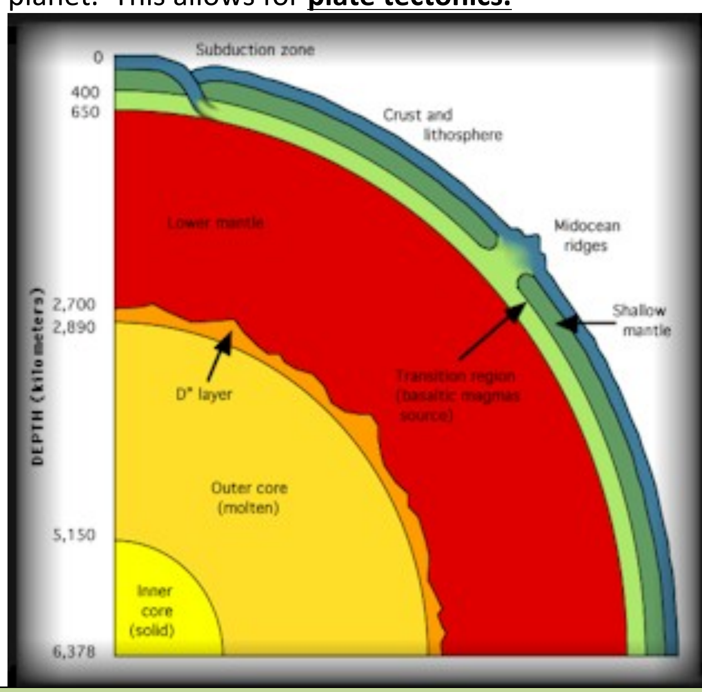
"Igneous and Metamorphic Rocks"
Newcomer Academy
Visualization Four

Chapter	Subtopic/Media	Key Points of Discussion	Notes/Vocabulary
Introduction	**Title** Various Pictures of Igneous and Metamorphic Rocks	NA	NA
One Rock to Another	**Composition of the Earth** Various Images of each layer	The Earth is a layered rocky planet. The rocky portion of the Earth is its outermost layer the **crust**. The crust varies in thickness from 10 km (in the ocean) to 50 km (mountains). Under the crust is the **mantle**. It is 4200 km deep and it made of solid rock. Deep inside the Earth is a two-layered core. The molten **outer core** is composed of iron-nickel, and the **inner core** is made of solid iron. The crust and the uppermost region of the mantle make up the **lithosphere**, the dynamic surface of our planet. This allows for **plate tectonics.** 	Crust Mantle Outer Core Inner Core Lithosphere Plate Tectonics
	Video clip of the layers and composition of the Earth		
	Igneous Rocks Various images of different rock samples	**Igneous rocks** were the first rocks to form on the Earth. They form from molten Earth material. In the beginning the Earth was a planet of molten, seething mass. It took millions and millions of years for it to cool and form a crust of igneous rock.	Igneous Rock

	Still images of intrusive and extrusive Magma vs. Lava images Video clip of igneous rock formation Still images of composition and texture	Igneous rocks can form above and below the surface of the Earth. The rocks that form below the surface are made from the **magma** and are called **intrusive** (HINT: "IN"trusive = IN the Earth). These rocks intrude into the crust, but do not break the surface. When magma breaks through the surface of the planet it is called **lava**. When lava cools it becomes a type of igneous rock called **extrusive**. Because the rocks cool so quickly that the crystals don't have time to grow large in size. (Obsidian, a glassy rock, cools so quickly that no crystals form at all) New extrusive rocks are forming right now on the big island of Hawaii. Igneous rocks are identified by their **composition** (mineral content) and **texture** (size of crystals). Rocks that cool slowly have large crystals (e.g. pegmatites are intrusive, igneous rocks that form in dikes). When rocks cool slowly, the crystals are small and may not form at all (e.g. Obsidian from above).	Magma Intrusive Lava Extrusive Composition Texture
	Metamorphic Rocks Various pictures of metamorphic rock samples Pictures of rock features	**Metamorphic rocks** are rocks that have been changed by heat and pressure. **Regional metamorphism** is when metamorphic rocks are formed in a region of mountain building. Example Shale into Gneiss: 1. Mud is deposited into a bay. The mud contains shells and leaves which in time become fossils. The mud compresses and more layers of sediments deposit on top of it. The layer becomes shale, a sedimentary rock. 2. (Low-grade Metamorphism) Shale into Slate: Mountain Building forces begin deep below the sedimentary rocks. Pressure lifts, folds, and distorts the shale layers. It becomes harder, and the fossils may be destroyed. The **pressure** increases, creating **heat** in the rocks. Heat and pressure turn the shale into a new rock, slate. 3. (Medium-grade) Slate to Schist: A magma intrusion continues to build under the slate and the pressure and temperature continues to rise. The minerals in the slate realign to form schist.	Metamorphic Rock Regional Metamorphism Heat Pressure

		4. (High-grade) Slate to gneiss: Increased heat and pressure with the introduction of a super-heated fluid containing new chemicals **transforms** the slate into a course grained rock called gneiss. If the heat and pressure increase, the rock will become magma. **Contact metamorphism** occurs when existing rocks come in contact with magma pushing through Earth's crust or with lava flows on the surface. The contacted rock bakes and changes. Metamorphic rocks can be recognized by certain features: **Foliation** – mineral crystals flatten and arrange themselves along a plane (regional metamorphism – e.g. schist and gneiss) **Crystallinity** – Randomly arranged, coarse crystals that are fused together (e.g. compare sandstone and quartzite/metamorphosed sandstone). Mineral **composition** – minerals commonly found are garnet, kyanite, pyrite, and brucite.	Transforms Contact Metamorphism Foliation Crystallinity Composition
	Video Clip of Metamorphic Rock formation		
	The Rock Cycle	**IGNEOUS:** Granite, Igneous Rock, forms beneath the Earth's surface. A mountain-sized body of granite, a **batholith**, forms. **Forces** push the granite upward, eventually exposing it at Earth's surface. **SEDIMENTARY:** The exposed granite weathers and is **eroded** by water, wing, and ice, reducing the granite to sediments. The sediments deposit in a basin some distance from the granite source. Over time sand-sized particles of quartz may be **cemented** together, forming sandstone. **METAMORPHIC:** Sandstone may get buried deeper and deeper under layers of sediment. The depth results in increased heat and pressure (metamorphoses). The sandstone then changes into quartzite.	Rock Cycle Batholith Force(s) Eroded Cemented

<table>
<tr>
<td rowspan="2">Closure</td>
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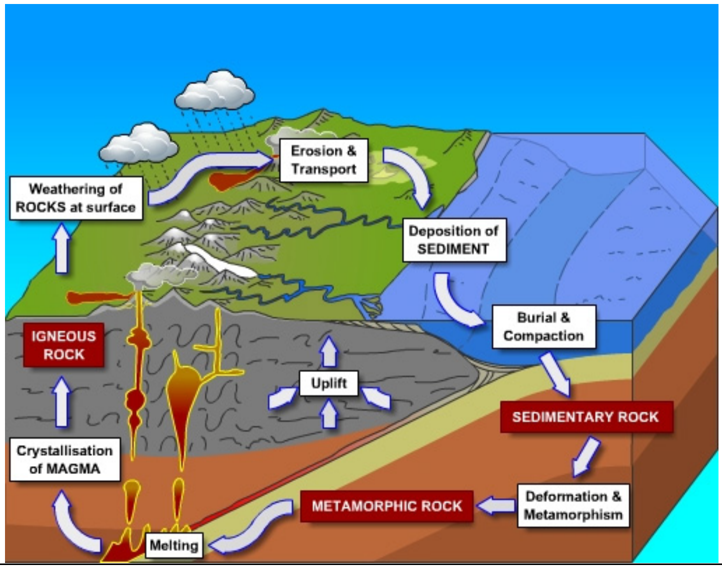
<td>The quartzite is pressed down into the mantle and melts. The quartzite becomes part of the magma and is ready to be pushed up, crystallizing as basalt or granite.

NOTE: Rocks can go from one form to the other without following the exact sequence (from above). All rocks begin as igneous and end in metamorphosis back to a molten state.

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<td>Our Dynamic Earth

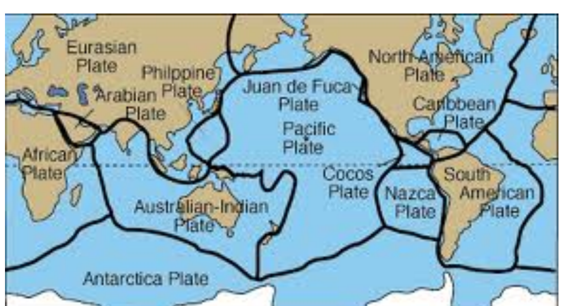
Still images of Earth divided into plates

Animated SOS of all water drained from Earth to expose plate boundaries in the ocean

Animated SOS of Plate tectonic shifts from Pangea to today</td>
<td><u>Plate tectonics</u> is the movement of the crustal plates (<u>lithosphere</u>) atop the <u>asthenosphere</u>. There are large continental plates and many smaller plates that make up the Earth's crust.

<u>Uplifting</u> is caused when continental plates collide with one another. This causes mountains to form at boundaries.

The lithosphere is continually being created by volcanos and openings in the oceanic crust. <u>Convection currents</u> cause the plates to continually break away from one another, thus making new crust from the newly exposed molten rock.



Major tectonic plates of the world.</td>
<td>Plate tectonics

Lithosphere

Asthenosphere

Uplifting

Convection Currents</td>
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<td colspan="4">Reinforcement Movie Clip: In the above chapter/subtopic – Highlighting the entire rock cycle and the dynamic Earth with plate tectonics and the resulting land features/rocks</td>
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