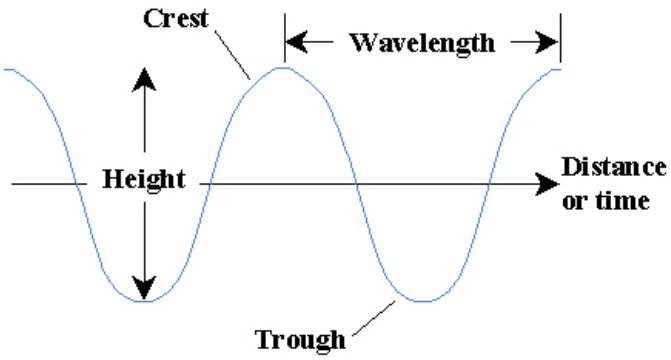
Coastal Dynamics
FCAT Type Questions
Grades 9-12
http://fcit.usf.edu/florida/teacher/science/mod2/index.html

Earth's oceans provide a dynamic system to study. Oceanographers, scientists who study the oceans, may specialize in a variety of content areas depending on their particular areas of interest. While some oceanographers like to study marine life, others are interested in the physical and chemical aspects of ocean water. The formation and movement of ocean waves and currents would be studied by physical oceanographers. Ocean waves form primarily as a result of the interaction of Earth's atmosphere with the surface waters of the ocean. Most surface wave activity one can observe is due to moving air, or wind, blowing across the surface of the water. Wind energy is then transferred to the water creating wave energy. Stronger winds produce greater energy and larger waves. Surface waves traveling toward a coastline will vary in height and frequency depending on the atmospheric conditions of the day. When a surface wave approaches a coastline, it gives up its energy to the shore. This process produces "breaking" waves commonly known as "breakers". The energy release of breaking waves on a coastline may alter the shape of the coastline and the size of rock material located on the coast because of erosion. Wave velocity and frequency can be calculated using the distance or wavelength between waves as they approach a shoreline. Wavelength is measured between successive "crests". A crest is the highest point of an individual wave.



1. Physical oceanographers would prefer to study:

   a. Earth's atmosphere.
   b. whales and fish.
   c. wave energy.
   d. seaweed and plankton.

2. Given the formula, velocity = (frequency) x (wavelength), what is the velocity of a series of ocean waves traveling toward the coast with an average frequency of 2 waves per second and an average wavelength of 5 meters?

   a. 10 m/s
   b. 7 m/s
   c. 2.5 m/s
   d. 0.4 m/s

3. Using the same formula, calculate the average wavelength of a series of waves approaching a coastline with a velocity of 25 m/s and a frequency of 10 waves per second.

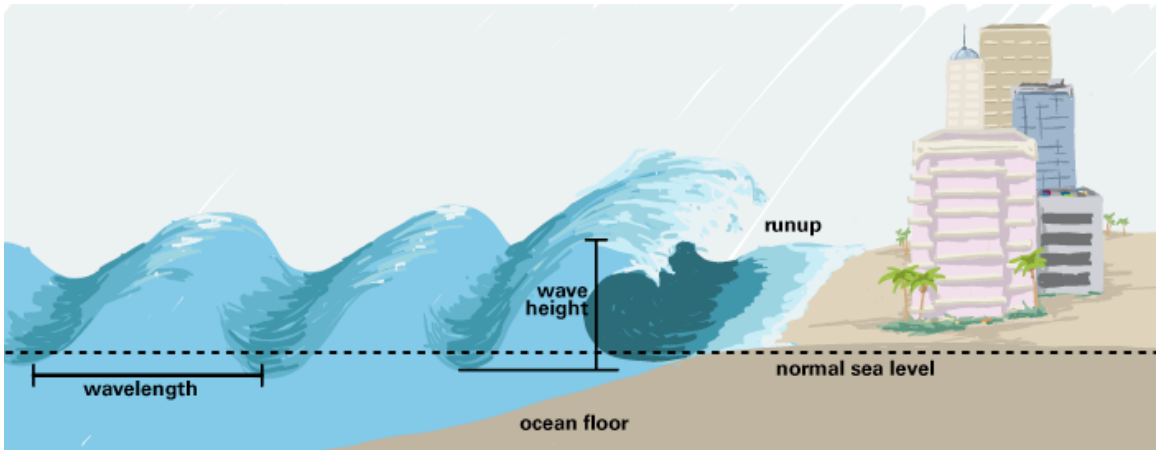
   a. 250 meters
   b. 35 meters
   c. 2.5 meters
   d. 0.4 meters

4. Which of the following wind speeds would produce waves with the highest crests?

   a. 2 m/s
   b. 5 m/s
   c. 10 m/s
   d. 15 m/s

5. Which of the following would **most likely** be caused by wave energy?

   a. no fiddler crabs on the shore.
   b. many dead fish along the shore.
   c. a rocky shoreline with many cliffs and caverns.
   d. an increase in sand deposits along shore.



Above: Diagram of a tsunami approaching shore.

6. A tsunami is a very large wave created when earthquake energy is released on the ocean floor. The energy released acts on the column of water above the epicenter. The epicenter is the spot on the ocean floor directly above the point in the earth's crust where the earthquake occurred. The energy transferred by the earthquake would be released:

   a. on boats or objects at sea.
   b. when the tsunami reaches the coast.
   c. within the first 5 miles the tsunami travels at sea.
   d. into the atmosphere above the earthquake.

7. In 2004, a devastating tsunami struck the Indonesian Island of Sumatra. Here the Indian Ocean Plate slides under Sumatra creating conditions that make earthquake activity possible. This particular tsunami proved deadly, killing nearly 300,000 people. Sea levels were affected along coastlines world-wide. Following an earthquake, people in coastal areas should:

   a. try to escape the region by boat.
   b. quickly travel to the closest area of high elevation.
   c. get out of buildings and head to the shore.
   d. stay in a secure shelter.

8. If a tsunami were to strike the coast of Florida, which source would be the **least likely** cause of this event?

   a. an underwater explosion caused by a nuclear bomb
   b. impact of an asteroid or meteoroid
   c. offshore volcanic eruption
   d. thunderstorms producing a tornado

9. Scientists have developed an idea to construct offshore wave energy farms. It is projected that wave energy could produce five to ten percent of the nation's future energy supply. The Pacific Ocean region is better suited for capturing wave energy than the Atlantic Ocean region. Engineers have designed buoy-like structures holding turbines to collect wave energy. The **best** reason to construct wave energy farms would be because:

    a. there could be a negative effect on migrating fish and whales.
    b. the farms could provide a cheap source of alternative energy.
    c. buoys would require speeding boats to slow down.
    d. big waves annoy beach-goers and they could be reduced.

10. Since the 2004-2005 hurricanes hit Florida, beach erosion problems have become more widespread along the Florida east coast. Many beaches are almost completely gone, with wave and water lines nearly up to the coastal structures. It will be difficult for these areas to survive the next wave of severe hurricane activity.

    How can coastal engineers **best** help protect coastal structures?

    a. develop laws to protect the environment and man-made structures.
    b. build giant seawalls along the coast.
    c. build offshore, underwater structures that reduce wave action ability.
    d. cover the coast with protective plastic sheets when storms approach.

The three main types of energy are kinetic energy, potential energy and electromagnetic energy. Many other types of energy exist but can be categorized as one of the three main types. For example, energy from electricity and sound would be a type of kinetic energy because both involve moving particles. Chemical and gravitational energy are forms of potential energy because they are due to stored energy or energy of position. Energy can be transformed from one type to another.

11. What type of energy transformation occurs in the production of hydroelectric power?

    a. chemical energy to potential energy
    b. nuclear energy to electromagnetic energy
    c. potential energy to gravitational energy
    d. kinetic energy to electrical energy

12. Which type of energy is nonrenewable?

    a. wind
    b. hydroelectric
    c. fossil fuel
    d. geothermal

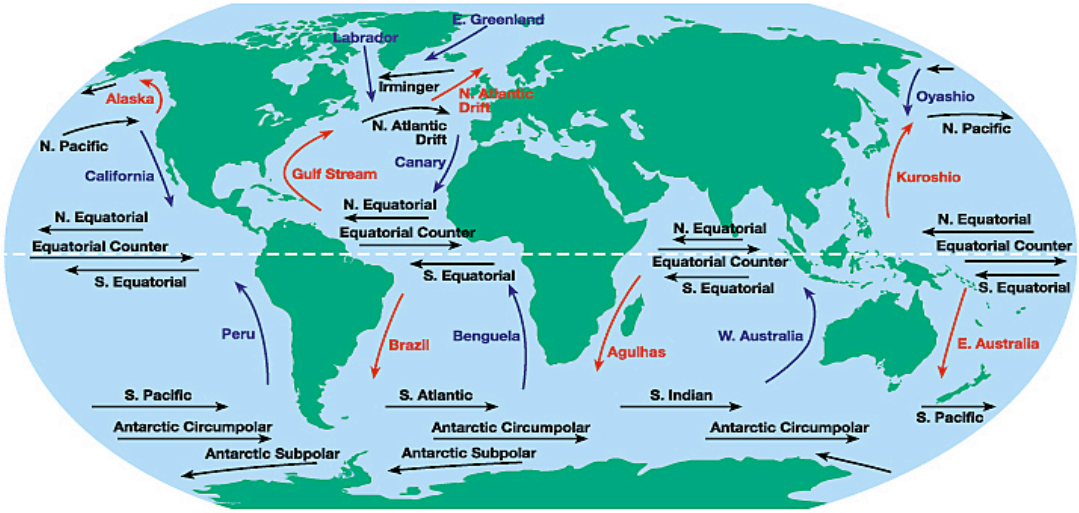
Wind patterns and ocean current movement are caused primarily by Earth's rotation on its axis and the fact that the Earth is not heated uniformly by the sun. Solar energy is most directly received at the equator. Therefore, there is an imbalance of heat between the equator and the poles. Winds and ocean currents
transport heat energy from the equator toward the poles. Cold air and water from the poles circulates toward the equator. This global circulation of air and water serves to better balance heat energy on Earth.

13. Which of the following areas on Earth receives the **least** solar energy?

    a. equator
    b. mid-latitudes
    c. the poles
    d. the tropics

14. If the Earth had a much thinner atmosphere, global temperatures would be:

    a. cooler
    b. warmer
    c. about the same
    d. more extreme



Above: Diagram of surface ocean currents.

15. Which ocean current would have the greatest influence on Florida coasts?

    a. North Equatorial
    b. South Equatorial
    c. Gulf Stream
    d. North Atlantic Drift

16. Which currents probably circulate warm water?

    a. North Equatorial and North Atlantic
    b. Gulf Stream and Brazil
    c. Labrador and California
    d. South Equatorial and South Pacific

17. Strong, dangerous surface currents that may cause swimmers to be carried farther out from shore are:

    a. longshore currents
    b. swash currents
    c. rip currents
    d. backwash currents

18. The circulation of ocean water efficiently transports:

    a. heat
    b. oxygen
    c. evaporation
    d. fish

19. When seawater freezes, most of the salt in the seawater

    a. is included in the ice making it more dense.
    b. is left behind, decreasing the seawater density.
    c. is included in the ice making it less dense.
    d. is left behind, increasing the density of the seawater.

20. If sound travels an average rate of about 1500 m/s in seawater, how deep is the ocean if a sound wave takes 10 seconds to strike the ocean floor and return to the ocean surface?

    a. 150 meters
    b. 300 meters
    c. 7500 meters
    d. 15,000 meters

ANSWERS:

1. c
2. a
3. c
4. d
5. c
6. b
7. b
8. d
9. b
10. c
11. d
12. c
13. c
14. d
15. c
16. b
17. c
18. a
19. d
20. c