

Environmental Earth Studies II

04 August 2023

EVE206D

Semester Test II

National Diploma: Environmental Sciences

Question 1

1. Briefly explain the main difference between volcanic rocks and plutonic rocks? (6)

Volcanic Rocks- Form very close or on earth surface

-Crystallise very fast

-Fine grained

Plutonic Rocks-Deep below surface

-Crystallise very slowly

-Medium to coarse grained

2. C a neat diagram to illustrate the mode of occurrence of the following: (5)
 1. Batholith
 2. Dyke

1.2.3 Sill

3. Lacolith

4. Lopolith

See diagram

1.3 Describe the three facies of a kimberlite pipe? (6)

Crater facies- Well bedded, poorly sorted consolidated sediments with chaotic debris flow deposits and pyroclastics.

Diatreme facies- Well bedded breccia and angular country rocks xenoliths and mantle fragments in fine grained matrix.

Root zone- Irregular shaped intrusions with dyke and sills, porphyritic = phenocrysts and xenocrysts of olivine and phlogopite

1.4 Differentiate between xenocrysts and phenocrysts. (2)

Phenocrysts-Large well formed crystals in porphyritic rocks; familiar to those rocks

Xenocrysts- Crystals resembling phenocrysts but that are foreign to the rocks to which it occurs

Question 2

1. Explain how the following are used to describe the texture of igneous rocks. (9)

1. Grain size

2. Crystallinity

3. Grain Shape

Grain Size

Coarse grain –Composed of mineral grains with a mean diameter of more than 5mm.

Medium Grain – Composed of mineral grains with a mean diameter in the range of 1 to 5mm.

Fine Grain – Composed of mineral grains with a mean diameter of less than 1mm.

Crystallinity

Holocrystalline Rocks-Consists entirely of crystals or minerals fragments.

Hypocrystalline Rocks-Composed partly of crystals/minerals fragments and partly of glass.

Holohyaline Rocks- Consists entirely of glass (volcanic glass).

Grain Shape

Idiomorphic- Largely composed of euhedral crystals that have well developed crystals faces.

Hypidiomorphic-The composite crystals have only some faces which are developed (subhedral).

Allotriomorphic-Composite mineral grains have no discernable crystals faces (anhedral).

2. Describe the following igneous rock textures:

1. Vesicular Texture (2)

Lava often exhibits vesicular texture characterized by vesicles or gas bubble cavities which form when a gas escapes from the magma as it flows out onto the surface.

2. Amygdaloidal Texture (2)

Vesicles(gas bubble cavities) – filled with secondary material like Quartz, carbonates, zeolites. This phenomenon is called amygdales and the texture is referred to as amygdaloidal texture

3. Orbicular Texture (2)

Diorites that are characterized by spherical shaped segregation or orbicular each consisting of concentric shells set in a ground mass of a different composition.

2.2.4 Corona Texture (2)

A reaction rim around a core of the primary product. Primary olivine rimmed by pyroxene.

Question 3

1. Define the following terms:

1. Resorption (2)

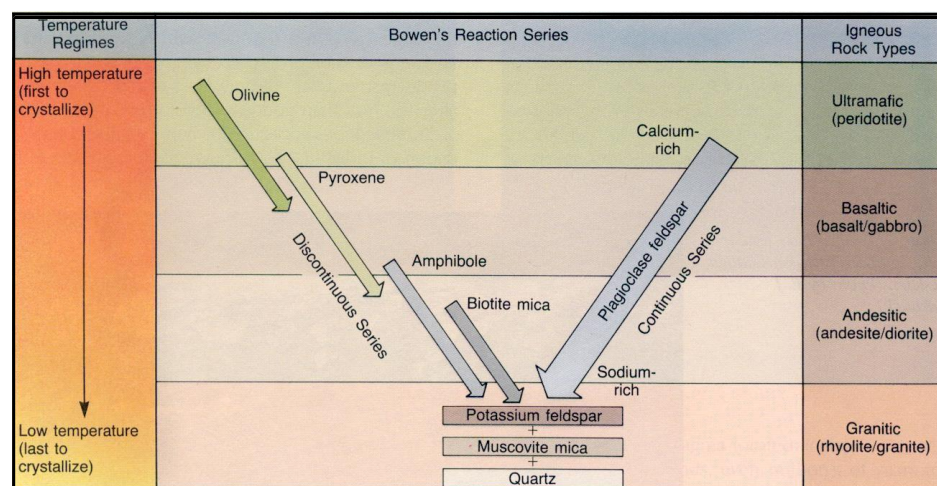
Partial solution (or refusing) of phenocrysts followed by recrystallization in modified forms

2. Solid solution (2)

A crystalline phase of which the chemical composition can vary within finite limits without the appearance of a new phase

3.2 By means of a drawing illustrate Bowen's Reaction Series (6)

BOWEN'S REACTION SERIES



Question 4

4.1 Discuss the following classification schemes:

4.1.1 Colour Index (3)

- The shading/colour of igneous rocks vary according to dark mineral (ferromagnesian mineral) content**

- The percentage of dark minerals present is denoted as the colour index
- The following classification can be done according to colour index
 - **Leucocratic rocks** 0-30% dark minerals
 - **Mesocratic rocks** 31-60% dark minerals
 - **Melanocratic rocks** 61-100% dark minerals

4.1.2 Total SiO₂ Content (3)

- Igneous rocks can be categorized into four divisions based on the total SiO₂ content of the rock
 - **Felsic rocks** >63% SiO₂
 - **Intermediate rocks** 52 - 63% SiO₂
 - **Mafic rocks** 45 - 52% SiO₂
 - **Ultramafic** <45% SiO₂

4.1.3 SiO₂ Saturation (3)

- The degree of SiO₂ saturation is reflected in the presence/absence of quartz in igneous rocks as well as in terms of the abundant minerals presence
- Three rock divisions are distinguished
 - **Oversaturated igneous rocks**
Contain free quartz (visible quartz)
 - **Saturated igneous rocks**
Contain saturated minerals (feldspars, micas, amphiboles and pyroxenes, **BUT NO** free quartz and no undersaturated minerals (e.g. olivine and nepheline)
 - **Undersaturated igneous rocks**
Contain only undersaturated minerals (e.g. olivine and nepheline)

Total Marks: 50 Marks