

Name _____

Date _____

Ocean-Tides

There are many poems and songs that allude to the mystery and romance of the waves crashing against a sandy beach or a rocky cliff and the ebb and flow of ocean tides. Most waves on the ocean are simply called wind waves because they are caused by the wind. Another major factor in the amount of water that reaches the shore is the tide. The tide or tides is the name given to the daily rise and fall of the ocean level at a particular spot on the coastline of an ocean. High tide is the time when the water at a coastline reaches the furthest inland on a beach or is the deepest at a rocky cliff. Conversely, low tide is the time when the water has receded to its lowest point on a beach or is the shallowest at a cliff. Most coastal areas, except the Gulf of Mexico, experience two high and two low tides each day.

The Intertidal Zone

Marine biologists call the area of land between the highest point of high tide and the lowest point of low tide the intertidal zone. The section of a sandy beach that is closest to the water and gets wet at high tide is an example of an intertidal zone. In rocky areas, the intertidal zone may contain tide pools, sea water that gets trapped in depressions among and between the rocks. This is a harsh environment because of the force of the waves and rapid changes that occur there. Part of the day the intertidal zone is submerged under water that can be cooler than the air temperature and the rest of the day the area is subject to ambient conditions. However, there are animals that are well-adapted to life in the intertidal zone, such as worms, clams (mollusks) and crabs (crustaceans). Shorebirds such as seagulls, pelicans, and sandpipers frequent the intertidal zone and feed on these creatures.

The intertidal zone can also include coastal wetlands that are covered with sea water during most of the year. Wetlands are prime habitat for unique plants as well as fish, insects, reptiles, amphibians and a wide variety of birds. Wetlands are excellent breeding grounds because they are sheltered from the open ocean. Subtropical and tropical coastal wetlands are home to mangrove forests. Mangroves are a species of evergreen tree that is able to grow in salt water. Mangrove forests and their surrounding vegetation protect land further inland from erosion and storm damage. Humans damage the environment when they drain these valuable wetland areas and make the coastline vulnerable to storm damage.

The Causes for Tides

The earth is dynamic which means the earth is always moving and changing every second of the day. Going back to basic earth science, the earth rotates on its axis and makes one complete revolution every 24 hours. The earth's rotational axis is not vertical but it is tipped about 23.5 degrees from vertical. At the same time, the earth is revolving in an orbit around the sun, taking a year to make one complete trip. Meanwhile the moon, namely earth's moon, is revolving around the earth, making one complete revolution every 27.3 days. Both the earth's orbit around the sun and the moon's orbit around the earth are elliptical, not circular.

How are these basic facts related to the tides on earth? The tides are related primarily to the gravitational forces that exist between the moon and the earth and are also slightly related to gravitational forces between the sun and the earth. The moon has about twice the effect on the earth's tides as the sun because the moon is so close to the earth in space distance. One other factor is that the gravitational forces are dynamic as well. The gravitational forces between the earth, moon and sun will vary depending upon their relative positions in their respective orbits.

The moon's gravitation pull on the earth is sufficient to move the ocean water towards the side of the earth that is facing the moon at any given time. At the same time there is another high tide, called an indirect tide, on the opposite side of the earth. Therefore, most coastal areas experience two high tides and two low tides per day. The movement of water from high tide to low tide is gradual as the moon's gravitational pull on the earth changes second by second since both the earth and moon are in constant motion. The water level along an average coastline varies about 6 to 12 feet between high tide and low tide. The Bay of Fundy on Canada's east coast experiences the greatest tidal variation on earth, about 40 feet.

When the sun, earth and moon align in a straight line, this results in higher than normal high tide, called spring tide. When the sun is at a right angle relative to the moon, the result is a lower than normal low tide, called neap tide.

Tides are predictable because the orbits and motions of the earth and moon are known. Mariners have kept track of tides for centuries because of the effect tides have on navigation at sea. Coastal areas publish tide information as charts to guide mariners piloting all kinds of vessels.

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Circle True or False after analyzing each of the following statements.

1. True False The tide is the name given to the monthly rise and fall of the ocean level at a particular spot on the coastline of an ocean.
2. True False The Gulf of Mexico experiences the greatest tidal variation on earth.
3. True False The intertidal zone is that part of the ocean between the highest point of high tide and the lowest point of low tide.
4. True False The intertidal zone is a gentle environment because marine plants and animals live in tide pools.
5. True False Mangroves are a species of evergreen tree that is able to grow in salt water.
6. True False Humans damage the environment when they drain coastal wetland areas and make the coastline vulnerable to storm damage.
7. True False Both the earth's orbit around the sun and the moon's orbit around the earth are circular.
8. True False The gravitational forces between the earth, moon and sun will vary depending upon their relative positions in their respective orbits.
9. True False A spring tide occurs sometime in March or April in the Northern Hemisphere.
10. True False Tides are predictable because the orbits and motions of the earth and moon are known.

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Answers

1. False
2. False
3. False
4. False
5. True
6. True
7. False
8. True
9. False
10. True