Plate Tectonics concept 2.1

1. How Does Earth’s Interior Structure Affect Changes on Earth’s Surface?
   1. Earth is constantly changing.
      1. We cannot see what is going on under Earth’s surface, but we can see the effects of these invisible activities.
      2. Volcanoes are just one window into the world of tectonic activity.
      3. Earth’s tectonic plates also cause earthquakes, landslides, the formation of mountains, and the formation of islands, among other things!
   2. (Remember that tectonic plates are giant slabs of Earth’s lithosphere. These “plates” move slowly around the planet’s surface over millions of years.)
2. What Are Tectonic Plates, and How Do They Move?
3. Earth’s interior is divided into layers.
   1. Each layer has different physical and chemical properties and responds differently to heat and pressure.
      1. Earth’s topmost layer is its crust.
      2. Beneath the thin crust is a much thicker layer: the mantle.
      3. The crust and the cool, brittle top of the mantle are called the lithosphere.
      4. The lithosphere is divided into tectonic plates.
   2. Beneath the lithosphere, Earth’s mantle—though still solid—behaves more like a fluid.
      1. Scientists divide this fluid-like region into the asthenosphere and the mesosphere.
      2. This rising and sinking (from the heating and cooling inside Earth) happens in cycles called convection currents. Convection reshapes the rock in the asthenosphere.
      3. As the asthenosphere moves, the tectonic plates that make up the lithosphere move with it.
      4. Different plates move in different directions.
   3. tectonic plates move extremely slowly:
      1. less than 2.5 centimeters per year. (The fastest plates move about 15 centimeters per year.)
      2. All the continents were once together in a landform known as Pangea
      3. Africa and South America are located on plates that are moving apart, but other plates are coming together. Still others are sliding past each other.
      4. All these different movements have profound effects on Earth’s surface.

III. How Do the Three Primary Types of Plate Boundaries Cause Different Landforms?

1. The lithosphere is divided into dozens of tectonic plates,
2. The region where any two plates meet is called a boundary. .
3. Scientists classify plate boundaries into three main categories,
   1. Convergent: At a convergent boundary, two plates move toward each other.
   2. Divergent: At a divergent boundary, two plates move away from each other. New crust forms in the gap between the plates.
   3. Transform: At a transform boundary, two plates slide horizontally past each other. Unlike at a divergent boundary, the plates remain in contact and new crust does not form.
4. Divergent Boundaries
   1. When a divergent boundary forms along the sea floor, both plates consist of oceanic crust.
      1. As the plates separate, magma rises between them, cools, and hardens into new rock making a mid-ocean ridge.
   2. Divergent boundaries also happen on land where plates of continental crust move apart.
      1. The force of this pressure creates additional cracks, or rifts, in the crust.
      2. Land between the plates sinks to produce a rift valley.
5. Convergent Boundaries
   1. What happens at a convergent boundary depends on density.
      1. oceanic crust is denser than continental crust.
      2. When an oceanic plate collides with a continental plate or with an oceanic plate that is less dense, the boundary becomes a subduction zone.
         1. The denser plate is destroyed as it is forced down into Earth’s mantle.
         2. (The verb subduct is related to words that mean “to withdraw or take away.”)
         3. Deep trenches run alongside subduction zones, and tall mountains may form on the other side as the less dense plate rises.
      3. Subduction zones and trenches also form at convergent boundaries between two oceanic plates.
      4. Chains of volcanic islands typically rise above these boundaries.
      5. The third type of convergence also forms mountains.
         1. When two plates of continental crust collide, neither plate is dense enough to be forced down.
         2. Instead, both plates are forced up.
6. Transform Boundaries
   1. Because crust is neither created nor destroyed at transform boundaries, they do not produce characteristic landforms.
   2. As two plates grind past each other, sections of rock may become temporarily “stuck,” like the coils of a compressed spring. The pressure increases until the rocks shake free.
   3. When this happens, earthquakes occur.
7. Three Specific Landforms
8. Some of Earth’s most spectacular features are the result of tectonic forces.
   1. Mid-Atlantic Ridge
   2. Himalaya Range looms as evidence of convergent plate motion.
   3. A transform boundary called the San Andreas Fault extends along the Pacific coast for more than 1,200 kilometers. The plate movement is literally splitting California into pieces. In about 15 million years, the cities of Los Angeles and San Francisco will be side by side. In about 85 million years, Los Angeles will be adjacent to Alaska.

IV. How Are the Rock Cycle and Plate Tectonics Related?

1. The rock cycle describes how the three main types of rocks are formed over time.
   1. Igneous rocks consist of molten rock that has cooled and solidified. This may happen below ground (to magma) or above ground (to lava).
   2. Metamorphic rocks form when heat or pressure causes existing rock to undergo chemical changes. Metamorphism produces new rock with a different chemical composition from before.
   3. Sedimentary rocks consist of bits of rock and other materials, called sediments, that have been compacted or cemented together.
2. Processes in the rock cycle may transform any type of rock into another type.
3. Plate tectonics is a crucial part of the rock cycle.
   1. Magma that rises from Earth’s asthenosphere through gaps between tectonic plates may harden to form new crust.
   2. This crust is igneous rock.
   3. Plate motion at a convergent boundary may uplift rock that has been buried underground, exposing it to wind and flowing water.
      1. These agents gradually weather, erode, and deposit the rock as sediment.
      2. As layers of sediment build up over time, the increased pressure may form sedimentary or metamorphic rock.
   4. Plate motion at a subduction zone forces crustal rock down into Earth’s asthenosphere.
      1. There, heat and pressure may form metamorphic rock, or it may melt the rock completely.
      2. The molten rock may then cool and resolidify as new igneous rock.
   5. If Earth’s plates did not move, rocks would be distributed very differently throughout the crust.
      1. Igneous rocks would cluster around volcanoes.
      2. Sedimentary rocks would remain where gravity carries sediments—at the bottom of valleys and water bodies.
      3. Metamorphic rocks would be rare at Earth’s surface because heat and pressure are not great enough to cause metamorphism there.
   6. In reality, tectonic forces constantly cycle rocks around Earth, above ground and below. As a result, the three main rock types can be found all over the planet. Even so, certain rocks are much more abundant than others.