Explorer Education Programme

Lesson Plan: What causes Tides?

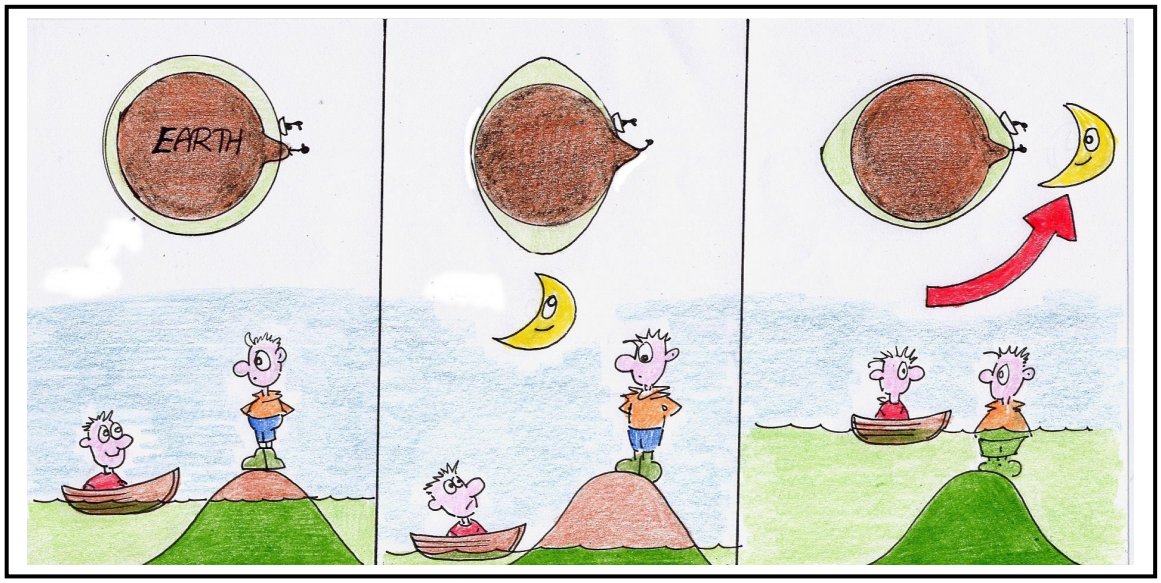

Image courtesy of John Joyce 2009

TIDES

Aim / Description:
Before introducing the concept of tides, students should understand the structure of the Earth and how it functions in the solar system.

Learning about the effects of **gravity and inertia** has on the ocean students will establish an understanding of what causes tides.

Background Information:

Gravity
A scientist called Isaac Newton discovered three laws of motion and the law of gravity to explain motions observed on Earth and in space. Gravity acts between everything in the Universe.

On Earth, there is an invisible force of nature called Gravity. Gravity is the force working between two bodies of matter trying to pull them together.

The best way to explain gravity is to look at a person. You are a body of matter. Gravity pulls you down to the earth and allows you to walk a round. If there was no gravity you would float off into space.

The earth is also a body of matter shaped like a ball and consists of land and water. The Earth's gravity holds our moon in its orbit. Without gravity, the moon would fly out into space!

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Inertia

Inertia is taken from the Latin word, "*iners*", meaning “idle” or “lazy”. If an object is at rest, it will stay at rest. If an object is moving from an outside force, it will keep moving in a straight line until something stops it. If an object is not moving, it will rest until something comes along to move it.

Inertia, acts to counterbalance gravity.

Two Bulges = Tides:

Gravity and inertia are responsible for the creation of two bulges of water on the Earth (see illustration showing tides). These result in what we know as tides.

The gravitational pull between the Earth and the moon is strongest on the side of the Earth that faces the moon. This pull causes the mass of water facing the moon to be pulled towards it causing a “bulge”.

As gravitational force pulls the water closer to the moon, inertia attempts to keep the water in place on the opposite side. This forms a bulge on the opposite side of the Earth. Therefore, the combination of gravity and inertia create two bulges of water. Because water is fluid, the two bulges stay aligned with the moon as the Earth rotates.

Types of tides:

A high tide is created where there is bulge of water occurring from the gravitational pull of the moon. A low tide occurs when water is being drawn away from the earth (towards the bulges).

The sun also plays a major role, affecting the size and position of the tidal bulges.

Spring Tides are very high tides and very low tides. They occur every two weeks when the sun, moon and Earth are in alignment.

Neap tides are smaller tides. These happen one week after spring tides. Neap tides occur when the sun and moon are at right angles to each other. During each lunar month, two sets of spring and two sets of neap tides occur.

Monitoring the Tides:

Knowing the state of the tides is important for people who look to the sea for their livelihood. Commercial and recreational fishermen use their knowledge of the tides to help improve their catches. Knowledge of the tides is also important to recreational beachgoers and surfers for their general safety and enjoyment of the sea.Scientists also study the tides. Marine scientists such as oceanographers can study tidal fluctuations to learn about the circulation of the ocean and its relationship to the world’s climatic changes.

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Materials
Balls
Illustrations of Tides

Activity: Gravity and Inertia
Step 1. Go outdoors and explore and discuss the meaning of gravity and inertia. Demonstrate the law of "what goes up must come down." Ask the students to through a ball straight up into the air. Discuss with the students that the ball came down because gravity pulls objects down to the Earth.

Pair up the children and get them to swing each other around in a circle. The children will experience the feeling of gravity and inertia working.

Point out the moon or sun. Explain that gravity causes the Earth to rotate around the sun and the moon to rotate around the Earth.

Step 2. Back in class, introduce the concept of tides by learning the following vocabulary: moon, earth, sun, gravity, inertia, ocean, tide, spring tide, neap tide, low tide, high tide.

Step 3. Ask students to brainstorm on what they think causes the tides.
- Why does the tide go in and out?
- What are Spring tides and Neap tides?

Step 4: Discuss ideas about why it is important to know the tides.

Step 5: Evaluate the students understanding of tides by answering the following questions:

a. Q. What are tides?
A. *Tides are periodic rises and falls of large bodies of water. Tides are caused by the gravitational pull between the Earth and the Moon.*

b. Q. How many times do we have Spring tides in a month? Why?
A. We have Spring tides twice a month. This happens when there is a full moon and new moon and the sun and moon are in line.

c. Q. Why does the sun not affect the tides as much as the moon does?
A. *Because the sun is much further away than the moon.*

d. Q. Why are storms more dangerous during a Spring tide?
A. *Spring tides are higher than normal, and storms can raise the height of tides due to the increased rainfall and winds. This increased water level can cause flooding near coastal areas.*

e. Q. What time are low tides and high tides at _____ (select your local area) on _____ (select date)?
   A. *Have the students look at the tide tables in the local newspaper to find the times for low tide and high tide.*

f. Q. List three groups of people who are interested in tides.
   A. Recreational users e.g. surfers / Livelihoods e.g. fishermen / Scientists e.g. studying the effects of tides

Outcome:
Students will learn:

- vocabulary associated with tides
- tides on Earth are caused by the gravitational pull of the Moon
- the features and movement of tides including what spring tides and neap tides are
- who is effected by tides