Shaking Things Up **Name _____ Hour ___**

(Lesson by Cathy Oates-Bockenstedt and Mary Gallus)

Problem: Why do earthquakes happen in certain locations around the world?

Prediction: Describe, in one sentence, where you think most earthquakes in the world will occur over the next month.

Thinking about the Problem:

Can you predict earthquakes? Scientists have never predicted a major earthquake. They do not know how, and they do not expect to know how any time soon. However, probabilities, based on scientific data, can be calculated for potential future earthquakes. Scientists are becoming better and better at predicting the likelihood of potential earthquakes.

Plates are the slabs of the Earth's crust that make up the lithosphere (*lithos,* "stone" in Greek). Geologists developed the plate tectonic theory as a model of movement of Earth's crust on the surface. Earth's crust is composed of the continental crust (30 to 100 km thick) and the oceanic crust (about 10 km thick). Faults (*fallere,* "to fail" in Latin) are fractures in the Earth's crust caused by the stresses of plate movements.

The word earthquake is used to describe any seismic (*seismos,* "earthquake" in Greek) event—whether a natural phenomenon or something caused by humans—that generates seismic waves. Seismic waves are caused mostly by the rupture of geological faults, but also by volcanic activity, landslides, mine blasts, and nuclear experiments. An earthquake is usually the result of a sudden release of energy in Earth's crust, due to slippage along geologic faults, causing a vibration of the Earth.

There are many misconceptions about earthquakes. Some believe that animals can predict earthquakes. Un-researched evidence does exist of animals, such as fish, birds, reptiles, and insects, exhibiting strange behavior anywhere from weeks to seconds before an earthquake occurs. However, consistent and reliable behavior prior to seismic events has never been shown.

Earthquakes may occur near a volcanic eruption, but they are the result of the active forces connected with the eruption, and not the cause of volcanic activity. As well, contrary to some beliefs, earthquakes are equally as likely to occur at any time of the day or month or year.

Geologists use the Richter scale to assign magnitude to earthquakes by the height of the largest seismic wave that each earthquake creates. Each unit of additional magnitude refers to a tenfold increase in the level of ground shaking and an even more dramatic increase in energy. For example, a magnitude 7.0 earthquake has over 30 times more energy than a magnitude 6.0.

Thinking about the Problem:

1.
2.
3.

Materials:

Colored pencils
Internet access to the United States Geological Survey's earthquake page
Wall-size map of the world

Procedures:

1. Post a map of the world on a wall in the classroom.
2. Each student should have a smaller world map in their lab notebooks.
3. Visit the United States Geological Survey's "Current Worldwide Earthquake List" on the internet (http://earthquake.usgs.gov/regional/neic/).
4. Place a colored dot on the wall map where any earthquakes have occurred that day. Repeat this pattern weekly (assign students this job).
5. Students use colored pencils to indicate the same information in their lab notebooks.
6. Use different colors to indicate magnitudes of earthquakes (strong, medium, and weak).

Expansion and Further Investigation:

1. Follow a similar procedure to trace subduction zones, by noticing depths of earthquakes (in 100 km increments). Use Air Server to show the class your world map, explaining the patterns that you find.
2. Research and report on a fault zone in the United States, sharing especially any future predictions for activity levels.
3. Develop a presentation on building materials and methods that are designed to sustain earthquakes without damage.

Analysis:

1. Describe how your map of the world has changed over the course of four months.

2. What patterns do you notice in terms of the locations of earthquakes?
3. What patterns do you notice in terms of the magnitudes of earthquakes?

Conclusion:
I Learned:
Re-Do:
Manipulated Variable:
Measured Variable:
Controlled Variable:

Teacher Note: According to the U.S. Geological Survey Earthquake Hazards Program, "The magnitude of an earthquake is determined from the logarithm of the amplitude of waves recorded by seismographs. On the Richter Scale, magnitude is expressed in whole numbers and decimal fractions. For example, a magnitude 5.3 might be computed for a moderate earthquake, and a strong earthquake might be rated as magnitude 6.3. Because of the logarithmic basis of the scale, each whole number increase in magnitude represents a tenfold increase in measured amplitude; as an estimate of energy, each whole number step in the magnitude scale corresponds to the release of about 31 times more energy than the amount associated with the preceding whole number value."

Earthquake Monitoring and Mapping
Shaking Things Up in Enriched Science on Wednesdays

You will use the United States Geological Survey's (USGS) "Current Worldwide Earthquake List" at http://earthquake.usgs.gov/regional/neic/, to conduct your Earthquake Monitoring and Mapping. On your assigned date, you will use the data presented by the USGS to record one dot at the exact latitude and longitude, on our classroom wall map, for each earthquake that has measured 5.5 magnitude, or higher, during the past seven days.

Procedure:
1. Follow the link on my web site to the National Earthquake Information Center (NEIC):
http://earthquake.usgs.gov/regional/neic/

2. Click on "Current Worldwide Earthquake List".

3. Click on the settings Icon in the top-right corner of the page.

4. Select, "7 Days, Magnitude 4.5+ Worldwide" on the right side of the map.

5. Select "Largest Magnitude First" for the List Sort Order.

6. Remove the checkmark in the box that says, "Only list Earthquakes Shown on Map", so that worldwide earthquakes will be shown.

7. You will be plotting dots on our wall map for all Earthquakes with a 5.5 Magnitude or greater. Count out how many dots you will need to plot by looking at the listing on the left side of the website map.

8. The location is named for each particular Earthquake. Click on each location name, in order to be able to see the location's Longitude and Latitude. For example, "20.764°N 146.760°E". Mark a dot on the wall map in the classroom for that location.