Title: Earth Science-Geology

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Course

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**Briefly describe the rock cycle; be sure to define each rock type (igneous, sedimentary and metamorphic) and briefly discuss the processes that lead to formation of each.**

Igneous rocks; these rocks are formed from the solidification of molten magma or lava. When magma pulls and solidify beneath the earth surface it forms intrusive igneous rocks such as granite. When lava erupts on to the earth surface and cools quickly it forms extrusive igneous rocks, Such as basalt which is dark-colored, fine grained and also one of the main rock that are prevalent in oceanic crust rich in iron. They can also be classified based on the mineral composition, texture and cooling rate. This igneous form of rocks does not include any fossil deposite.If there are any chance of fossil deep inside the crust, it erupts out of the earth’s surface and get destroyed due to sheer heat the rocks produce. Most igneous forms include more than one mineral deposit. They are either glassy or coarse. These usually do not react with acid. The minerals deposits are available in the form of patches with different size.

Sedimentary rocks; these rocks are formed from the accumulation and compaction of sediments. Sediments are small particles of rocks, minerals or organic matter that are transported and deposited by water, wind or ice. Overtime these sediments undergo compaction and cementation, which binds particles together to form sedimentary rocks. Sedimerty rocks are produced by the weathering of preexisting rocks and the subsequent transportation and deposition of weathering products. Weathering refers to the various processes of physical disintegration and chemical decomposition that occur when rocks at earth’s surface are exposed to the atmosphere (mainly in the form of rainfall) and the hydrosphere. These processes produce soil.Uncosolidated rock detritus and components dissolved in ground water and runoff.Erosion is the process by which weathering products are transported away from the weathering site, Either as solid materials or as dissolved components, eventually to be deposited as sediment. Any unconsolidated deposit of solid weathered materials constitutes sediments. It can form as the result of deposition of grains from moving bodies of water or wind Examples of sedimentary rocks include; Sandstone, limestone and shale.

Metamorphic; these rocks are formed from the transformation of existing rocks through heat, pressure and chemical process. Metamorphism occurs when rocks are subjected to high temperature and precious deep within the earth’s crust causing their mineral composition and texture to change. This process can occur due to tectonic activities such as mount building or contact with hot magma. Examples of this rocks include; Marble, slate and gneiss

**Briefly discuss the processes that lead to formation of each.**

The rock cycle begins with the formation of igneous rocks through the cooling and solidification of magma or lava. These igneous rocks can then be weathered and eroded by natural forces such as water, or wind into sediments. These sediments are then transported and deposited, eventually undergoing compaction and cementations to form sedimentary rocks. Overtime these sedimentary rocks can be buried deep within the earth’s crust and subjected to heat and pressure leading to their transformation into metamorphic rocks. These metamorphic rocks can then be uplifted and exposed at the earth surface where they can undergo weathering and erosion again starting the cycle new.

**Igneous rocks are classified based on their TEXTURE and Composition. Define TEXTURE and Composition.**

TEXTURE; It refers to the size shape and arrangement of mineral grains or crystals within an igneous rock. It provides information about the cooling history of the magma or lava from which the rock formed. There are three main types of texture; Aphanite texture is characterized by fined grained rocks with crystals that are two small to be seen with the necked eyes. These rocks typically form from rapidly cooled lava on the earth surface or shallow intrusions. Phaneritic texture is characterized by coarse-grained rocks with visible crystals. This rocky typically form from slowly cooled magma beneath the Earth surface. Porphyritic texture is characterized by a mixture of fine grained and coarse-grained crystles.Porphyritic rocks typically form when magma undergoes two stages of cooling, with the first stage occurring slowly beneath the earth surface and the second stage occurring rapidly on the surface.

COMPOSITION refers to the types and relative proportion of minerals present in an igneous rock. It provides information about the chemical composition of the magma or lava from which the rock formed. The three main type of composition are; Felsic composition is rich in light colored minerals, such as quartz and feldspar. They typically high in silica content and have lower density. Examples of these rocks include; Granite and rhyolite. Intermediate composition is a mix of light colored minerals and dark colored minerals such as amphibole and plagioclases feldspar. These rocks have moderate silica content and densities .Example of this composition; Diorite and andesite. Mafic composition is rich in dark colored minerals such as pyroxene and olivine. These rocks are typically low in silica content and have higher density.exmples; Basalt and gabbro.

**Define the following; igneous rock textures: aphanite Phaneritic, porphyritic, vesicular, glassy and pegmatitic.**

Aphanite texture; this texture is characterized by fined grained rocks with crystals that are two small to be seen with the necked eyes.

Phaneritic texture; this texture is characterized by coarse-grained rocks with visible crystals.

Porphyritic texture. This texture is characterized by a mixture of fine grained and coarse-grained crystals.

Vesicular, Refers to the presence of numerous small cavities or vescals within an igneous rock.

Glassy, describes the appearance of igneous rocks that have cooled so rapidly that no mineral crystals have had time to form.

Pegmatitic texture. It refers to occurrence of exceptionally large mineral crystals within an igneous rock.

**List the common igneous rock forming minerals (There are 8 or 9) and give their formulas.**

* Quartz;SiO2
* Feldspar(Plagioclase and Orthoclase)-Plagioclase:(Na,Ca)(Al,Si)AlSi208,Orthoclase:KALSi308
* Mica(Biotite and Muscovite)-Biotite:K(Fe,Mg)3(ALSi3O10)(OH)2,Muscovite:KAl2(AlSi3O10)(OH)2
* Amphibole(Hornblende)-(Ca,Na)2-3(Mg,Fe,Al)5(Al,Si)8O22(OH)2
* Pyroxene(Augite)-(Ca,Na)(Mg,Fe,Al)(Si,Al)2O6
* Olivine-(Mg,Fe)2SiO4
* Plagioclase feldspar-(Na,Ca)(Al,Si)ALSi2O8
* Magnetite-Fe3O4
* Biotite-K(Fe,Mg)3(ALSi3O10)(OH)2

**Define ULTRAMAFIC, MAFIC, INTERMEDIATE and FELSIC.**

Ultramafic rocks (also referred to ultrabasic rocks) are igneous and meta igneous rocks with a very law silica content(Less than 45%),generally>18% MgO,high FeO,low potassium,and are composed of greater than 90% mafic minerals(dark colored,high magnesium and iron content).The earths mantle is composed of ultramafic rocks.Ultrabasic ia a more inclusive term that includes igneous rock with low silica content that may not be extremely enriched in Fe and Mg, Such as carbonates and ultrapostassic igneous rocks. rocks that are composed predominantly of mafic minerals, specifically minerals reaching iron and magnesium.

Mafic rocks are igneous rocks that higher silica content that ultramafic rocks but still relatively low compared to intermediate and felsic rocks. Most mafic minerals are dark in color and common rock-forming mafic minerals include olivine, pyroxene, amphibole and biotite. Common mafic rocks include basalt, diabase and gabbro. Mafic rocks often also contain calcium-rich varieties of plagioclase feldspar. Mafic materials can also be described as ferromagnesian.

Intermediate rocks also known as Andestis rocks, have a silica content ranging from 52%-66%.They are intermediate in color ranging from light gray to dark gray. SiO2being and intermediate between felsic and mafic compositions. Typical intermediate rocks include andesite and trachyandesite among volcanic rocks and diorite and granodiorite among plutonic rocks.

Felsic also known as silicic rocks have the highest silica content among the four classifications. In geology, Felsic is a modifier describing igneous rock that is relatively rich in elements that form feldspar and quartz. It is contrasted with mafic rocks, which are relatively richer in magnesium and iron. Felsic refers to silicate minerals, magma and rocks which are enriched in lighter elements such as silicon, oxygen, aluminum, sodium and potassium. Felsic magma or lava is higher in viscosity than mafic magma/lava. Felsic rocks are usually light in color and have specific gravities less than .The most common felsic rock is granite. Common felsic minerals include quartz, muscovite, orthoclase and the sodium rich plagioclases feldspars (albite-rich)

**For each of the following igneous rocks state if it is extrusive or intrusive and whether it is ultramafic mafic intermediate or felsic: Peridotite basalt gabbro, Andesite diorite Rhyolite Granite.**

Peridotite: Intrusive and ultramafic.

Basalt: Extrusive and mafic.

Gabbro: Intrusive and mafic.

Andesite: Extrusive and intermediate.

Diorite: Intrusive and intermediate.

Rhyolite; Extrusive and felsic.

Granite: Intrusive and felsic.

**List and briefly define the 3 types of volcanoes**

Shield volcano: Is a broad, gently sloping volcano characterized by its law profile and wide base. Although the volcanoes are the largest volcanoes on earth, they do not form soaring mountains with conical peaks like composite volcanoes. They have a convex shape as they are flattered near summit. They are truly massive with volumes that dwarf other types of volcanoes, even large composite volcanoes. Shield volcanoes are usually constructed almost entirely of basaltic lava flows which were very fluid when erupted. They are built by repeated eruptions that occurred intermittently over vast period of time (up to millions years or longer).Mauna Loa’s base on the sea floor is about 100 miles (160km) wide. Mount Rainier, the tallest composite volcano in the contiguous united states, is about 14,000feet (4,270) tall, but only 10mi (16km) wide. Overall, the bulk of shield volcanoes are substantially greater than that of composite volcanoes. Some of these volcanoes include: Hawai’i volcanoes National park, Kaloko-Honokohau National Historic Park, Wrangell-St. Elias National Park, Bering Land Bridge National Monument, Lava Beds National Monument,

Composite volcano (Stratovolcano): Is a tall stipe- sided volcano composed of alternating layers of lava flows and pyroclastic materials such as ash, sinders and volcanic bombs. They can be the most picturesque of all volcanoes. These mountains commonly have snow-covered peaks standing high above the surrounding mountainous terrain. Composite cones are large volcanoes (Many thousands of feet or meters tall) generally composed of lava flows, pyroclastic deposits, and mudflow (lahar) deposits, as well as lava domes. Composite volcanoes are active over long periods (tens to hundreds of thousands of years), and erupt periodically. There are at least eight units of the national park system containing composite volcanoes including: Mount Rainier, Katmai National Park, Lake Clark National Park, Aniakachak National Monument, and Lassen Volcanic National Park.

Cinder cones Volcano (Scoria cones): A sindercon volcano is a small step sided volcano that forms from explosive eruptions of gas rich magma. In fact, they’re only tens of hundreds of meters in size. But at the same time, they’re very steep typically with a bowl-shaped crater at the summit. They include: Cerro Negro and Paricutin in Mexico and the one in the middle of Crater Lake in Oregon. Cinder cones form out of tephra, magma, and ash that it ejects. When cinder cones spew out lava, it splits it up in air and spletters.Eventualy; it cools down and becomes part of its steep cone-like feature. They usually are created of eruption form a single opening, unlike a strata-volcano or shield volcano which can erupt from many different openings. Cinder cones are typically made of piles of lava, not ash. During the eruption blobs (“cinders”} of lava are blown into the air and break into small fragments that fall around the opening of the volcano. The pile forms an oval-shaped small volcano.

**Reference/appendix**

1. **“**The rolling stone encyclopedia of rock and role”By Holly Georgde-Warren and Patrcia Romanowski.
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4. “Rocks:Hard,Soft,Smooth,and Rough”by NatalieM.Rosinsky
5. “The complete Book ofRocks and Minerals”By Chris Pellant

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