**THE ROCK CYCLE**

**Rocks tell the story of the Earth**

The Earth is made of rock, from the tallest mountains to the floor of the deepest ocean. Thousands of different types of rocks and minerals have been found on Earth. Most rocks at the Earth’s surface are formed from only eight elements (oxygen, silicon, aluminum, iron, magnesium, calcium, potassium, and sodium), but these elements are combined in a number of ways to make rocks that are very different.

Rocks are continually changing. Wind and water wear them down and carry bits of rock away; the tiny particles accumulate in a lake or ocean and harden into rock again. The oldest rock that has ever been found is more than 3.9 billion years old. The Earth itself is at least 4.5 billion years old and rock forming and rock-destroying processes have been active for billions of years. Types of Rocks Geologists classify rocks in three groups, according to the major Earth processes that formed them. The three rock groups are igneous, sedimentary, and metamorphic rocks

**Igneous Rocks** Igneous rocks are formed from melted rock that has cooled and solidified. When rocks are buried deep within the Earth, they melt because of the high pressure and temperature; the molten rock (called magma) can then flow upward or even be erupted from a volcano onto the Earth’s surface (extrusive rocks).

When magma cools slowly, usually at depths of thousands of feet, crystals grow from the molten liquid, and a coarse-grained rock forms. When magma cools rapidly, usually at or near the Earth’s surface, the crystals are extremely small, and a fine-grained rock results. A wide variety of rocks are formed by different cooling rates and different chemical compositions of the original magma. Obsidian (volcanic glass), granite, basalt, and andesite porphyry are four of the many types of igneous rocks with different textures. The texture of a rock refers to the size, shape, and arrangement of its mineral grains, or crystals.

Common igneous (volcanic rocks) are basalt, andesite, and rhyolite. When magmas crystallize deep underground they look different from volcanic rocks because they cool more slowly and, therefore, have larger crystals. Igneous rocks cooled beneath the Earth’s surface are called intrusive (plutonic) rocks. The intrusive equivalents of basalt, andesite, and rhyolite are gabbro, diorite, and granite, respectively.

**Sedimentary Rocks** Sedimentary rocks are formed at the surface of the Earth, either in water or on land. They are layered accumulations of sediments: fragments of rocks, minerals, or animal or plant material. Temperatures and pressures are low at the Earth’s surface, and sedimentary rocks show this fact by their appearance and the minerals they contain. Most sedimentary rocks become cemented together by minerals and chemicals or are held together by electrical attraction; some, however, remain loose and unconsolidated. The layers are normally parallel or nearly parallel to the Earth’s surface. Compacted and dried mud flats harden into shale. Common sedimentary rocks include sandstone, limestone, and shale.

These rocks often start as sediments carried in rivers and deposited in lakes and oceans. When buried, the sediments lose water and become cemented to form rock.

**Metamorphic Rocks** Sometimes sedimentary and igneous rocks are subjected to pressures so intense or heat so high that they are completely changed. They become metamorphic rocks, which form while deeply buried within the Earth’s crust.

The process of metamorphism does not melt the rocks, but instead transforms them into denser, more compact rocks. New minerals are created either by rearrangement of mineral components or by reactions with fluids that enter the rocks. Some kinds of metamorphic rocks, “granite gneiss” and “biotite schist” are two examples, are strongly banded or foliated. (“Foliated” means the parallel arrangement of certain mineral grains that gives the rock a striped appearance.) Pressure or temperature can even change previously metamorphosed rocks into new types.

Common metamorphic rocks include schist, marble, and gneiss. Sedimentary rock shale (formed mostly of clay sediments) when buried and heated to high temperatures (300-500˚C) becomes transformed or metamorphosed into schist.

No rock is permanent over geologic time; instead, all rocks change slowly from one of the three rock types to another. This continuous process is called the rock cycle. The transformations from one rock type to another can follow many different paths. For example, weathering may reduce a metamorphic rock to sediment, which then becomes cemented to form a sedimentary rock. An igneous rock may be metamorphosed. The rock cycle simply expresses the idea that rock is not permanent but changes over geologic time.

Exercise 1:

The oldest rock that has ever been found is less than 3.9 billion years old.

2. The process of metamorphism melts the rocks.

3. Volcanic rocks cool rapidly, so are fine-grained.

4. Compacted and dried mud flats harden into schist.

5. The intrusive equivalent of basalt is diorite.

6. The extrusive equivalent of granite is rhyolite.

Exercise 2:

A (An) ……………….. igneous rock forms when magma erupts and solidifies on the Earth’s surface.

a) intrusive b) extrusive c) magmatic d) coarse grain

2. Diorite is the ……………….. equivalent of andesite.

a) magmatic b) fine grain c) plutonic d) igneous rock

3. Weathering may reduce a metamorphic rock to ………………..

a) sediment b) igneous rock c) schist d) rock cycle

4. When magma cools slowly, crystals grow from the ……………….. liquid.

a) magma b) intrusive c) cooling d) molten

5. Igneous rocks form when a hot, molten liquid called magma ………………..

a) solidifies b) intrusive c) lithification d) weathered

6. Pressure or temperature can even change previously metamorphosed rocks into new ………………..

a) sedimentary rocks b) metamorphic rocks c) igneous rock d) minerals 7. Igneous rocks could change in to sediments by ………………..

a) lithification b) melting c) solidification d) weathering