

Date	Class 5th and 6th	Subject Science
Strand Energy and Forces		Strand Unit Forces
Title Build your own seismometer – learning about forces under the sea		
<p>Objective(s) Earthquakes occur when parts of the Earth’s crust and upper mantle move suddenly. Large earthquakes can cause catastrophic amounts of damage so it’s very important to be able to predict when they might happen.</p> <p>Earthquakes are detected using a seismometer which detects vibrations in the earth. In class, groups of students can work together to make a simple model of a seismometer to demonstrate how they work.</p> <p>The students will experience working in groups and through a creative process develop skills intrinsic to working scientifically.</p>		
<p>Skills Required Observation, group work, creativity, planning and design, analysing data, recording of results, use of scientific terms, predicting, investigating, asking questions, evaluating, communicating results</p>		
<p>Learning Objectives</p> <p>The students will be able to:</p> <ul style="list-style-type: none"> • Question and predict what will happen with their experiment based on research. • Work collaboratively to plan and build their seismometer. • Develop engineering skills such as creating a balanced structure and selecting materials appropriate to their function • Use three dimensional materials to design and invent. • Investigate, experiment and record the outcome • Record, analyse and discuss the data they collect. 	<p>Learning Activities</p> <p>Preparation It is recommended to teach this lesson along with the Geography, English and Art lesson plans.</p> <p>Discussion</p>  <p>Discussion of what seismology is.</p> <p>Follow the SEA-SEIS Expedition at https://sea-seis.ie/ This link provides short animated videos of content that teachers can use to help explain seismic activity.</p> <p>Also see: How a seismometer works at:</p>	

<https://www.youtube.com/watch?v=Gbd1FcuLJLQ>

Discuss how the seismometers can be used on a seismic survey to monitor the vibrations in the earth's crust.

Consider what a seismologist could discover by monitoring these seismic waves.

Follow up questions:

What is a seismometer?

What type of information can the seismometers gather?

What is an earthquake? How is it caused?

What is a seismic wave?

What could the scientists on the survey hope to find out about the earth's evolution by recording the seismic waves?

How long do the seismometers usually stay underwater?

Activity 1:



Construction and Experiment

1. The teacher can help each group to carefully make two holes in the top of their shoebox.

2. Next, make another hole in the centre of the bottom of the plastic or paper cup and two holes on either side of the top of the cup.

3. Push your pen or pencil through the bottom hole and make sure it's secure. Just a couple of cm of the pen should be poking through the bottom.

4. Thread the string through the two holes in the cup and then through the holes in the box and tie securely. The cup should be dangling down inside the box. The string must be tied so the pen rests on the bottom of the box.

5. Carefully make a slit on either side of the bottom of the box and cut a length of paper that will pass through the slits.

6. Thread the paper through the slits.

7. The class can each place their seismometer on a flat surface and one person from each group can shake the box while another person pulls the paper.

8. A wiggly line on the paper should be seen. The more the box is shaken the wider the lines will be.

9. The students can try making different types of movements to see how they change the line created.

Design

The students can decide together how they want to decorate their seismometer using colouring pencils, paints or markers.

10. Complete the Experiment Analysis and Follow up questions

Development Activity

Visit the blog scientists@sea where students can see what life is like for a real explorer and researcher aboard a research vessel.

Take an online virtual tour of [The Celtic Explorer](#) via the Marine Institute website. Complete the worksheet provided as a group activity – “find the place where...”

Materials

- Shoebox
- Paper or plastic cup
- Pencil or felt tip



- Scissors
- String
- Sellotape
- Long paper

Resources

Follow the SEA-SEIS Expedition at <https://sea-seis.ie/> This link provides short animated videos of content that teachers can use to help explain seismic activity.

Check the Explorers Education vimeo channel for content posted about the SEA-SEIS Expedition and other surveys:

<https://vimeo.com/explorerseducation/videos>

Check out the Marine Institute blog posts at <http://scientistsatsea.blogspot.com/> This provides blogs by scientists that have been on expeditions on the RV Celtic Explorer.

Also see CoastMonkey Sea Diary for an update by the outreach specialist on board the research vessel: <http://coastmonkey.ie/sea-diary-celtic-explorer/>

Track the RV *Celtic Explorer* out on its survey via the [Track A Vessel](#) weblink:

<https://www.marine.ie/Home/site-area/infrastructure-facilities/research-vessels/track-vessel?language=en>

Imagine what life is like on a research vessel by exploring the online virtual tour of [The Celtic Explorer](#) via the Marine Institute website:

<https://www.marine.ie/Home/sites/default/files/VirtualTour/index.htm?language=en>

Differentiation

Mixed ability pairing in groups

Assessment

Teacher observation; Student samples; Oral feedback

Linkage and Integration

English – Writing – Emotional and imaginative development through language.

Geography – Natural Environments – Land, rivers and seas of Ireland.

All about Ocean Bottom Seismometers



Seismometers are special instruments that collect sound information through the earth.

Acoustic waves (sound) cause tiny vibrations through the earth.

The seismometer is a detector that is placed in direct contact with the earth and converts these tiny vibrations into electrical signals.

Each seismometer consists of a solid object with four legs. Each one has an electrical coil inside that is hanging by a spring between two magnets. When the earth moves, the magnet and spring move with the earth.

The sound waves in the earth are produced by either earthquakes or by man-made devices.

If the earth moves and a scientist knows the exact time of day and the exact location of where the movement came from and where the seismometer is, they can make a model of the entire earth's structure.

The ocean bottom seismometers can provide information about the type of sediments (eg. sand) and the crust (down to 30-40 kilometres) under the ground.

The ocean bottom seismometers are very easy to release from a ship. All that is needed is space on the deck to store the seismometer and equipment to deploy (release) and recover it.

The ocean bottom seismometer is bolted an anchor and then dropped (gently) over the side. The ship will come back to collect it after some time has passed. The ocean bottom seismometers can survive on their own in the freezing darkness of the oceans depths for weeks!

Extra Information for discussion

What causes an earthquake?

Giant slabs of the Earth's crust, called tectonic plates, grind together. Sometimes, though, the plates get stuck, the pressure builds up and they suddenly slam into a new position. This causes an earthquake. If an earthquake lifts or drops part of the ocean floor, the water above rises and starts spreading across the ocean, causing a tsunami. Underwater landslides or volcanic eruptions can also displace water (cause water to spread across the ocean) and may lead to a tsunami.



Foreshocks and Aftershocks

Generally before and after a large earthquake there will be smaller earthquakes. The ones that happen before are called foreshocks. The ones that happen after are called aftershocks. Scientists don't really know if an earthquake is a foreshock until the bigger earthquake occurs.

Tsunamis

Meaning "great harbour wave" in Japanese, tsunamis are sometimes called "tidal waves" but their strength has nothing to do with the tides. About four out of five tsunamis happen within the Ring Of Fire, a zone in the Pacific Ocean where earthquakes and volcanic eruptions frequently take place.



Worksheet 1. Experiment Analysis and Follow up questions

1. What causes an earthquake?

2. What is a tsunami?

3. What did you expect to happen when the shoebox vibrated?

4. What did happen? Was your prediction correct?

5. What is a seismic wave?

6. Where do seismic waves occur?

7. What is the scientific term for the piece of paper that the seismometer produced?

8. Can you think of anything else that a seismometer could be used for, apart from detecting earthquakes?

9. Why do you think it is important for a scientist to monitor seismic waves?