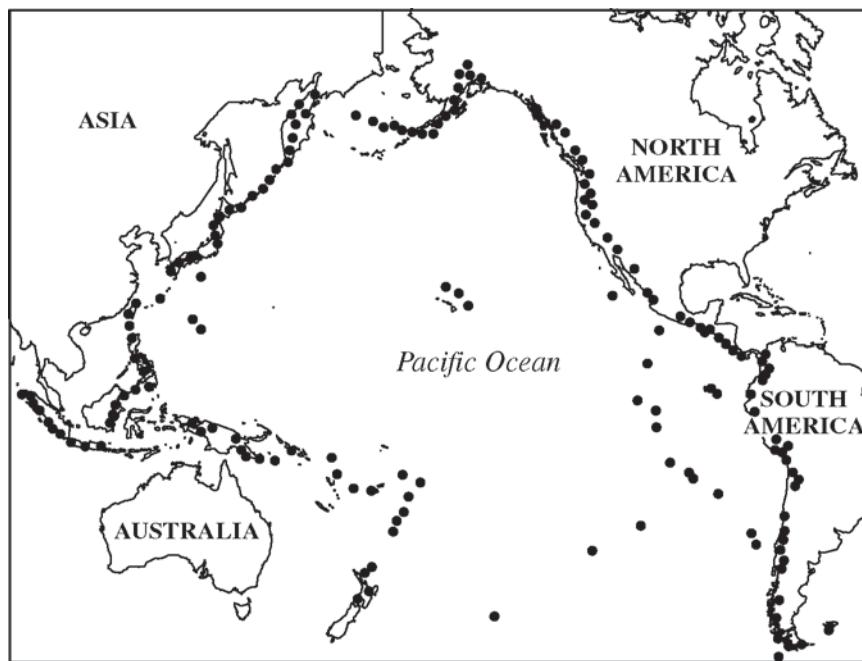


## 2014 AP® ENVIRONMENTAL SCIENCE FREE-RESPONSE QUESTIONS



3. Plate-tectonic theory states that the Earth's lithosphere is broken into very slowly moving pieces or plates. Plate movements over vast stretches of time have led to the current orientation of our continents and oceans. Individual events along plate boundaries, such as earthquakes and volcanic eruptions, pose periodic threats to human activity and ecosystems. The "Ring of Fire" is a term that describes the location of increased seismic and volcanic activity around the margins of the Pacific Ocean basin. On the map above, each dot represents a volcano or an earthquake.
- (a) Japan, Indonesia, and the Philippines are examples of volcanic island chains that have formed along subduction zones between plates in the western Pacific.
- (i) **Describe** what happens when two tectonic plates collide along a subduction zone.
- (ii) **Explain** how subduction leads to volcanic activity.
- (b) Although the landscape following a volcanic eruption may appear unable to support ecological communities, over time the area can be transformed through succession.
- (i) What is primary succession?
- (ii) **Explain** how primary succession can lead to soil formation on a newly formed volcanic landscape.
- (c) In addition to volcanic activity, highly destructive tsunamis are generated along Pacific Plate subduction zones.
- (i) **Explain** how a tsunami is generated along a subduction zone.
- (ii) **Describe** one negative ecological impact that tsunamis have on coastal environments.
- (d) Southern California experiences periodic devastating earthquakes along the San Andreas Fault, which is a transform boundary located along the eastern edge of the Pacific Plate.
- (i) **Describe** what happens to the tectonic plates along a transform boundary at the moment when an earthquake occurs.
- (ii) **Describe** what happens to the tectonic plates along a transform boundary during the time between earthquakes.

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**Question 3**

**(a) Japan, Indonesia, and the Philippines are examples of volcanic island chains that have formed along subduction zones between plates in the western Pacific.**

**(i) Describe what happens when two tectonic plates collide along a subduction zone.**

*(1 point for a correct description of plate movement in a subduction zone)*

- One plate is pushed beneath the other, or equivalent description
- A trench may be formed at the subduction zone

**(ii) Explain how subduction leads to volcanic activity.**

*(2 points: 1 point for a correct explanation of one plate being pushed down and melted and 1 point for a correct explanation of molten material/magma rising to the surface near the zone)*

**(b) Although the landscape following a volcanic eruption may appear unable to support ecological communities, over time the area can be transformed through succession.**

**(i) What is primary succession?**

*(1 point for a correct description of the establishment of organisms where bare rock/ash/sand/inorganic substrate, or no soil previously existed)*

**(ii) Explain how primary succession can lead to soil formation on a newly formed volcanic landscape.**

*(2 points: 1 point for a correct explanation of the role of organisms in physically/chemically weathering rock and 1 point for a correct explanation of the role of organisms and decomposition in soil formation over time)*

**(c) In addition to volcanic activity, highly destructive tsunamis are generated along Pacific Plate subduction zones.**

**(i) Explain how a tsunami is generated along a subduction zone.**

*(2 points: 1 point for a correct explanation of tsunami generation resulting from an underwater earthquake and 1 point for a correct explanation of rapid water displacement leading to tsunami formation)*

**(ii) Describe one negative ecological impact that tsunamis have on coastal environments.**

*(1 point for a correct description of a negative ecological impact; only the first description given can earn points)*

- Destruction of/loss of habitat such as mangrove forests, coral reefs, etc.
- Flooding resulting from tsunami waves can create saltwater intrusion into coastal ecosystems
- Drowning of terrestrial species

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**Question 3 (continued)**

**(d) Southern California experiences periodic devastating earthquakes along the San Andreas Fault, which is a transform boundary located along the eastern edge of the Pacific Plate.**

**(i) Describe what happens to the tectonic plates along a transform boundary at the moment when the earthquake occurs.**

*(1 point for a correct description of the movement of plates when an earthquake occurs)*

- A large amount of energy is released
- Plates suddenly/rapidly slide past each other in opposite directions

**(ii) Describe what happens to the tectonic plates along a transform boundary during the time between earthquakes.**

*(1 point for a correct description of tectonic plates along transform faults binding or locking-up causing pressure to build up over time)*