

Grade Level: 3-5

Time Estimate: 2-4 days

OCEAN TIDES / INSTRUCTOR INFO

Summary

This lesson includes vocabulary, content, and creative hands-on activities all about the ocean tides. This lesson will also allow students to discover the physical properties that the Earth and the Moon have along with how the Sun and the Moon affect the Earth.

Part 1. What are Ocean Tides?

Part 2. What Causes Ocean Tides?

Part 3. Types of Ocean Tides

Activity 1. Tidal Expedition

Goals & Objectives

The students will:

- Define an ocean tide;
- Describe the physical characteristics of the Earth, the Moon, and the Sun;
- Learn how the Earth, the Moon, and the Sun are connected;
- Learn the factors that cause the oceans tides;

// STANDARDS

This lesson aligns with the following TEKS:

Grade 3 Science: 2A, 2B, 2C, 2D, 2F, 3A, 3C, 3D, 4A, 8C, 8D

Grade 4 Science: 2A, 2B, 2C, 2D, 2F, 3A, 3D, 4A, 8C

Grade 5 Science: 2A, 2B, 2C, 2F, 2G, 3A, 3D, 4A, 8C, 8D

STEM

This lesson plan aims to assist teachers in implementing a STEM-based program into their classroom while inspiring the next generation of explorers, scientists, and stewards of the ocean. Based on real science and the Global Shark Tracker™, this lesson is intended to promote environmental awareness and to prepare students for STEM careers.

Helpful Tips

1. The content in this lesson is related to OCEARCH and the Global Shark Tracker. Spend a few minutes getting familiar with the website and the tracker if you have not done so already. The Global Shark Tracker is also available as an app for iPhone and Android.
2. This lesson plan is designed to be adaptable to suit your specific needs. Use the entire lesson plan or just parts of it. This material can be expanded to be an entire unit or condensed for just one day in the classroom.
3. Vocabulary words will be underlined as they appear in the lesson plan. A complete list of vocabulary words is included as well.
4. Answers to questions and prompts for discussions will appear in italics.
5. Optional activities and content (side notes) will appear in a box. Use these to enhance your lesson and adapt it to suit your needs!
6. Have questions for OCEARCH Expedition Leader, Chris Fischer? Email info@OCEARCH.org to schedule a Skype session and let your students/child talk directly to Chris and the OCEARCH crew!
7. Email all questions about this lesson to info@OCEARCH.org.

OCEAN TIDES / VOCABULARY

Astronomer - Scientist who studies space.

Atmosphere - The envelope of the gasses that surround the earth or another planet.

Climate - The weather conditions prevailing in an area in general or over a long period.

Diameter - A straight line that goes from side to side and passes through the center of a circle or sphere.

Gravity - The force that attracts something toward the center of the Earth.

Physical Characteristic - Trait or feature that can be seen.

Radius - A straight line from the center of a circle or sphere to its perimeter.

Revolve - To move in a circle on a central axis.

Rotation - The action of rotating around an axis or center.

Terrestrial - something of, on, or relating to the earth.

Tides - The alternate rising and falling of the sea, usually twice in each lunar day at a particular place, due to the attraction of the moon and sun.

Weather - The state of the atmosphere at a place and time as regards heat, dryness, sunshine, wind, rain, etc.

OCEAN TIDES

/PRE-LESSON ASSESSMENT

Use the following true/false and multiple-choice questions as an introduction/warm-up to the lesson topics. You can do this in a verbal or written format, as a game, individually, or as a whole class! A handout is provided if you wish to hand the questions out in a quiz format.

The questions do not need to be graded. They are intended to give the students an idea of what they will be learning and to see what they already know.

1. True or False

The Earth does not rotate on an axis.

Answer: False

2. True or False

Within a single day, beaches experience two high tides and two low tides.

Answer: True

3. How many hours does it take for the Earth to complete one rotation?

- a. 15 hours
- b. 24 hours
- c. 30 hours

Answer: b

4. What is the radius of the Earth in kilometers (1 km = 0.621 mi)?

- a. 6371 km (3,959 mi)
- b. 7261 km (4,512 mi)
- c. 5079 km (3,156 mi)
- d. 2042 km (1,269 mi)

Answer: a

5. Which of the following affects the ocean's tides?

- a. Gravity
- b. The Moon
- c. The Sun
- d. All of the above

Answer: d

Name: _____

Date: _____

OCEAN TIDES

Select the correct answer(s) to each of the following questions.

1) True or False

The Earth does not rotate on an axis.

2) True or False

Within a single day, beaches experience two high tides and two low tides.

3) How many hours does it take for the Earth to complete one rotation?

- a. 10 hours
- b. 24 hours
- c. 30 hours

4) What is the radius of the Earth in kilometers (1 km = 0.621 mi)?

- a. 6371 km (3,959 mi)
- b. 7261 km (4,512 mi)
- c. 5079 km (3,156 mi)
- d. 2042 km (1,269 mi)

5) Which of the following affects the oceans tides?

- a. Gravity
- b. The Moon
- c. The Sun
- d. All of the above

OCEAN TIDES / LESSON PLAN

PART 1. WHAT ARE OCEAN TIDES? 15-20 mins

Tides are a natural phenomenon that occurs every day on the shores of beaches all over the planet. There are two different kinds of tides: high tide and low tide. High tide is when ocean waves land at the highest point on the beach, whereas low tide is when waves land at the lowest point on the beach. *Browse through pictures of high tides and low tides on the internet, slideshow, or a book. See if the students can differentiate between the two.* Every beach experiences one or two high tides and one or two low tides within every 24 hour period. Because of geographic location, every beach experiences ocean tides at different times.

A government organization called NOAA, which stands for the National Oceanic and Atmospheric Administration, employs scientists to study the skies, space, and oceans. Some of these scientists are responsible for measuring, recording, and tracking ocean tides. *Why do you think it's important to track and study tides?* Being able to measure and predict tides is very important to those who rely on the sea for their livelihood. Commercial fishermen, coastal zone engineers, ecologists, and many more utilize the NOAA's Tide Predictions to plan their days.

Visit NOAA's website https://tidesandcurrents.noaa.gov/tide_predictions.html and select the body of water closest to you to see the tide predictions for the day.

PART 2. WHAT CAUSES OCEAN TIDES? 5-10 MINS

Ask students to brainstorm why or how ocean tides occur. What causes them? Record their responses on the board.

Gravity is the major force that influences ocean tides. Gravity is the attraction between an object and the center of the Earth, which results in that object being pulled towards the center of the Earth. The gravitational attraction that occurs between the Earth and the Moon is what dictates the ocean's tides. How?

The Moon's gravitational force results in two tidal bulges on opposite sides of Earth's surface. The Moon attracts ocean water towards it, creating a tidal bulge on the surface of the Earth closest to the Moon. On the other side of the planet where the Moon's gravitational force is weakened, inertia (an object's tendency to resist change in motion) resists the Moon's pull, creating a second tidal bulge of ocean water. As the Moon orbits our planet and as the Earth rotates, the tidal bulges also move which results in sea levels constantly rising and falling throughout the day.

PART 3. TYPES OF OCEAN TIDES 5-10 MINS

Because there are so many variables involved (the Sun, Moon, gravity, etc.), there are also many different types of tides.

High tide occurs when the sea level is at its highest point. *So when do you think low tide occurs?* When the sea level is at its highest point!

Diurnal tides occur once a day (one high tide and one low tide). Semidiurnal tides occur twice a day (two high tides and two low tides).

Spring tides occur when the Earth, Moon, and Sun are perfectly aligned. This causes an increase in gravitational force which results in the highest of high tides and the lowest of low tides. In contrast, neap tides occur just after the first and third quarters of the Moon resulting in the least difference between high and low tide.

MORE ABOUT THE EARTH AND THE MOON

Earth

Earth is classified as a terrestrial planet, meaning that it is primarily composed of silicate rocks or metal. There are only four terrestrial planets within our solar system and it is the only planet within our solar system that is known to have life. Earth has a radius of 6371 km (3,959 miles), making it the largest terrestrial planet and the fifth largest planet overall. The Earth is 149,668,992 km (93 million miles) from the Sun, from which it receives warmth and energy for life.

Earth completes one rotation in 24 hours and one revolution around the Sun in 365 days. The Earth has four main layers, the inner core, the outer core, mantle, and crust. Earth is covered with land and water with almost 70% its surface being water. Earth's atmosphere consists of 21% oxygen, 78% nitrogen, and only 1% of other gases. The atmosphere protects the Earth's surface and its inhabitants from harmful solar (from the Sun) radiation and helps regulate weather and climate.

Moon

Earth is the only planet in our solar system that has a single moon and is the most familiar and brightest object in the night's sky. The Earth's moon is the fifth largest moon in our solar system and has a radius of 1,738 km (1,080 miles). Our moon is 384,400 km (238,855 miles) away from Earth - 30 Earth-sized planets could fit between us and the Moon!

The surface of the Moon, which is covered with craters, can be seen at night without a telescope. These craters are caused by erupting volcanoes and the impacts of meteors. These craters range from less than one mile in diameter to over one hundred miles in diameter!

The Moon is covered in "lunar soil", which is nothing like the soil we have here on Earth. Instead, it is fine, powdery rock. Also unlike Earth, the Moon does not have an atmosphere. The surface temperature of the Moon ranges from 127°C in the sunlight to -173°C in the dark areas of the Moon.

OCEAN TIDES

/ACTIVITY 1. TIDAL EXPEDITIONS

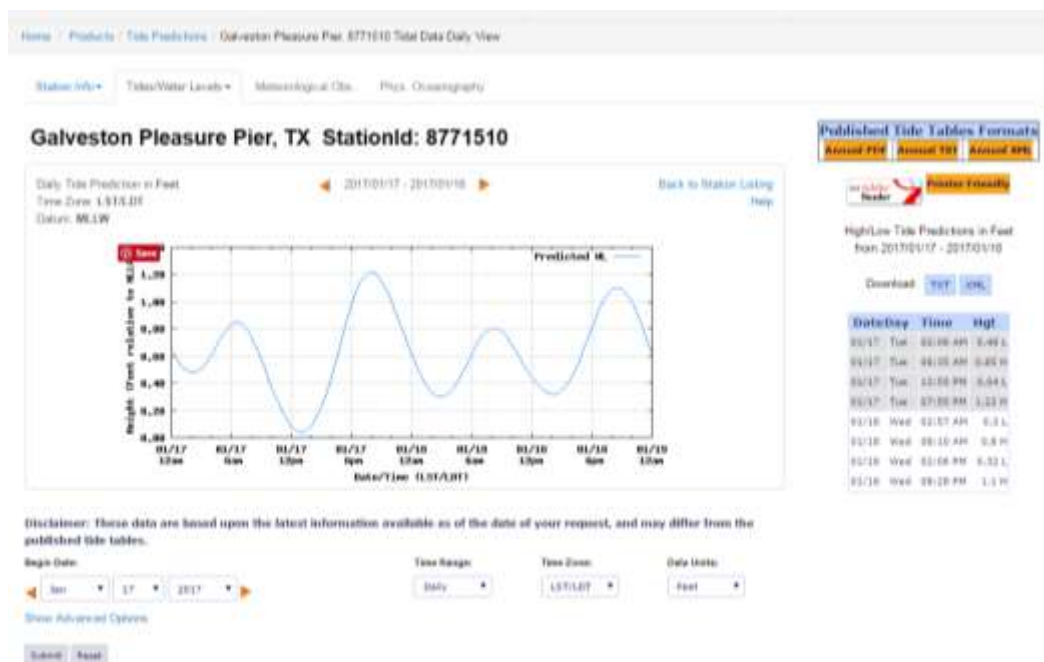
INSTRUCTIONS

In this activity, students will learn how scientists graph tidal data and will predict tidal patterns. As we've mentioned before, understanding tides and knowing their patterns is important to those who depend on the ocean.

Students will pretend that they are planning an expedition to research sharks, just like the OCEARCH crew! As an Expedition Leader, it's the student's job to determine the best time to look for sharks. A successful expedition will result in the collection of valuable data! So when is the best time to look for sharks? Many fishermen believe a strong, incoming high tide in the best because it results in plenty of water movement. This means that fish will also be moving and active. When the fish are active, so are the predatory sharks that feed upon them.

Visit the NOAA website to collect data on tidal patterns in a location of the student's choosing (where are they going on expedition?!). Students can also visit the OCEARCH Global Shark Tracker for ideas of where to go on expedition.

Use the provided Tidal Tracking Worksheet to record data and then create a line graph (similar to the one pictured below). Students should then analyze their data and graph to determine what day, if any, would be best to begin their expedition!



Source: https://tidesandcurrents.noaa.gov/tide_predictions.html

Name: _____

Date: _____

OCEAN TIDES: TIDAL EXPEDITIONS

Fill in the data table below with tidal information from the NOAA website:

Table 1. Tidal Data		
Date	Time	Water Level

Use the data from the table above to create a line graph (use graphing paper if necessary):

