1.**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**

The rock cycle is a series of processes that create and transform the types of rocks in the crust of the earth . Any type of rock can transform and be another one. we can categorize rocks into sedimentary, igneous and metamorphic rocks. These rocks are formed through processes such as melting, cooling, eroding and compaction.

The rock cycle leads to the occurrence of three types of rocks metamorphic rocks, sedimentary rocks and igneous rocks.

* Igneous Rocks. These are formed when molten rock within the earth’s crust cools and hardens slowly underground, this leads to formation of granite. When the molten rock hardens quickly and erupts it will lead to the formation of a volcano. This will lead to formation of a rock like basalt.
* Sedimentary Rocks. These originate from pieces of other existing organic material or rock. Sedimentary rocks can be further classified into clastic, biological or organic and chemical.

Clastic sedimentary rocks form from pieces of other rocks or clasts.

Organic sedimentary rocks form from hard biological matter like plants, animal shells and bones from animals and humans that are compressed into rock.

Chemical sedimentary rocks form from chemical precipitation. Chemical precipitation is when a chemical compound forms when a solution is dissolved in water evaporates and leaves the compound behind. This is a result of water travelling through the Earth’s crust weathering the rock and dissolving some of its minerals transporting them elsewhere. The dissolved minerals are precipitated when water evaporates. A good example is limestone.

* Metamorphic Rocks.These occur when the rocks have been changed from their original form by intense pressure or heat. These can be further classified into foliated and non-foliated.

Foliated occurs when a rock with flat or elongated minerals is put under immense pressure the minerals line up in layers creating foliation. A good example is schist.

Non foliated occurs when minerals do not elongate or align during metamorphosis. On foliated rocks tend to be simpler compared to foliated rocks .A good example of a foliated rock is marble. Marble is made up of dolomite or calcite and is a result of metamorphism of limestone or dolostone.

The formation and transformation of the various rock types can take different paths through the rock cycle depending on different environmental conditions. The texture, structure and composition of a rock indicate the conditions under which it was formed and tell us about the history of the earth.

2.Igneous rocks are classified on their texture and composition define Texture and composition.

The Texture of a rock refers to details of its visible characteristics. This includes the size and quality interrelations of its grains and the fabric that they form. Larger scale features such as fractures and layering are considered rock structures in comparison.

The composition of a rock refers to what the rock is made up of. The composition of a rock will depend on several factors such as; temperature and pressure conditions, chemical and mineral composition,

the formation process, texture and particle size formation process and presence of fluids .

* Temperature and pressure conditions. The conditions under which a rock is formed especially temperature and pressure play a significant role in determining a rock’s final composition.
* Chemical and Mineral Composition. The amounts of minerals and types in a rock affect its composition. Largely determined by the original material from which a rock is formed.
* Formation process. Rocks can be formed from molten material, from fragments of preexisting rocks or precipitated material and formed under conditions that cause changes in preexisting rocks. Each of these processes result in different compositions.
* Texture and particle size. The composition of a rock is determined by the arrangement of grains or crystals, size and shape of a rock.
* Presence of fluids. The type and amount of fluids like water, petroleum and gases in a rock also affects its composition.

3.**Define the following Igneous rock textures; aphanitic, phaneritic, porphyritic, vesicular and pegmatitic.**

* Aphanitic Rock Texture. These are small, invisible mineral crystals that you cannot see with the naked eye. You must use a polarizing petrological microscope to see the minerals.

They have fine grained texture. These rocks are crystalline. Aphanitic stones may have some large crystals. Examples of rocks with this texture are andesite, rhyolite and basalt.

* Phanerite Rock Texture. These are rocks whose microstructure is made up of crystals large enough to be distinguished by the naked eye. The crystals are too fine grained to be identifiable. Phanerites are formed when magma deep underground cools slowly giving the crystals time to grow. Phanerites are coarse grained. An example of Phanerite is granite.
* Porphyritic Rock Texture. These are well formed larger crystals in a finer grained matrix. The consistent larger crystals are known as phenocrysts while the larger fined grained matrix is known as groundmass. A good example of this type of rock is porphyry.
* Vesicular Rock Texture. This is a rock with many cavities at its surface and inside. This is common on aphanitic rocks. As magma rises to the earth’s surface pressure on it decreases

gases dissolved in the magma come out of solution leading to formation of cavities inside it.

When the magma inform of lava flows to the surface of the earth and cools the rock solidifies around the gas bubbles and traps them inside preserving them as holes filled with gas called vesicles. Notable examples of vesicular rocks are pumice and scoria.

* Pegmatitic rock texture. Form during the last stage of magma crystallization. Pegmatitic rocks are characterized by exceptionally large crystals and in some instances contain minerals that are rarely found in other types of rocks. Pegmatites are made up of crystals that are at least one centimeter in diameter. A good example of a pegmatite is emerald.

4.List Common Igneous Rock forming Minerals

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| No. | **Class** | **Minerals** | **Chemical Formula** |
| 1. | Silica | Quartz | SiO2 |
| 2. | Oxide | Magnetite | Fe3O4 |
| Ileminite | FeTiO3 |
| 3 | Olivine | Olivine | (Mg, Fe)2SiO4 |
| 4. | Sulfide | Pyrite | FeS2 |
| Pyrrhotite | Fe 1—x S |
| 5. | Amphibole | Hornblende | (K, Na)0-1(Ca, Na,Fe,Mg)2(Mg,Fe,Al)5(Si,Al)8O22(OH)2 |
| 6. | Mica | Biotite | K (Mg, Fe)3(AlSi3O10)(OH)2 |
| Muscovite | KAl2(AlSi3O10) (OH)2 |
| 7. | Feldspathoid | Nepheline | (Na, K) AlSiO4 |
|  | Leucite | KAlSi2O6 |
| 8. | Feldspar | Plagioclase | (Ca, Na) (Si, Al)4O8 |
| Orthoclase | KAlSi3O8 |
| Microcline | KAlSi3O8 |
| Sanidine | KAlSi3O8 |
| 9. | Others | Titanite | CaTiSiO5 |
| Zircon | ZrSiO4 |
| Apatite | Ca5(PO4)3(OH, F, Cl) |

5.Define Ultramafic, mafic, intermediate or felsic

Ultramafic Rocks

Can be defined as igneous and metamorphic rocks that consist predominantly mafic (ferromagnesian) with a very low silica content and rich in minerals such as olivine, augite and hyperstherene. These rocks are also called ultrabasic rocks. Notable examples include peridotite, lamprophyre, dunite and komatite.

Mafic Rocks

Mafic rocks can be defined as an igneous rock that is rich in iron and magnesium. Characterized by being dark in color. Mafic rocks are characterized by having olivine, biotite, pyroxene and amphibole. Examples of mafic rocks include basalt, diabase, and gabbro. Mafic rocks also contain calcium rich varieties of plagioclase feldspar.

Felsic

These are igneous rocks that are relatively rich in elements that form feldspar and quartz. Felsic refers to silicate minerals, magma and rocks which are enriched in the lighter elements such as silicon, oxygen,aluminium ,sodium and potassium.

6.For each of the following igneous rocks state if its extrusive or intrusive and whether its ultramafic,mafic,intermediate or felsic peridotite,basalt,gabbro,andesite,diorite ,rhyolite and granite

7.List and briefly define three types of volcanoes

I. Active Volcanoes

Active volcanoes are those volcanoes which have erupted recently and are likely going to erupt in the future.

ii.Dormant Volcanoes

Have not erupted for a long time but may erupt in the future.

iii.Extinct Volcanoes

Are not expected to erupt in the future.

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| No. | **Rock Name** | **Extrusive or Intrusive** | **Ultramafic, mafic,intermediate or Felsic** |
| 1 | Peridotite | Intrusive | Ultramafic |
| 2 | Basalt | Extrusive | Mafic |
| 3 | Gabbro | Intrusive | Mafic |
| 4 | Andesite | Extrusive | Intermediate |
| 5 | Diorite | Intrusive | Intermediate |
| 6 | Rhyolite | Extrusive | Intermediate |
| 7 | Granite | Intrusive | Felsic |