SCIENCE NORTH SCIENCE NORD
SUDBURY, ONTARIO, CANADA

Earthquakes Part 2 **Grade 5 – Forces Acting on Structures and Mechanisms**

Lesson Plan

Assessment	AFL, demos, build model
Cross-curricular	

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

- Understand how earthquakes form.
- Understand the purpose and basic functioning of a seismograph to measure the magnitude 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
2.1 follow established safety procedures for working with tools and materials (e.g., wear protective eyewear when testing structures to the breaking point)
2.4 use technological problem-solving skills to design, build, and test a frame structure (e.g., a bridge, a tower) that will withstand the application of an external force (e.g., a strong wind or simulated vibrations from a train) or a mechanical system that performs a specific function (e.g., a building crane)

Description:

This is the **second** lesson in a five-lesson unit about earthquakes in the context of forces on structures and mechanisms. In this lesson we focus on better understanding earthquakes and how we measure their magnitude.

Materials/Resources:

Two blocks of wood (e.g. 2x4), sandpaper
Poster paper
Towel
Each student group should bring one can of food
Rulers, markers for every group
Masking tape, paper

Safety Notes

Introduction

Quick Review

- Yesterday we discussed plate tectonics and how earthquakes form.
    - Three different types of plate boundary interactions.
    - Earthquakes form when two plates slide past each other (transform plate boundary) or one goes under the other one (convergent plate boundary)
    - Ocean plates have a higher density than continental plates. That is why we usually see them sliding UNDER continental plates.
    - Earthquakes create force on structures and people – back and forth as well as up and down.

Earthquake demos

- We can see nicely how earthquakes form when we have a **transform plate** boundary using two wood blocks:
    - **Ahead of time, glue sandpaper to one side of each block.**
    - Push blocks against each other and then slide them in opposite directions.
    - Try sand paper facing sand paper, and wood facing wood.
    - You should notice that the blocks move unevenly – this is like earthquakes, where the plates jump suddenly.
    - Let students try for themselves (having a few sets of blocks will help)
- We can demonstrate earthquakes due to a **convergent plate** boundary with a sheet of poster paper and a towel:
    - Slide towel down past a horizontal poster paper (works well by pulling towel off a desk and the poster paper extended over the edge of another nearby desk so it just touches the towel).
    - Notice how the poster paper bends downward and then jumps back up in small jumps.
    - Demonstrate and let students try if you have the supplies (note that you will need poster paper for lesson 3 anyway)

Measuring Earthquakes

- How do we measure the strength of earthquakes? We can use a seismograph that records shaking in the ground.
    - A traditional one has a needle that hovers over a roll of paper that slowly moves past the needle.
    - The bigger the quake the larger the deflection of the needle is.
- Let's try to build one!

Action

Build a seismograph

This is a nice and simple activity to show students how we can measure a force. In this case, we measure the force of an earthquake. Students should work in a small group so that one or two can shake the table while someone else one looks after the seismograph.

1. Tape a felt marker to the end of a ruler at right angles to it (making an L shape)
2. Tape the other end of the ruler to the can, so the marker's tip just touches the tabletop
3. Place a piece of paper under the marker.

4. Shake the table back and forth (gently) and observe what happens. Does the seismograph record the shaking?
    a. Try different strengths of shaking. Start mildly and work your way up to stronger shaking.
    b. Tap on the table with your hand. Does it record the "quake"?
5. One student pulls the paper smoothly and slowly from under the marker as the others shake the table.
    a. This is how real seismographs work. The force of the shaking is recorded on a roll of paper.
6. Discussion:
    a. What do you observe? (the harder you shake the bigger the waves recorded on the paper, etc.)
    b. Could you measure the strength of an earthquake from this? How would you do that? (E.g. measure the amplitude of the recorded waves.)

Consolidation/Extension

The Richter Scale

- Scientists use a scale called the Richter scale to indicate the strength of earthquakes.
- Higher numbers indicate a stronger earthquake.
- It is not a linear scale. In fact for every increase of one on the scale the earthquake actually gets 10 times stronger!
- Many small earthquakes happen every day. For example there are thousands of earthquakes a day with magnitudes less than 3. Earthquakes stronger than 8 only happen every few years.
- The USGS has a nice website for kids with information on earthquakes: http://earthquake.usgs.gov/learn/kids/. Includes a map of the latest earthquakes!

Richter Scale of Earthquake Energy:

Each level is 10 time stronger than the previous level

	Description	Occurrence	In Population	Movement
1	Small	Daily	Every minute	Small
2	Small	Daily	Every hour	Small
3	Small	Daily	Every day	Small
4	Small	Daily	Every week	Moderate sudden
5	Moderate	Monthly	Every 10 years	Strong Sudden
6	Moderate	Monthly	Every 30 years	Strong Sudden
7	Major	Monthly	Every 50 years	Severe Sudden
8	Great	Yearly	Every 100 years	Very Severe
9	Great	Yearly	Every 300 years	Very Severe
10	Super	Rarely	Every 1,000 years	Extreme

Unit Project

With the rest of class time keep working on your unit project using the worksheet. Finish at home if you don't get done.

- Make a drawing of how tectonic plates move for the three different cases.
- Write a few sentences about how a seismograph works.