Explorer Education Programme

Lesson Plan: Waves

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WAVES

Aim / Description:
The aim of the lesson is to introduce students to what waves are and why they happen.

Background Information:
What Are Waves?
Waves begin when the wind begins to blow across the surface of the water. The wind causes little ripples on the surface of the water which form whitecaps that you often see from the shore. As the wind speed increases, the size of the ripples increase and begin to develop into waves.

Water does not move forward with the wave instead the energy moves through the body of water in a circular motion. (See Figure 1.)

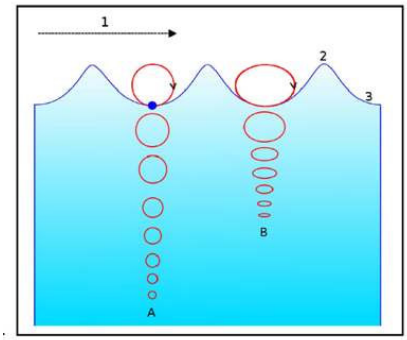

Figure 1: Wave Movement
http://en.wikipedia.org/wiki/File:Wave_motion-i18n-mod.svg

Tsunamis are another type of wave that cannot be seen on the surface until they reach the shore. They are formed as a result of energy that comes from a sudden movement of the earth deep below the ocean – usually from an underwater earthquake or landslide. Tsunamis can travel at very high speeds (over 970 km per hour) compared to a normal wave that can travel up to 90 km per hour. Instruments have been developed to sit on the seabed to record them so people can receive warnings before they hit shore.

Waves and Energy

The more energy contained in a wave, the higher it will be. The reason why waves are so large during storms is because a great deal of energy is being driven into the sea by the wind. Waves are commonly described by their height, wave length and period.

The distance between the peaks of waves is called the "wave length" (see Figure 2). The longer the wave length, the more energy waves contain. This is because when a wave height reaches one seventh of its wave length, it will become unstable, fall over and "break", scattering its energy. Wave period is the time it takes for two crests or troughs to pass through a single point.

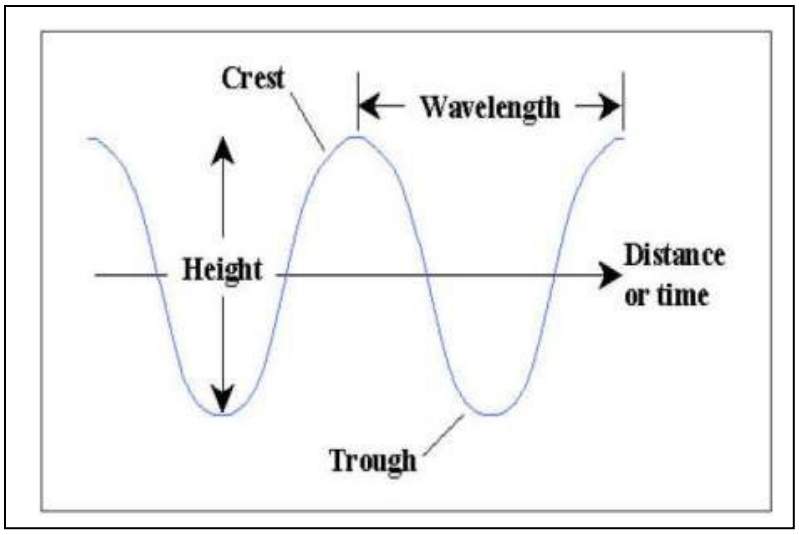

Figure 2: Wave description
http://earthsci.org/processes/weather/waves/Waves_files/Wave_Diagram.jpg

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Surfers use the energy contained in waves to propel themselves forward.
The energy contained in waves is one of the most powerful forces affecting the shape of our coasts. During severe storms, when huge amounts of energy generated by the wind create large waves that crash onto our shores, soft rocks and sand dunes can be broken down and crash into the sea, causing coastal erosion and even flooding.

The energy in waves can also be harnessed to generate electricity. Already, a number of prototype devices are being tested off the Irish coast and will soon be generating electricity that can be fed into the National Grid and from there to our homes, offices and factories.

Activity 1: How do I make a Wave?

Materials:

- Bowl
- Water
- Jam jar with lid
- Food colouring
- Cooking Oil

Method:

Step 1: Discuss and elicit ideas from the students of what they think causes waves.
Step 2: Demonstrate how the wind forms a wave by blowing on the surface of water in a tub of water. Note the ripples caused i.e. waves – the stronger the wind the bigger the waves.
Step 3: Demonstrate how a wave forms and rolls in a circular motion using an old jam, jar with lid, oil, water, food colouring.

- Fill the jar 1/4 with water and add some food colouring.
- Full the jar to the halfway point with oil.
- Tighten the lid.
- Move the jar in a circular motion (up, across and down) to make a wave motion.

Step 4. Discuss the Result: The circular movement of the coloured water and oil will show the circular motion that waves form as they move across the surface of the ocean.

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Activity 2: What is a wave?

Materials:
- Rope

Method:
Step 1: Discuss with the class how the water itself is not the wave. A wave is a form of energy moving through the water. This can be demonstrated by showing how a strong form of energy can create movement in an object that is still.
Step 2. Lay the rope along the ground. (Explain that the rope represents the surface of water). Pick up one end of the rope and give it a good snap.
Step 3. Observe the ripple effect caused that travels down the rope to the other end. This movement down the rope is like the waves moving across the ocean surface. The energy is released at the end of the rope in the same way waves release their energy on the shores.
Step 4: Discuss what determines the size of the wave? Highlight that the size of a wave depends on:
- the distance the wind blows (over open water) which is known as the "fetch",
- the length of time the wind blows, and
- the speed of the wind.

The greater these three, the larger the wave.

Outcome:
Students have developed skills:
- understanding language and meaning of the word - waves
- understanding waves as a form of energy.
- identifying the features and movement of waves.
- understand the effects of waves (e.g. coastal erosion etc).