

Lesson Plan

Assessment
Cross-curricular

AFL, questions, simulation

Big Ideas

- Structures and mechanisms throughout our environment have forces that act on and within them.
- Forces that result from natural phenomena have an effect on society and the environment.

Learning Goals

- Be able to identify natural forces and their impact on structures and the environment.
- Gain a basic understanding of plate tectonics and how it relates to the forces of earthquakes.

Specific Expectations:

- 1.1** analyse the effects of forces from natural phenomena (e.g., tornadoes, hurricanes, earthquakes, tsunamis) on the natural and built environment
- 3.2** identify external forces acting on a structure (e.g., the weight of people and furniture in a house, wind blowing on a tent, the movement caused by a passing train), and describe their effects on the structure, using diagrams
- 3.4** describe forces resulting from natural phenomena that can have severe consequences for structures in the environment (e.g., a house loses its roof in a wind storm), and identify structural features that help overcome some of these forces (e.g., cross supports for roofs, steel beams in bridges)

Description:

This is the **first** lesson in a five-lesson unit on the theme of earthquakes. Earthquakes provide an exciting and interesting entry point to discussing forces and how they act on and in structures and mechanisms. In this lesson we start by having a look at a number of big natural forces and the impact they can have on structures and the environment.

Materials/Resources:

Graham crackers
 Pudding or similar
 Plastic spoons and paper plates

Safety Notes

Some students may have allergies or dietary restrictions. Make sure the workspace is clean before starting activity. Be aware before letting students eat the activity.

Introduction

Opening Discussion

- For the next few days we will discuss forces, and specifically natural forces. What is a natural force? (A force of nature – not created by humans, or an artificial mechanism etc.)
- What do we mean when we call someone a “Force of Nature”? (Someone unstoppable and determined. Seemingly not caring about anything standing in their way). Does that give us a hint how humans tend to experience natural forces?
- Can you think of some natural forces? (Wind, earthquakes, tsunami, hurricanes, water, landslides, etc.)
 - Of course there are plenty of natural forces that don’t create catastrophic events as well...
- How can these forces affect humans?
 - Act on us – from mild to catastrophic
 - Act on things we build – from mild to catastrophic
- Is it important to be aware of what forces may act on us in a certain place?
 - Yes – for example we need to know what the risk of a major earthquake is in any location we want to build in order to make sure we build strong enough.
- Engineers have to always take into account all the forces that may act on a structure when designing pretty much anything. Otherwise things can go badly wrong.
- Let’s learn some more about this...

Optional: Show a couple of videos of natural forces in action

Many excellent videos exist of course showing natural forces in action. If you want to focus just on earthquakes, only showing one or two of videos of an earthquake might be best. Check out the links at the end of the lesson.

Action

Plate Tectonics Discussion and Activity

There are a few classic plate tectonic demonstrations that you may want to do with your class to introduce the topic of earthquakes. Some are quite involved and you could easily spend a whole period on it. Our aim is with this lesson is to provide a brief introduction to earthquakes in order to use them as a basis for discussing forces. It is therefore great to know a little bit about plate tectonics but we do not need to get into all the details of it. We therefore include a basic graham crackers activity here.

- So why do earthquakes happen? (Because the earth’s crust moves)
- Why does the crust move? (It is a thin layer on top of a molten interior.)
- Let’s do a yummy activity to see how it works a bit better!
- **Graham crackers activity:**
 - Give each student a graham cracker (that they can crack in half) and some pudding or other gooey food. A few students may be able to share pudding from one cup to reduce the amount of supplies needed.
 - Spread some pudding on the plate with a spoon. Make a fairly thick layer that is big enough to fit the graham cracker on top.
 - Break graham cracker in half, and place on top of pudding.

- The pudding represents the asthenosphere, the cracker the earth's crust.
 - Discuss different forms of plate collisions and have students try them out:
 - **Divergent plate boundary.** Gently push on crackers and pull them apart from each other. What do you notice? (The pudding can be seen between the crackers). This is what happens in our mid-ocean ridges. Volcanoes form as the crack widens.
 - **Convergent plate boundary.** Now push the graham crackers back together. Once they touch make one cracker go below and one above. What happens now? (Mountains form, you may get earthquakes!)
 - **Transform plate boundary.** Place the crackers side by side and slide them past each other. Apply light pressure, pushing the crackers towards each other. Is it a smooth sliding? (No – as the crackers are not totally straight where they meet. The crackers move in small jumps and starts. These are earthquakes).
 - Take questions and discuss a bit further.
 - This is enough detail for the purpose of this unit on forces, but if you want to go a bit more into depth you may choose to do so of course.
 - Finally: Eat your activity!
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Consolidation/Extension

Students will work on a project each day that they will hand in at the end.

- Today we will start by designing a title page for the project.
- A template is attached that can be handed out for this.
- Can be done at the end of class (time permitting) or as homework

Links to videos on natural forces:

- National Geographic Earthquake Montage:
<http://video.nationalgeographic.com/video/earthquake-montage>
- Earthquake in Japan: <https://www.youtube.com/watch?v=zuogIPDGbZk>
- Optionally show some images of the aftermath of an earthquake (collapsed buildings and highways, etc.).
- National Geographic Tornado montage:
<http://video.nationalgeographic.com/video/tornado-montage>
- Japanese Tsunami (a less graphic but impressive video, but may not be appropriate for everyone):
<https://www.youtube.com/watch?v=vYy2h8IUV1U>
- Landslide (safe footage): <https://www.youtube.com/watch?v=EFWnppxgU1U>
- National Geographic volcano eruptions:
<http://video.nationalgeographic.com/video/volcano-eruptions>