SHAKE IT UP

OVERVIEW: This presentation gives a brief discussion of plate tectonics, types of boundaries, and the importance of earthquake resistant structures

OBJECTIVE: To teach the types of boundaries, the importance of earthquake resistant structures, and to have students collaborate on building an earthquake resistant structure

GRADE LEVEL: 8

OHIO STANDARDS:

Earth and Space Science Grade 8: The composition and properties of Earths' interior are identified by the behavior of seismic waves

Earth and Space Science Grade 8: Earth's crust consists of major and minor tectonic plates that move relative to each other

Earth and Space Science Grade 8: A combination of constructive and destructive geologic processes formed earth's surface

TIME: 60 minutes

VOCABULARY: Plate tectonics, plate boundaries, convergent boundaries, divergent boundaries, transform boundaries, S and P waves

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MATERIALS:

Shake tables (2)
Paper and pencils (to show seismograph if time)

Map of earthquakes in Ohio

Magic Springs to represent S and P waves

Materials per each group of 4 students

1 cardboard base

15 stir sticks

5 Paper clips

10 toothpicks

10 marshmallows

5 gumdrops

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IMPORTANT:

Read all instructions before proceeding

PROCEDURE:

Pass out the earthquake maps. Discuss where there have been earthquakes, and how recent we had them.

Describe what earthquakes are. They are sudden motions along breaks in the crust called faults. They are caused by plate motions. They are not randomly scattered, they are at fault zones. Often active volcanoes are along those same fault zones. Discuss the 3 different types of plate boundaries

Convergent – Where plates collide. You often get a combination of earthquakes and volcanoes. The lighter plate floats on top while the other dives below the edge in a process called subduction. The submerging plate melts and bubbles up through the cracks.

Divergent – Plates pull apart. You get few earthquakes because the plates are not storing up energy as they collide or rub past each other. Instead, a gap forms between the plates and magma from the mantle fills in the hole. These types of plates cause several volcanoes

Transform Boundaries – Where plates grind past each other. The most commonly known is the San Andreas fault. The friction between the plates allows them to store energy between them until it reeases in the form of an earthquake

Pass out the magic springs. Let groups of students look at S waves and P waves. P waves stand for Primary waves. They are the waves of energy coming from the earthquake that are fast moving and are also known as longitudinal or compression waves. To make these, have one student pull the slinky towards themselves while a partner is holding the other end. Next, shake the slinky up and down. This represents S waves (or Secondary Waves). These are transverse waves that travel through solid rock. They are much stronger than P waves and slower.

Explain how earthquakes are measured with a Richter Scale. The Richter Scale is as follows:

Light earthquake: 4-4.9

Moderate earthquake: 5-5.9

Strong earthquake: 6-6.9

Major earthquake: 7-7.9

Great earthquake: 8-9.9

OTHER EARTHQUAKE FACTS TO SHARE

The average motion along the San Andreas Fault Zone is 2 inches per year.

The hypocenter of an earthquake is beneath the earth's surface where the rupture of the fault begins

The epicenter of an earthquake is the location directly above the hypocenter on the surface of the earth

It is estimated there are 500,000 detectable earthquakes in the world each year. Only 100,000 of them are felt.

Magnitude is the estimated value of the earthquakes size. Intensity is the measure of the shaking created by the earthquake.

The San Andreas fault is not a single continuous fault but it is made up of many segments

The world's deadliest earthquake recorded was in 1556 in central China. People were living in caves and an estimated 830,000 people died

Alaska is the most earthquake prone state

ACTIVITY:

Discuss the importance of creating earthquake resistant structures. The process engineers se is called seismic design or earth-quake proofing. Describe some examples of earthquake proofing such as: 1. Flexible Windows 2. Flexible columns supporting buildings 3. Use of rollers or rubber pads to separate the base columns from the ground which allow the building and columns to shake parallel to the ground. Tell them today they will be working in teams of 5 to create an earthquake resistant building that will withstand an earthquake. Hand out the worksheet and go over the directions.

Allow the students to begin their designing. After 15 minutes test the structures. After the trial run, allow 5 minutes for improvement. Then retest

You may offer other advice asking which types of bases are best, wide or narrow, should the building be symmetrical, etc

FOLLOW UP:

Discuss why certain items worked better…marshmallows and gumdrops since they

wiggle with the movement of the table.

EARTHQUAKE CHALLENGE

Your group has been hired to create an earthquake resistance structure. You may be as creative as you like, and use any of the materials that have been provided for you. I will give you 15 minutes to create your first tower. After testing the structure, you will get 5 minutes to make improvements and test again. The tallest structure that withstands 60 seconds on the shake table will be the winning structure.

MATERIALS:

1 cardboard base

15 stir sticks

5 paper clips

10 mini marshmallows

5 gum drops

10 toothpicks

Your building must meet these requirements:

It must fit on the base. If the building touches the platform, you are disqualified

You must find a way to secure your building to the base so it doesn't fall off

Your design must survive 60 seconds on the highest level of the shake table

GOOD LUCK!