

1. **DESCRIPTION:** Students will use process skills to complete tasks related to earthquakes and volcanoes.

A TEAM OF UP TO: 2

APPROXIMATE TIME: 50 minutes

2. **EVENT PARAMETERS:** Each team may bring one 8.5" x 11" two-sided page of notes containing information in any form from any source. Each participant may bring any kind of (non-graphing) calculator, but no other resources.

3. **THE COMPETITION:** Participants will be presented with one or more tasks, many requiring the use of process skills (i.e., observing, classifying, measuring, inferring, predicting, communicating, and using number relationships-source: AAAS) for any or all of the following topics:

- Types of volcanoes: shield, cinder cone, composite (stratovolcano), lava dome
- Relate volcano type to kinds of eruptions: explosive, effusive, submarine
- Volcanic hazards including pyroclastic flows, lahars, volcanic gases, lava flows, ash, landslides
- Volcanic features including calderas, crater lakes, lava plateaus, geysers, hot springs, volcanic plugs
- Relate rock type to kinds of eruptions, plate boundaries, and hot spots
- Seismograms and characteristics of Primary (P), Secondary (S), Love (L) seismic waves
- Earth's interior: boundaries and characteristics of inner core, outer core, mantle, lithosphere, Moho
- Features and characteristics of thrust, normal, and reverse faults
- Measuring ground movement and assessing damage: Mercalli Scale, Richter Scale (Seismic Moment)
- Emergency preparedness
- Climate change as related to volcanic activity
- Topographic map skills as related to earthquake and volcanic hazards
- Plate boundaries: convergent, divergent, transform
- Features at various plate boundaries including earthquake patterns, mid-ocean ridges, subduction zones, volcanic arcs and mountains, trenches, mountain ranges
- Evidence of continental drift including, but not limited to, matching fossils, rock types, shape of continents, mountain ranges
- Evidence of sea floor spreading including the age of rocks and patterns of magnetic reversals on either side of mid ocean ridges
- Tsunamis: generation, propagation and risk

4. **REPRESENTATIVE TASKS:**

- Calculate the rate of sea floor spreading using information found on the map of Hawaii, i.e. age of island vs. distance from hot spot; or age and distance from mid ocean ridge
- Interpret isoseismic lines to determine damage and location of epicenter
- Calculate velocity of P wave given travel time and distance
- Use graphs of P & S wave travel time to determine epicenter distance and location of epicenter
- Calculate origin time of an earthquake based on travel time and arrival times of P & S waves
- Topographic map skills - calculate gradient of slope of volcano; draw profile of Mt. St. Helens before and after the 1980 eruption, formation of new features
- Match a cross sectional model of a plate boundary with type of plate boundary observed on world map
- Predict likely path of mud or pyroclastic flows given a map with historic data

5. **SCORING:** Points will be awarded for the quality and accuracy of responses. Ties will be broken by the accuracy and/or quality of answers to pre-selected questions.

SUGGESTED RESOURCES: Websites: <http://earthquake.usgs.gov/learning/>;
<http://nemo.sciencecourseware.org/VirtualEarthquake/>; <http://www.earth2class.org/>;
<http://pubs.usgs.gov/gip/dynamic/dynamic.html>; <http://vulcan.wr.usgs.gov/>;

Books: Tarbuck, Edward J. and Frederick K. Lutgens, *Earth Science*. Prentice Hall, 2006. ISBN-10: 0131258524; Spaulding, Nancy E. and Samuel N. Namowitz. *Earth Science*. McDougal Littel. 2005. ISBN 0-618-49938-5; Decker, Robert and Barbara Decker, *Volcanoes*, W. H. Freeman. 1997. ISBN 0716724405; Bolt, Bruce A. *Earthquakes*. W. H. Freeman. 1992, ISBN 0716722364

NATIONAL SCIENCE EDUCATION STANDARDS: Content Standard D. Structure of the Earth System; Earth's history.