Background Information for Parents- Earth's Layers and Plate Tectonics

I. Earth's Layers

The Earth is composed of three distinct layers: crust, mantle, and core. Each of these layers is easily identified from the other on the basis of temperature, density and composition.

· *The Crust*

The outermost layer of the Earth is the *crust*. Depending on location, the crust ranges from 5 – 60 kilometers in depth. There are two types of crust—thinner and more dense oceanic crust and thicker and less dense continental crust.

· *The Mantle*

The next layer of the Earth, the *mantle*, is the largest layer of the Earth. It is 2900 km in depth, making it the thickest layer. Sixty-seven percent of the Earth's mass is located in the mantle. The mantle is a solid layer which has temperatures as high as 2800º F, and is denser than the crust.

· *The Core*

The innermost layer of the Earth is known as the *core*. It is the densest and most hot layer of the Earth. Geologists believe the Earth's core is made mostly of iron with smaller amounts of nickel. The core is divided into two parts—the *outer core* and the *inner core*. The inner core—the center of Earth – is solid due to high amounts of pressure. The outer core is liquid and consists mainly of iron, some nickel, and about ten percent sulphur and oxygen. The outer core and inner core together are responsible for the processes that produce Earth's magnetism.

II. Plate Tectonics

Earth's plates move relative to one another as they "float" on the asthenosphere. The plates move because of convection currents in the mantle. As the mantle heats up near the core, molten rock becomes less dense, rising towards the top of the mantle, where it cools, becomes more dense, and sinks again. The convection current drags the plates along, causing them to separate at some plate boundaries and converge at others. The average rates of motion range from less than 1 cm to more than 15 cm per year. Nearly all the world's earthquake and volcanic activity occurs along or near boundaries between the plates.

The development of the theory of plate tectonics began in 1912 when Alfred Wegener proposed his theory of continental drift. He suggested that the continents were once all attached in a single landmass he called Pangaea (Greek for 'all earth'). Over time, this mass broke apart and drifted to separate places on the globe. Evidence to support this included the shape of the continents, the existence of similar fossils on different continents, matching rock types and geologic structures and proof of ancient climate patterns. Wegener's ideas were very controversial because he didn't have an explanation for how or why the continents moved. As a result, few people accepted his views and his theory was discounted. In 1960 Harry Hess used evidence he found, along with the work of other scientists, to propose that the movement of the continents was the result of the sea floor spreading. In 1962, he proposed the mechanism to account for Wegener's moving continents: convection currents in the mantle.

III. Plate Boundaries

There are three types of plate boundaries found at the edge of the plates:

- divergent
- convergent
- transform

A divergent boundary, also known as a rift zone, occurs where two plates are moving away from each other. As the two plates part, mid-ocean ridges are created as magma wells up through the cracks and cools to form new crust. As the plates move, the ocean basin expands and a ridge system of mountains is created. Divergent boundaries are responsible for the motion driving the plates.

A convergent boundary is where two plates come together. There are two types of convergent boundaries. A subduction zone occurs when a denser oceanic crust converges with and sinks under less dense continental crust. Subduction zones are the location of very strong earthquakes and volcanic activity. The 'Ring of Fire' around the margins of the Pacific Ocean is due to the subduction zones found at the edges of the Pacific plate. When there is a convergent boundary between two continental plates we call this a buckling zone. The two continental plates push into each other and create a high mountain range. The Himalayas in India are the result of the Indo-Australian and the Eurasian plates colliding head on.

A transform boundary (or zone) occurs where two plates slide past each other. The San Andreas fault in California is a transform boundary where the North American and Pacific plates are moving past each other. Earthquakes occur as a result of the accumulation and subsequent release of energy as the plates slide past each other.