

Name: _____

Date: _____

Gizmo Activity: Descriptive Investigations

[Note: This activity requires you to use the Ocean Tides Gizmo™.]

Learning goals

After completing this activity, you will be able to ...

- Design and implement a descriptive investigation.
- Draw conclusions based on what you observe.

Vocabulary: descriptive investigation, gravity, high tide, low tide, tides

Warm-up questions (Do these BEFORE using the Gizmo.)

Jeremy wonders how honey bees produce honey. He observes bees collecting nectar from flowers. He watches bees at a local museum that has a real honeycomb under glass. He sees that the bees sometimes eat the honey and then spit it up again. He concludes that honey is made from nectar that is partly digested by bees.



1. What question did Jeremy start with? _____

2. Did Jeremy perform any experiments to answer his question? _____

3. How did Jeremy gather data and evidence to answer his question? _____

4. In your opinion, would you say that Jeremy's investigation was scientific? Explain.

Activity A: Descriptive investigations

When many people think of "science," they think of a scientist in a lab coat carefully performing experiments and following the steps of the scientific method. But science can be done in many ways. An ornithologist observing nesting owls is just as much of a scientist as a biochemist testing a cancer drug. Any investigation that yields new information about the natural world can be classified as science.

Scientists use many methods to learn about the world around them. The simplest method is a **descriptive investigation**. In a descriptive investigation, a scientist simply observes and measures how the world works. They may observe the behaviors of animals, the growth of plants, or the paths of planets and stars through the night sky.

Usually, a descriptive investigation begins with a question about the natural world. Before beginning the investigation, a scientist may do research to see what is known. Then, the scientist observes the natural world to answer the question. The scientist may make measurements and collect data for a long period of time. However, the scientist does not perform experiments or actively interfere with the natural world during the investigation.

In many cases, it is useful to do experiments to follow up the descriptive investigation. For example, Jeremy could do several experiments to explore how honey is made. For example, he could gather and store flower nectar himself to see if digestion by a bee is required to make honey. He could also run experiments to see how the flower types affect the taste of honey. Once he begins doing experiments, however, Jeremy will no longer be doing just a descriptive investigation.



1. Do all scientists learn all their scientific knowledge from experiments? _____

2. What are some topics in science that would be difficult to learn about through experiments?

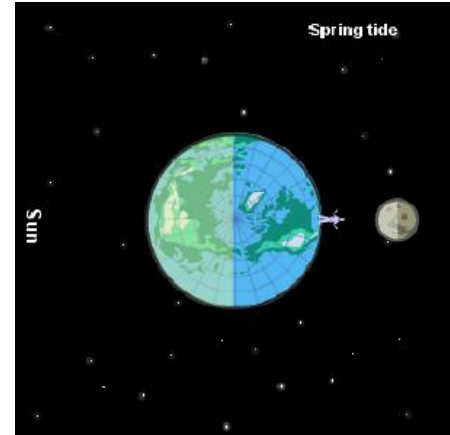
3. Which of the following investigations are descriptive investigations? (You may circle more than one.)

- A. Lucy observes the Moon every night for two months to learn about Moon phases.
- B. Max tries four different brands of bubble gum to see which brand lasts the longest before losing its flavor.
- C. Charlotte digs for fossils of ancient sea creatures looking for patterns in their evolution.
- D. Isabelle watches the birds in her neighborhood, trying to determine what each species of bird likes to eat.
- E. Anthony rubs four different brands of sunscreen on his skin, and leaves part of his skin bare. He then lies on the beach for two hours to see which brand works best.

Activity B: Observing the tides

Open the *Ocean Tides Gizmo*. On the left side of the Gizmo, you will see a view of Earth looking down on the North Pole. The Moon is to the right of Earth and the Sun is to the left. None of the objects are to scale.

An observer is shown on the turning Earth. The observer is also shown sitting on a dock on the right side of the Gizmo. This view will allow you to see the **tides**. At **high tide**, the depth of the ocean is at a maximum. At **low tide**, the depth of the ocean is at a minimum.



Click **Play** () to begin. Observe the tides for a while.

1. Observe: Click **Pause** () when there is a high tide. (Does not have to be exact.) The time (in days, hours, and minutes) is shown at the bottom of the Gizmo.

A. What is the time of day? (Hours and minutes only): _____

B. Turn on **Show value**. What is the depth of the ocean below the dock? _____

2. Measure: Click **Play**, and then click **Pause** at the next high tide.

A. What is the time of day now? _____

B. About how much time passed between high tides? _____

3. Test: Use the Gizmo to record the time of two low tides.

A. Time of first low tide: _____ Time of second low tide: _____

B. About how much time passed between low tides? _____

4. Observe: Click **Reset** (). Turn on **Show tidal bands**. This graphic shows that ocean water bulges on each side of the Earth. These bulges are exaggerated in the Gizmo so you can see them. Click **Play**.



A. What does the observer experience when he passes through a tidal bulge? _____

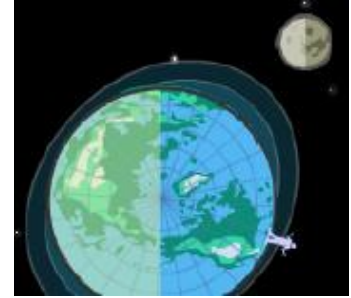
B. What does the observer experience when he passes between tidal bulges? _____

5. Observe: As the simulation is playing, observe the tidal bulges. What do you notice about the position of the right tidal bulge? Is it pointed toward anything?

6. Summarize: What have you learned so far about tides? _____

Activity C: The Moon and the tides

In this activity, you will complete a descriptive investigation to determine how the Moon affects the tides.



Question: How does the Moon affect the tides?

1. Observe: Click **Reset**. Check that **Show tidal bands** is selected. Click **Fast forward** (). Observe the path of the Moon and the direction of the tidal bands over time.

What do you notice? _____

2. Analyze: The Moon's **gravity** pulls on the ocean at Earth's surface. How does the Moon's gravity affect the tides? _____

3. Infer: Gravity becomes weaker with distance. Where does the Moon's gravity pull strongest and weakest? Fill in the blanks with the words "strongest," "weakest," or "moderately."

The Moon's gravity pulls _____ on the ocean surface nearest to the Moon.

The Moon's gravity pulls _____ on Earth's center.

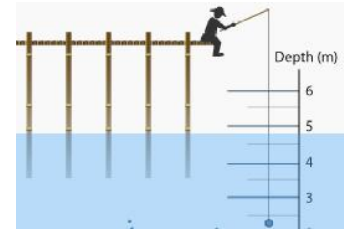
The Moon's gravity pulls _____ on the ocean surface farthest from the Moon.

4. Analyze: If the Moon pulls more strongly on Earth's center than on the ocean on the far side of the Earth, what causes the tidal bulge pointed opposite the Moon?

5. Draw conclusions: Based on what you have observed, how does the Moon cause the tides?

Extension Activity: The Sun and tides

Although you cannot see the Sun in the *Ocean Tides Gizmo*, you know that its position is to the left of Earth. In this activity, you will design and implement your own descriptive investigation of the Sun and the tides. Start by writing a question. Then, describe the procedure of your investigation, what you observed, and your conclusions. Use extra sheets of paper if necessary.



Question: _____

Procedure: _____

Observations: _____

Conclusions: _____
