Observation Sequences

Observation Sequence #1

When Parkfield Gets a Beach

Will part of California sink into the ocean after a massive earthquake? Probably not, however one of the main components of the theory of Plate Tectonics is that Lithospheric plates are constantly moving, shifting, being destroyed, and being regenerated. Depending on the conditions, these plates can move at a pace of 2-12 centimeters per year.

In this observation sequence, students determine how quickly the Pacific Plate is slipping past the North American Plate through the state of California. The city of Parkfield, along this boundary, is a hotbed of tectonic activity. Following the length of the fault southward to the Sea of Cortez, students measure the distance and use this to figure out how many years it would take for the two to reach each other.

Observation Sequence #2

The Wave Keeps On Rolling

On March 11, 2011, a massive tsunami wave roared across the Pacific Ocean. Centered near the Japan Trench, arching northward along the east coast of Japan, the wave spread rapidly to coastal communities in Japan, the Western Pacific, and beyond. Many communities were caught off guard and devastated. By understanding the anatomy of a tsunami wave and why/when it may occur, scientists can better prepare all coastal communities for future tsunami events.

In this observation sequence, students calculate the speed at which the wave is traveling from the given variables of the event. They will use the wave's speed to determine when it arrived at Sendai, Japan and Santa Cruz, California.

***Note: A calculator will be helpful for both Observation Sequences**

Sample Schedule

12:00	Connect: Welcome and Introduction
12:05	Theory of Plate Tectonics
12:15	Earthquake/Volcano Dynamics *Observation Sequence #1: When Parkfield Gets a Beach*
12:30	Tsunami Waves *Observation Sequence #2: The Wave Keeps On Rolling*
12:40	Monitoring and Safety
12:45	Questions and Answers
12:50	Disconnect

Observation Sequence #1: When Parkfield Gets a Beach

Instructions: Calculate the time it will take for Parkfield to come in contact with the Sea of Cortez.

Step 1: Estimate the total number of miles the Pacific Plate will have to move

Hint: measure the number of inches from the top of the Sea of Cortez to Parkfield and use the map legend to estimate miles

_____ inches x _____ miles per inch =_____miles
Total number of miles

Step 2: Convert miles to inches

Hint: 1 mile = 64,000 inches

_____ miles x 64,000 = _____ inches
Total number of miles Total number of inches

Step 3: Calculate the time it will take for the Plates to move the Sea of Cortez to Parkfield

Hint: The Pacific Plate and the North American Plates move 2 inches per year past each other

_____ inches ÷ 2 = _____
Total number of years

Observation Sequence #2: The Wave Keeps on Rolling

Scenario: On March 11, 2011, a 9.0 magnitude earthquake near the Japan Trench to the east of Japan triggered a devastating tsunami that swept across the Pacific Ocean.

Objective: To measure the wave speed of the tsunami and the time it took take to travel from the earthquake's epicenter to Sendai, Japan and Santa Cruz, California.

Earthquake Epicenter Statistics
- Latitude: 38 Degrees North
- Longitude: 142 Degrees East
- Sea Floor Depth: 3200 meters

Sendai, Japan
- Latitude: 38 Degrees North
- Longitude: 140 Degrees East
- Distance from Epicenter: 129 kilometers

Santa Cruz, California
- Latitude: 37 Degrees North
- Longitude: 122 Degrees West
- Distance from Epicenter: 5004 kilometers

Instructions: Based upon the variables for the scenario, use Equation 1 to determine wave speed. Then use the conversion table to change the units from *meters per second* to *kilometers per hour.* Use Equation 2 to determine the wave's travel time to the two cities. A calculator will be required.

Equation 1
t = square root (g x d) or t= (g x d) ½

t = *Speed* in meters per second
g = *Acceleration* of gravity ~ 10 meters per seconds squared (10m/s2)
d = *Depth* of Sea Floor

Equation 2
d = r x t

d = *Distance* from Epicenter to fixed coordinate
r = *Speed* of tsunami wave in meters per second (kilometers per hour)
t = *Time*, in hours, tsunami wave will take to reach fixed point

Conversion units
Meters to Kilometers: 1000 meters = 1 kilometer
Seconds to Hours: 3600 seconds = 1 hour
Seconds to Minutes: 60 seconds = 1 minute
Minutes to Hours: 60 minutes = 1 hours

Data

Speed in meters per second:

Speed in kilometers per hour:

Arrival time in Sendai:

Arrival time in Santa Cruz:

When Parkfield Gets a Beach

Observation Sequence #1 Map