Tectonic Forces Simulation: Forces and Gravity

Activity One

Introduction

Forces are all around you. Think of riding a bike. The force of friction between the tires and the road keeps your bike firmly on the ground, while the force of gravity makes you ride faster down a steep a hill. A force is basically a push or a pull on an object - something that makes an object move, change direction, or stop moving.

Forces are constantly affecting and changing our planet. The force of gravity is what keeps our planet spinning and revolving around the sun. Tectonic forces also cause an earthquake to shake, a volcano to erupt, and continents to move. The energy behind these forces comes from deep within the earth, as heat and pressure move the mantle below the earth's crust. In turn, large pieces of the earth's crust - or tectonic plates - are also constantly moving. This movement causes earthquakes, volcanoes, and the formation of many of Earth's geographic features.

Directions

Using the tectonic forces simulation, compare the effects of two types of plate boundaries: divergent (when plates move away from each other) and transform (when plates slide against each other).

Procedure

1. Read Start Here and close the window. For more information, click Background and close the window. For detailed directions, click Help and read "How to Use this Simulation."
2. Click on the "Choose a type of plate boundary" pull-down menu and select Divergent.
3. Your goal is to find the different types of tectonic activity and geographic features that occur along those plate boundaries. One by one, click the different types of Tectonic Activity. If the graphic for that type of activity overlaps the divergent plate boundaries, leave the box checked. If that type of activity doesn't occur along the plate boundaries, click the box again to remove the selection. Do the same thing with Geographic Features.
4. Record the outcomes in the chart below by placing an "X" in the places where you found a match. (Note: A "Correct!" box pops up when you've checked all the types of tectonic activity and geographic features that occur along those plate boundaries.)
5. Now explore Transform plate boundaries. Transform plates slide past each other. Follow the same steps as above and record the outcomes below.

	Tectonic activity			Geographic features				
	Shallow focus earthquakes	Int. and deep focus earthquakes	Volcanoes	Rift zone	Mid-oceanic ridge	Deep sea trench	Mountain chain	Island arc
Divergent								
Transform								

6. Which type of plate boundary is an example of an opposing force?

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7. Describe the forces at work with divergent plates.

_____

8. Which type plate boundaries is the best example of the force of friction? Why?

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Tectonic Forces Simulation: Forces and Gravity

Activity Two

Introduction

Forces are constantly changing planet earth. As large pieces of the earth's crust (tectonic plates) move, the force causes earthquakes and volcanoes. These forces are responsible for the formation of many of earth's geographic features, from deep ocean trenches to soaring mountain ranges. In the first activity, you compared the effects of divergent and transform plate boundaries. In this activity, you'll compare the geographical features caused by three types of convergent boundaries, depending on whether they bring together two ocean plates, two continental plates, or an ocean plate and a continental plate.

Directions

Using the tectonic forces simulation, compare geographic features along different convergent plate boundaries.

Procedure

1. Read Start Here and close the window. For more information, click Background and close the window. For detailed directions, click Help and read "How to Use this Simulation."
2. Find the different types of tectonic activity and geographic features that occur along three plate boundaries: Convergent (Ocean & Continental), Convergent (Continental & Continental), and Convergent (Ocean & Ocean). To begin, choose a Plate Boundary from the pull-down menu. Then select the different types of Tectonic Activity and find the ones that occur along those boundaries. Do the same thing with Geographic Features. Record the outcomes in the chart below by placing an "X" in the places where you found a match.
3. When you've found all the matches, you'll see yellow circles highlighting examples of features found along those plate boundaries. Record important facts about these features in the chart below.

	Convergent (Ocean & Continental)	Convergent (Continental & Continental)	Convergent (Ocean & Ocean)
Shallow quakes			
Int. & deep quakes			
Volcanoes			
Rift Zone			
Mid-Oceanic Ridge			
Deep Sea Trench			
Mountain Chain			
Island Arc			
Examples	Results: Results:	Results: Results:	Results: Results:

4. Which features are found along the west coast of North and South America? What type of plate boundary caused these features?

_____

5. If a force causes something to move, change direction, or stop, explain how forces are currently affecting Mt. Everest.

_____

6. Do you think there's a greater force acting on the earth's crust under the Andes Mountains or the Appalachian Mountains? Explain your answer.

_____

_____

7. Describe the different events that may be caused by the force of colliding plates near the Aleutian Islands in Alaska.

_____

8. There are two types of energy: kinetic energy and potential energy. Kinetic energy is the energy of motion, like the energy a cart has when it's rolling down a hill. Potential energy is stored energy, like the energy a cart has when it's sitting at the top of a hill. Potential energy can be related to an object's position, like the cart at the top of the hill, or its shape, like a stretched rubber band. What type of energy is involved when a volcano erupts? Give another example of this type of energy.

9. Objects have different amounts of kinetic energy depending on their velocity and their mass. If a bike is moving 5 mph and a second, identical bike is moving 15 mph, the second bike has more kinetic energy. A car moving at 15 mph has even more kinetic energy because it has more mass. If the Andes Mountains are growing by just a few centimeters a year, does this mean it does not have a lot of kinetic energy? Explain your answer.

10. Energy can also be described in terms of its different forms:

- Mechanical energy: energy of motion
- Heat energy: motion of an atom's objects that causes heat
- Chemical energy: energy is released when bonds between atoms are broken; a fire is chemical energy
- Electromagnetic energy: energy such as light, radio waves, and x-rays
- Nuclear energy: energy in the nucleus of atom

What different forms of energy are involved in an erupting volcano?

11. What are some other forces - besides those acting on tectonic plates - that affect our Earth?

Tectonic Forces Simulation: Structures

Activity One

Introduction

When architects and engineers design structures, such as buildings, tunnels, and bridges, one of their main concerns is whether the structure can withstand the forces of nature. Wind can topple a bridge. Water can slowly erode a home's foundation. And as anyone living on the West Coast knows, an earthquake can damage an entire community.

Most earthquakes occur along the edges of tectonic plates -- the large pieces of earth's crust that fit together like pieces of a puzzle. Tectonic plates are always moving because they float on a layer of hot mantle deeper within the earth. The edges of these plates either collide against each other at boundaries, slide past each other at transform boundaries, or move away from each other at divergent boundaries. This movement causes earthquakes.

Directions

Using the tectonic forces simulation, find out which types of earthquakes occur along divergent and transform boundaries.

Procedure

1. Read Start Here and close the window. For more information, click Background and close the window. For detailed directions, click Help and read "How to Use this Simulation."
2. Click on the "Choose a type of plate boundary" pull-down menu and select Divergent.
3. Your goal is to find the different types of tectonic activity and geographic features that occur along Divergent plate boundaries. Divergent plates move away from each other. One by one, click the different types of Tectonic Activity. If the graphic for that type of activity overlaps the divergent plate boundaries, leave the box checked. If that type of activity doesn't occur along divergent plate boundaries, click the box again to remove the selection. Do the same thing with Geographic Features.
4. Record the outcomes in the chart below by placing an "X" in the places where you found a match. (Note: A "Correct!" box pops up when you've checked all the types of tectonic activity and geographic features that occur along those plate boundaries.)
5. Now explore Transform plate boundaries. Transform plates slide past each other. Follow the same steps as above and record the outcomes below.

	Tectonic activity			Geographic features				
	Shallow focus earthquakes	Int. and deep focus earthquakes	Volcanoes	Rift zone	Mid-oceanic ridge	Deep sea trench	Mountain chain	Island arc
Divergent								
Transform								

6. At which of these boundaries will you find both shallow focus earthquakes and volcanoes?

_____

7. Name two places where transform plate boundaries occur. (Click on the yellow circles that appear when you find the matches for transform boundaries.) What important event in U.S. history occurred along a transform plate boundary?

_____

Tectonic Forces Simulation: Structures

Activity Two

Introduction

Earthquakes pose one of the greatest natural threats to structures. Most earthquakes occur along the edges of tectonic plates, where they collide, move apart, or slide against each other. In the first activity, you saw what types of earthquakes occurred along divergent and transform plates. In this activity, compare earthquake activity along different convergent plate boundaries. Then you'll find where some of the world's biggest earthquakes occurred.

Directions

Using the tectonic forces simulation, compare earthquake activity along different convergent plate boundaries.

Procedure

1. Read Start Here and close the window. For more information, click Background and close the window. For detailed directions, click Help and read "How to Use this Simulation."
2. Find the different types of tectonic activity and geographic features that occur along three plate boundaries: Convergent (Ocean & Continental), Convergent (Continental & Continental), and Convergent (Ocean & Ocean). To begin, choose a Plate Boundary from the pull-down menu. Then select the different types of Tectonic Activity and find the ones that occur along those boundaries. Do the same thing with Geographic Features. Record the outcomes in the chart below by placing an "X" in the places where you found a match.

	Tectonic activity			Geographic features				
	Shallow focus earthquakes	Int. and deep focus earthquakes	Volcanoes	Rift zone	Mid-oceanic ridge	Deep sea trench	Mountain chain	Island arc
Convergent (Ocean & Continental)								
Convergent (Continental & Continental)								
Convergent (Ocean & Ocean								

3. What is the difference between shallow focus and deep focus earthquakes? (See Background if you need help.)

_____

4. Along what type of border might structures be threatened by earthquakes, but not volcanoes?

_____

5. The picture below shows an example of the devastating destruction of an earthquake in Kobe, Japan. What kind of plate boundary caused this damage?

6. An earthquake can have devastating effects to cities and their structures. Not only are structures threatened by ground shaking, surface faulting, and ground settling, they can also be damaged by landslides, tsunamis, and fires caused by the earthquake. Below are a few pictures showing earthquake damage. Use a world map to find the locations of each earthquake. Then use the simulation to find the type of plate boundary where each earthquake occurred and write your answer in the chart.

		Description	Location Date	Type of plate boundary
A.		Tipped house due to ground settling	Caracas, Venezuela July 29, 1967	
B.		Compression of freeway	San Fernando, California February 9, 1971	
C.		School "dropped" after soil failure	Prince William Sound, Alaska March 28, 1964	
D.		Failed bridge	Chi-Chi, Taiwan September 21, 1999	