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Question 1

Clay minerals: Clay minerals are the characteristic minerals of the earth's near surface environments. They form in soils and sediments, and by diagenetic and hydrothermal alteration of rocks.

Some clay minerals are:

1. Kaolinite is a clay mineral, part of the group of industrial minerals with the chemical composition $\text{Al}_2\text{Si}_2\text{O}_5(\text{OH})_4$. It is a layered silicate mineral, with one tetrahedral sheet of silica (SiO_2) linked through oxygen atoms to one octahedral sheet of alumina (Al_2O_3) octahedra.

Properties

- i) **Kaolinite** has mp 740-1785°C and density 2.65 g/cm³.
- ii) Kaoline is insoluble in water but darkens and develops a earthy odor when wet.

2. Halloysite is an aluminosilicate clay mineral with the empirical formula $\text{Al}_2\text{Si}_2\text{O}_5(\text{OH})_4$. Its main constituents are oxygen, silicon, aluminium, and hydrogen. Halloysite typically forms by hydrothermal alteration of aluminosilicate minerals.

Properties

- i) it is white in colour.
- ii) it has a specific gravity of 2.53g/cm^3

3. Muscovite is a hydrated phyllosilicate mineral of aluminium and potassium with formula $\text{KAl}_2(\text{F}, \text{OH})_2$, or $(\text{KF})_2(\text{Al}_2\text{O}_3)_3(\text{SiO}_2)_6$. It has a highly perfect basal cleavage yielding remarkably thin laminae which are often highly elastic.

Properties

- i) it has perfect cleavage
- ii) it is monoclinic

4. Biotite is a common group

of phyllosilicate minerals within the mica group, with the approximate chemical formula $K_3AlSi_3O_{10} \cdot 2H_2O$. It is primarily a solid-solution series between the iron-endmember annite, and the magnesium-endmember phlogopite; more aluminous endmembers include siderophyllite and eastonite.

Properties

- i) It is a black mica with perfect **cleavage** and a vitreous **luster** on the **cleavage** faces.
- ii) When biotite is separated into thin sheets, the sheets are flexible but will break upon severe bending.

5. Illite is a group of closely related non-expanding clay minerals. Illite is a secondary mineral precipitate, and an example of a phyllosilicate, or layered aluminosilicate. Its structure is a 2:1 sandwich of silica tetrahedron – alumina

octahedron – silica tetrahedron layers.

Properties

- i) **Illite** contains more water and less potassium than true micas, but it has a micalike sheet structure and is poorly crystallized.
- ii) It may form a chemical series with both muscovite and montmorillonite.
- iii) it is a weathering product of muscovite and alters to montmorillonite under humid conditions.

6. Vermiculite is a hydrous phyllosilicate mineral which undergoes significant expansion when heated. Exfoliation occurs when the mineral is heated sufficiently, and commercial furnaces can routinely produce this effect. Vermiculite forms by the weathering or hydrothermal alteration of biotite or phlogopite.

Properties

- i) It is very porous
- ii) It can hold 3–4 times its weight in water.

7. **Chlorite** is the name of a group of common sheet silicate minerals that form during the early stages of metamorphism. Most **chlorite** minerals are green in color, have a foliated appearance, perfect cleavage, and an oily to soapy feel. They are found in igneous, metamorphic and sedimentary rocks.

Properties

- i) it is monoclinic
- ii) It has a perfect cleavage in one direction

8. **Montmorillonite** is a very soft phyllosilicate group of minerals that form when they precipitate from water solution as microscopic crystals, known as clay.

Properties

- i) It is monoclinic
- ii) It has perfect cleavage

Question 2

The geology of Nigeria consists of the basement complex and

sedimentary basins.

The basement complex: This is one of the three major litho—petrological components that make up the geology of the world. Nigeria basement complex forms the path of the pan African mobile belt and lies between the west African and Congo Cratons and south of the Tuareg shield. Within the basement complex of Nigeria four major petro-lithological units are distinguishable namely:

- i) migmatite gneiss complex
- ii) The Schist Belt
- iii) The older Granites
- iv) Undeformed acid and basic Dykes

Sedimentary Basins: Nigeria is underlain the following sedimentary basins:

- i) Calabar flank
- ii) Benue trough
- iii) Chad basin
- iv) Dahomey Basin
- V) Iger Delta Basin