Nat Sci 102	Name:
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The high temperature inside Earth causes material at the bottom of the mantle to become hot, expand, and rise toward the surface. The mantle material then cools and sinks, resulting in a circular motion of material moving beneath Earth's surface. This circulation of mantle material causes the continental and oceanic plates to move across Earth's surface. At various locations on Earth's surface, we are able to observe plates colliding, plates separating, and plates moving horizontally.

The drawing below shows a cross section of Earth's surface and its underlying mantle. At this particular location of the surface, the dense oceanic plate is being forced beneath the less dense continental crust. The dense oceanic plate experiences higher temperatures (and pressures) as it is forced deeper into the mantle. This interaction between the oceanic plate and continental plate causes molten material to move upward through the continental plate until it breaks the surface in the form of volcanoes.



Oceanic to Continental Plate Convergence Zone

1) In the drawing above, which way (right or left) are the oceanic and continental plates moving?

Continental: <u>Left</u>

2) Which is hotter, the piece of mantle material at Position A or the piece of mantle material at Position D? Explain your reasoning.

Position D is hotter because it is deeper and closer to the Earth's hot core.

3) Which piece of mantle material is moving up? <u>D</u> (A, B, C, or D) Which is moving down? <u>B</u> Which to the left? <u>C</u> Which to the right? <u>A</u>

- 4) Consider the following statements made by two students debating why the oceanic and continental plates move.
 - **Student 1:** The material at position D is moving upward toward the surface because it has been heated and has expanded. Its density is less than the density of the material above it, so it rises to float on top. If the interior heat of the earth went away, this heating would stop, the motions of the mantle material would be stilled, and the plates would stop moving.
 - **Student 2:** I disagree. The stirring is being influenced by the friction of the plates as they move over surface; otherwise the bubbling you are talking about would just break up the continents rather than moving them. The whole process must depend somehow on the original motions of the continents.

Do you agree or disagree with either or both of the students? Why?

Student 1's explanation is correct. Student 2 is partially correct but the continents have enough strength that the "bubbling" can't break them up so no appeal to "original motions" is needed.

5) Just beneath *point I* on the drawing is a tropical island. What will eventually happen to the island as the oceanic plate moves? Why?

The island will eventually be carried under the continental plate as the oceanic plate to which it is attached is moving towards the continent and is moving downwards where it collides with the continental plate.

6) Consider the image below of the rocky and crater-covered Moon. Can you tell if it is an old or a young surface? Why? Do you see any evidence of plate motions (faults, places where sections are riding over or under other sections)? Do you think the Moon has an active, hot and molten interior or an inactive, cold and solid interior? Why?

The Moon's surface is very old because it has a large number of craters. No fault lines have been observed in the Moon's surface so there is no evidence for plate

motions. The lack of fault lines and large number of craters imply that the surface is not moving or being refreshed so the Moon 's core is inactive, cold, and solid.

