



MACHAKOS UNIVERSITY

University Examinations 2023/2024 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF PHYSICAL SCIENCES

FOURTH YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE IN ANALYTICAL CHEMISTRY

SAN 402: GEOCHEMICAL PERSPECTIVES AND PETROCHEMISTRY

DATE:

TIME: 2 HOURS

INSTRUCTIONS:

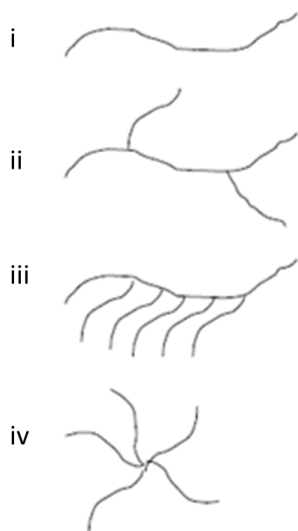
- The paper consists of **two** sections.
- Section **A** is **compulsory** (30 marks).
- Answer any **two** questions from section **B** (each 20 marks).

QUESTION ONE (30 MARKS)

- a) Geochemistry is the study of the composition of the various distinct chemical phases of the Earth.
- i) From a chemical point of view, the earth may be divided into a crust, mantle, and core. Describe these parts in terms of the major elements they are composed (3 Marks)
- ii. State four gases which contributes to the existence of greenhouse effect. (2 Marks)
- b) i) Explain using examples how Nuclear Fusion begins. (4 Marks)
- ii) With nuclear fission, there are shielding effects which distinguish the s-process nuclides from the r-process ones. State the four types of stable nuclides involved in this process (4 Marks)
- c) Discuss the four sites where trace elements (TE) are found in minerals (8 Marks)
- d) In nucleosyntheses describe the formation of the first 3 elements of the periodic table (3 Marks)
- e) Discuss the following physical properties of crude oils (3 Marks)
- i. Refractive Index
- ii. Viscosity
- iii. Odour
- f) Describe the major processes in Oxygen cycle (4 marks)
- g) Discuss the crystallization process applied in plastic industries (3 marks)

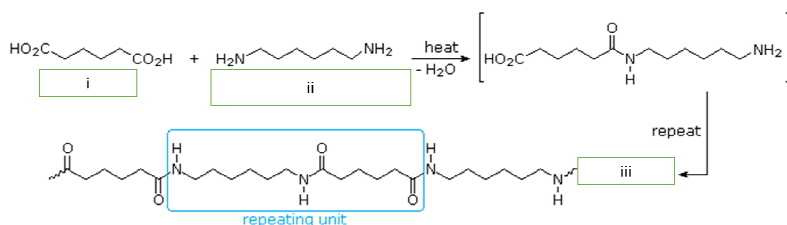
QUESTION TWO (20 MARKS)

- a) Addition polymerization and condensation are used in manufacture of polyethene and nylon. Using appropriate equations explain the above reactions (5 mark)
- b) Identify the following mechanisms in control architecture of polymers (4 marks)



c) Provide names of compounds (labeled i-iii) in the illustrated polymerization reaction

(6 marks)



d) The largest volume products of the industry are fuel oil and gasoline (petrol). Petroleum (oil) is also the raw material for many chemical industries list 5 examples of these products

(5 marks)

QUESTION THREE (20 MARKS)

- Define geothermal gradient and give an example of where we would find a low geothermal gradient and a high geothermal gradient. (3 marks)
- Extraction is the first step to separate the desired natural products from the raw materials. Explain stages in the extraction of natural products progresses stages (4 marks)
- Describe how Porphyrins contribute to increased heavy metals content in the crude oil. (5 marks)
- Discuss the following processes used crude oil refinery (8 marks)
 - Gas treating
 - Alkylation

- iii. Stream splitters
- iv. Isomerization

QUESTION FOUR (20 MARKS)

- a) Explain the supernovae explosions (3 marks)
- b) Draw a sketch diagram of Elemental Analyzer (EA) and explain how it works. (5 marks)
- c) Lithosphere; Hydrosphere; Biosphere; are formed by the cooling of hot molten rock also known as magma. Discuss each sphere giving two industrial raw materials obtained from them (8 marks)
- d) Earth's atmosphere is divided into four regions; Troposphere. stratosphere, mesosphere, thermosphere. Arrange these spheres in order of increasing altitude. (4 marks)

QUESTION FIVE (20 MARKS)

- a) List four applications of Kevlar (4 marks)
- b) If a stable nucleus breaks into its constituent nucleons, does it mean energy was added to the nucleus, or energy was released by the nucleus. Explain your answer. (6 Marks)
- c) Describe the mechanism of free radical polymerization styrene ($\text{CH}_2=\text{CHPh}$) as the starting material (5 Marks)
- d) Explain biocomposits bacterial nanocellulose as reinforcement for polymer matrices (5 marks)