

UNIVERSITY OF FORT HARE

GLG322
Metamorphic Petrology and
Engineering Geology

BSc Main Examination
November 2024

Time: 3 Hours

Marks: 100

Subject: Geology

One Paper

This paper consists of 3 pages including the cover page

Internal Examiners

Mr S Sinuka
Prof O Gwavava

External Examiner

Dr S Misra

INSTRUCTIONS

Answer two questions from each section.

SECTION A: METAMORPHIC PETROLOGY

Question One

[25]

Pelitic rocks with increasing temperature and pressure during metamorphism show progressive changes in mineralogy according to the classic Barrovian Zonal Scheme. Describe the temperature and pressure conditions, minerals assemblages and mineralogical reactions in each of the zones.

- a) Chlorite zone. [5]
- b) Biotite zone. [5]
- c) Garnet zone. [5]
- d) Staurolite zone. [5]
- e) Kyanite and Sillimanite zones. [5]

Question Two

[25]

The metamorphism of basic igneous rocks varies from low to high temperature and pressure conditions. Write an essay on low to high temperature and pressure metamorphism of basic igneous rocks considering the following points:

- a) The Greenschist Facies metamorphic conditions, the mineral transition from the Greenschist to the Blueschist Facies, the mineral assemblages present in the Greenschist Facies, the conditions of formation and mineral reactions transitioning from the Greenschist to the Blueschist Facies. [6]
- b) Discuss the metamorphic mineral assemblages present in the Blueschist Facies, the pressure and temperature conditions of formation and mineral reactions associated with the Blueschist Facies. [6]
- c) Discuss the metamorphic conditions involved/experienced in transitioning from the Blueschist to the Eclogite Facies, reactions indicating the upper temperature limit of the blueschist, reaction indicating the highest temperature blueschist and reaction indicating high pressure blueschist. [7]
- d) Eclogite Facies, conditions of formation, and mineral assemblages present in Group A, B and C eclogites. [6]

Question Three

[25]

Write an essay and discuss the influence of rock deformation on metamorphic textures and processes.

- a) differentiate between brittle, ductile, intercrystalline and intracrystalline deformations, highlighting the three (3) types of intracrystalline deformation. [10]
- b) With the aid of diagrams, explain and differentiate between dislocation flows and pressure solutions, textures produced by deformation during metamorphism and preferred orientations that develop. [15]

SECTION B: ENGINEERING GEOLOGY

Question Four

[25]

Illustrate, with the aid of diagrams/drawings, the different topographic zones of a beach, and explain the hydrodynamic conditions of each zone, and the particular topographic features observed in a rocky coast.

Question Five

[25]

What is a soil? Give an account on the types and classifications of soils based on the soil texture, structure and origin. You should add some drawings/diagrams to support your description and explanation.

Question Six

[25]

- a) With the aid of drawings/diagrams, show detailed soil zonation and describe the characteristics of each zone in a profile of matured soils. [15]
- b) Briefly discuss the factors affecting soil formation. Your discussion must include the significance of the parent material, topography, vegetation, time and climate. [10]

