WHAT ON EARTH IS PLATE TECTONICS?

The Earth is covered by a thin skin of solid crust and uppermost mantle called the lithosphere. The lithosphere is broken up into interconnected slabs that geologists call plates. Plate tectonics is the theory that describes how these plates move about and interact with each other at their boundaries.

To find out more about plate tectonics works, start with the explanation and diagram and explanation labeled ①.

1) There are two basic types of lithosphere, CONTINENTAL and OCEANIC. Continental lithosphere is made of relatively light-weight minerals, so it has a low density. Oceanic lithosphere is more dense than continental lithosphere because it is composed of heavier minerals. A single plate may be partly oceanic and partly continental lithosphere.

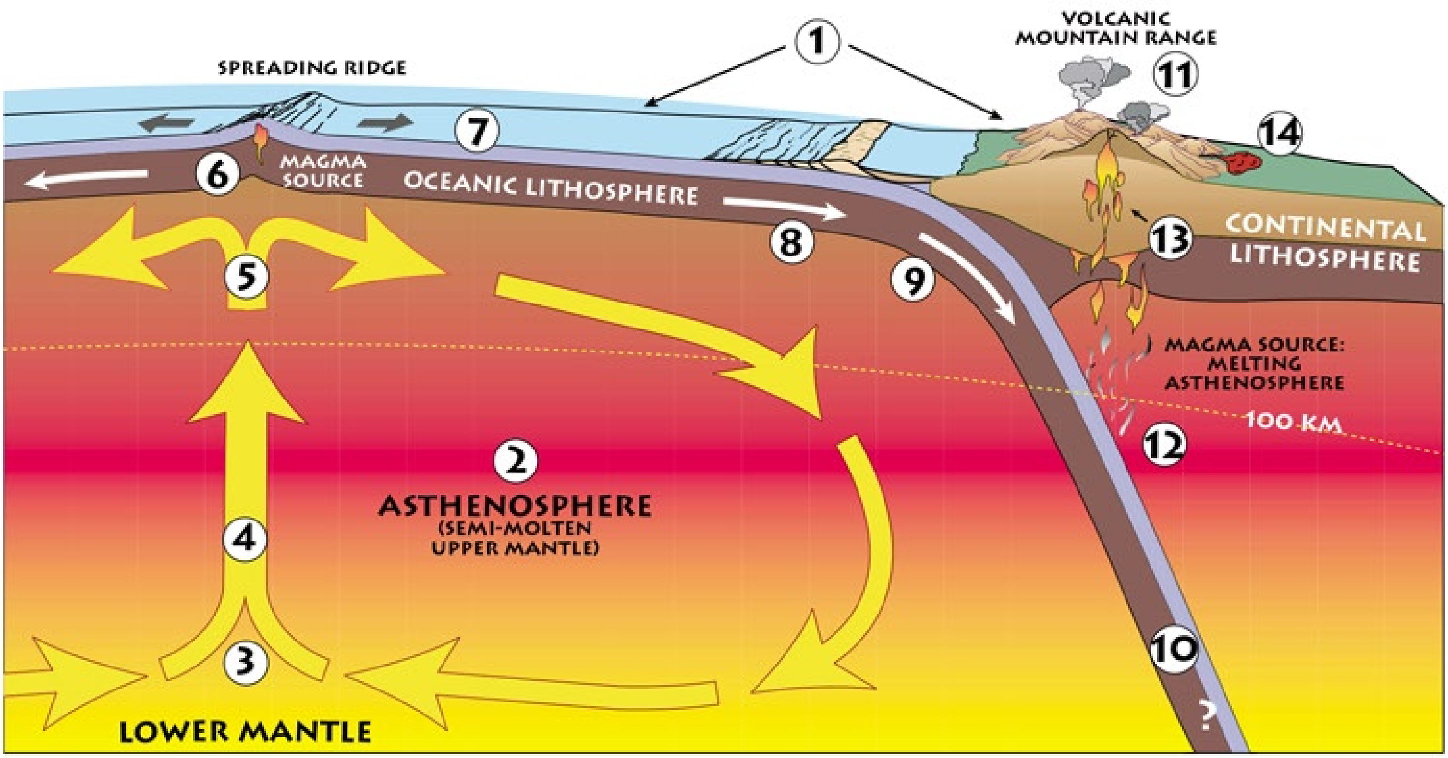
2) Beneath the lithospheric plates lies a layer semi-molten rock called the ASTHENOSPHERE. The asthenosphere is more dense than either continental or oceanic lithosphere. This means that the plates are floating on top of the asthenosphere.

3) Deep within the asthenosphere the pressure and temperature are so high that the rock softens and partially melts. This softened, dense rock can flow very slowly (think of Silly Putty). Where temperature instabilities exist near the core/mantle boundary, slowly moving CONVECTION CURRENTS may form within the semi-fluid asthenosphere

4) Convection currents bring hot material from deeper within the mantle up toward the surface. .

5) Convection currents diverge where they approach the surface. The diverging currents exert a weak tension or "pull" on the plate above it. Tension and high heat flow weakens the floating, solid plate, causing it to break apart. The two sides then move away from each other in opposite directions, forming a DIVERGENT PLATE BOUNDARY.

6) The 'gap' between these diverging plates fills with molten rock from below. Sea water cools the molten rock, which quickly solidifies, forming new oceanic lithosphere. This continuous process builds a chain of volcanoes and rift valleys called a MID-OCEAN RIDGE or SPREADING RIDGE.



7) Little by little, as new molten rock is extruded at the mid-ocean ridge, the newly created oceanic lithosphere moves away from the ridge where it was created.

8) As distance from the hot spreading ridge increases, the oceanic plate cools down. The colder the oceanic plate gets, the denser ('heavier') it gets. Eventually the edge of the plate that is farthest from the spreading ridge cools so much that it becomes more dense than the asthenosphere beneath it.

9) As you know, denser materials sink, and that's exactly what happens to the oceanic plate—it starts to sink into the asthenosphere! Where one plate sinks beneath another a SUBDUCTION ZONE forms.

10) The sinking leading edge of the oceanic plate actually 'pulls' the rest of the plate behind it—evidence suggests this is the main driving force of SUBDUCTION. Geologists are not sure how deep the oceanic plate sinks before it melts, but we do know that it remains solid far beyond depths of 100 km beneath the Earth's surface.

11) Subduction zones are one type of CONVERGENT PLATE BOUNDARY, the type of plate boundary that forms where two plates converge. Notice that although the cool oceanic plate is sinking, the buoyant continental plate floats like a cork on top of the more dense asthenosphere.

12) When the subducting oceanic plate sinks deeper than about 100 kilometers below the Earth's surface, huge temperature and pressure increases cause water and other volatile gasses trapped in the minerals of sinking plate to be released. These gasses work their way upward, MELTING THE MANTLE above the subducting plate.

13) The newly generated molten mantle is less dense than the surrounding rock, so it rises toward the surface. On its way upward, dense minerals solidify from the magma and are left behind, making the magma increasing less dense as it approaches the Earth's surface. Most of the molten rock cools and solidifies in magma chambers far below the Earth's surface. Large INTRUSIVE rock bodies that form the backbones of great mountain ranges such as the Sierra Nevada form by this process.

14) Some molten rock may break through the Earth's surface, instantly releasing the huge pressure built up in the gas-rich magma chambers below. Gasses, lava and ash explode out from the surface breach. Over time, layer upon layer of erupting lava and ash build volcanic mountain ranges above the simmering cauldrons of crystals and magma below.