studyjams.scholastic.com/studyjams/jams/science/weather-and-climate/tides.htm>

## CITATION OF SOURCES.

Based on Krech, M. J. (n.d.). Tides Activity. Retrieved April 25, 2016, from <http://mjksciteachingideas.com/pdf/TidesActivity.pdf>

Tides Simulator. [http://Sunshine.chpc.utah.edu/Labs/Tides/tides\\_simulator.html](http://Sunshine.chpc.utah.edu/Labs/Tides/tides_simulator.html)

Yes, I cited all materials and resources used in this lesson.

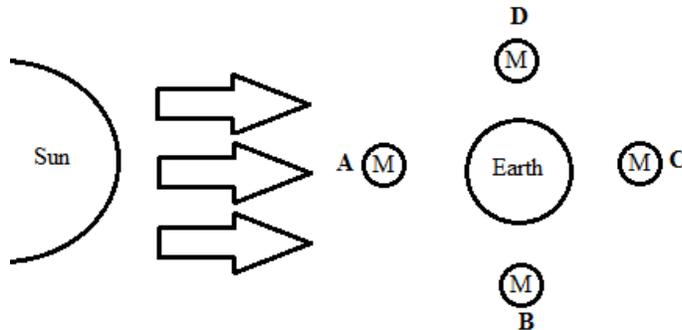
*Corinne Conley*

Lesson author signature

Name \_\_\_\_\_ Date \_\_\_\_\_ Student No. \_\_\_\_\_

Checking for Understanding: Tides

Use the diagram below to answer questions 1 and 2.

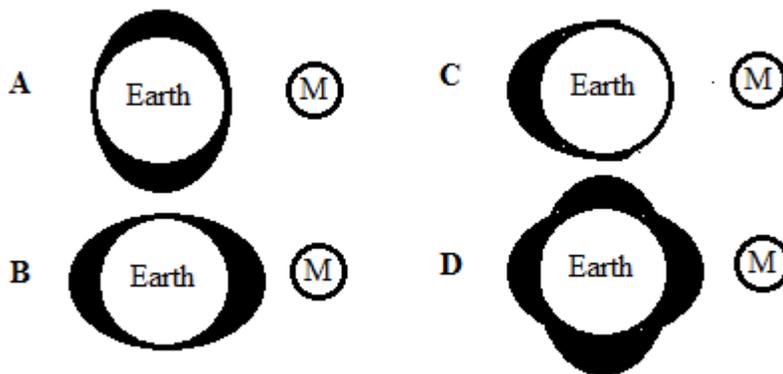


- \_\_\_ 1. Which Moon positions will create the smallest difference between high tide and low tide?
- A or B
  - A or C
  - B or D
  - B or C

- \_\_\_ 2. Spring Tides are the highest high tides and the lowest low tides. Which Moon positions above would create spring tides?
- A or B
  - A or C
  - B or D
  - B or C

- \_\_\_ 3. Why does the Moon have a greater tidal effect than the Sun?
- The Moon has more mass than the Sun
  - The Moon rotates faster than the Sun
  - The Moon is a solid and the Sun is a gas
  - The Moon is closer to the Earth than the Sun

- \_\_\_ 4. Which of the diagrams below most accurately represents the effects of the Moon on the Earth's tides?



**Blackline Master #1 Key**

Answer Key:

1. c
2. b
3. d
4. b