

EGIBUNU HIKMAT IGANYA

18/ENG03/025

300L

1. Read and write extensively on clay minerals and their distinct properties

Clay minerals are a diverse group of hydrous layer aluminosilicates that constitute the greater part of the phyllosilicate family of minerals. Clay minerals are the major constituent of fine-grained sediments and rocks. They are an important constituent of soils, lake, estuarine, delta and the ocean sediments that cover most of the Earth's surface.

The common clay minerals are:

1. Kaolinite: It is a 1:1 type clay mineral. It is composed of one layer of silica and one layer of alumina, which is formed under acidic conditions through advanced weathering processes or hydrothermal changes of feldspars and other aluminosilicates. The chemical formula for kaolinite is:  $Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$  (39%  $Al_2O_3$ , 46.5%  $SiO_2$  and 14.0%  $H_2O$ ). and its structure possesses strong expansion when wetted. Industrial uses of kaolinite include manufacture of paper, paint, rubber, ceramic, plastic and pharmaceutical products, catalyst for petroleum cracking and auto exhaust emission catalyst control devices, cosmetics base and pigments.

Distinct properties of kaolinite are:

Kaolinite has a low shrink-swell capacity and a low cation-exchange capacity (1-15 meq/100g); it is a soft, earthy, usually white mineral. It is produced by the chemical weathering of aluminum and silicate minerals like feldspar.

2. Smectite: which includes montmorillonite, beidellite, nontronite, saponite or volcanic ash and belongs to a group of hydroxyl aluminosilicate. Minerals associated with smectites include quartz, feldspars, calcite. Smectites are distinguished by their differences in the chemical composition pertaining to substitutions of  $Al^{3+}$  or  $Fe^{2+}$  for  $Si^{4+}$  in



the tetrahedral cation sites and  $Fe^{2+}$ ,  $Mg^{2+}$  or  $Mn^{2+}$  for  $Al^{3+}$   
in the octahedral cation sites.

3. **Vermiculite**: It is a hydrated magnesium aluminium-iron silicate which possesses 2:1 type of clay minerals. It has a layer charge of 0.9-0.6 per formula unit, and contains hydrated exchangeable cations primarily Ca and Mg in the interlayer. Vermiculite has a talc-like structure in which some  $Fe^{3+}$  has been substituted for  $Mg^{2+}$  and some  $Al^{3+}$  for  $Si^{4+}$ , with the resulting charge balanced by hydrated interlayer cations, most commonly  $Mg^{2+}$ . Vermiculite is much less often encountered in sedimentary rocks than in smectite, probably because it is most commonly a soil-formed clay, while coarsely crystalline vermiculite deposits are formed from alteration of igneous rocks.

4. **Illite**: It is also called mica. Mica is a group of phyllosilicate minerals with crystalline structure that can be split or delaminated into thin sheets. Substitution of one  $Al^{3+}$  for one  $Si^{4+}$  results in a layer charge of 1, which in true mica is balanced by one monovalent interlayer cation. The term clay grade mica is sometimes used to describe mica which has been weathered resulting in loss of interlayer cations. Illite is a 2:1 clay with layer charge  $\sim 0.8$ .

5. **Chlorite**: It consists of a 2:1 layer with a negative charge  $(R^{2+}, R^{2+})_3$   $(xSi_4xR^{2+})O_{10}OH_2$  that is balanced by a positively charged interlayer octahedral sheet. R is most commonly Mg, Fe II and Fe III. Chlorites are a group of minerals that exhibits a basic 2:1 layer structure similar to that described for talc or pyrophyllite, but with an interlayer brucite, which forms a 2:1:1 structural arrangement. Chlorites exist in soils as primary minerals that weather to form vermiculite and smectite.



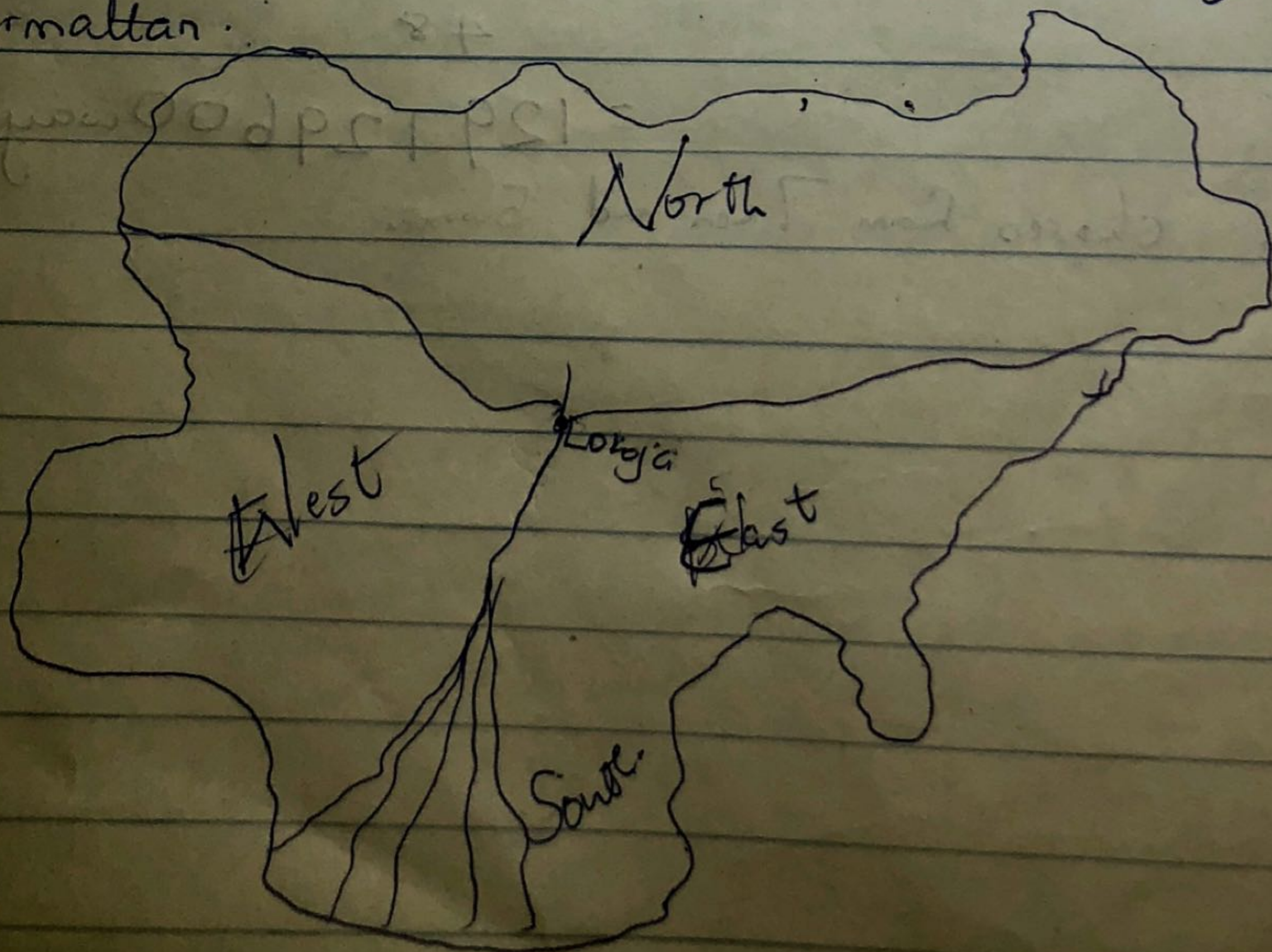
## 2. Write Comprehensively on geology of Nigeria.

Nigeria is a Country in West Africa. Nigeria Shares land borders with the Republic of Benin in the West, Chad and Cameroon in the East, and Niger in the North.

Its Coast lies on the Gulf of Guinea in the South and its borders Lake Chad to the North east.

Nigeria's most expansive topographical region is that of the Valleys of the Niger and Benue River Valleys (which meet at Lokoja). Plains rise to the North of the Valleys. To the Southwest of the Niger there is "rugged" highland, and to the Southeast of the Benue hills and mountains are found all the way to the border with Cameroon. Coastal Plains are found in both the Southwest and the Southeast.

Nigeria, like the rest of West Africa and other tropical lands, has only two seasons. These are the dry season and rainy season. The dry season is accompanied by a dust laden air mass from the Sahara desert, locally known as Harmattan.





Various Mineral Resources Can be found in Nigeria;

Bitumen - Lagos, Edo, Ondo, Ogun

Coal - Ondo, Enugu

Oil and gas - Akwa Ibom, Abia, Bayelsa, Edo, Delta, Rivers, Imo

Gold - Edo, Ebonyi, Kaduna, Jeshka, Oyo

Iron ore - Benue, Anambra, Kogi, Kwara

Lead and Zinc - Ebonyi, Benue, Kano

Limestone - Kogi