



JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY
SCHOOL OF BIOLOGICAL, PHYSICAL, MATHEMATICS AND ACTUARIAL SCIENCES
UNIVERSITY EXAMINATION FOR DEGREE IN BACHELOR OF SCIENCE (ANIMAL
SCIENCE)

1st YEAR 2nd SEMESTER 2023/2024 ACADEMIC YEAR

MAIN REGULAR

COURSE CODE: SPB 9114

COURSE TITLE: BIOINORGANIC CHEMISTRY

EXAM VENUE:

STREAM: ANIMAL SCIENCE

DATE:

TIME:

EXAM SESSION:

INSTRUCTIONS:

- 1. Answer question 1 (Compulsory) in section A and ANY other 2 questions in Section B.**
- 2. Candidates are advised not to write on the question paper.**
- 3. Candidates must hand in their answer booklets to the invigilator while in the examination room.**

SECTION A: (30 MARKS)

ATTEMPT ALL QUESTIONS

QUESTION 1

- (a) Copper is very important element to human body. Its deficiency may lead to diseases. Give **TWO** of them. (3 marks)
- (b) Antibodies are protective proteins which have found use in artificial cheap and easy substitutes in research. Name the artificial replacement protein. (2 marks)
- (c) List **FOUR** elements that are essential for life which are not trace type. (4 marks)
- (d) Zinc ions as life metal are usually incorporated in some amino acids. Name **THREE** of them. (3 marks)
- (e) Give the bioinorganic chemists definition of proteins. (3 marks).
- (f) Explain the contributions of the transition metals in our diet. (2 marks)
- (g) List **FIVE** conditions under which the living cells may operate optimally. (5 marks)
- (h) List **THREE** important factors which may be obtained by altering the side chains, metal ions, and surrounding species of porphyrins and related complexes in bioinorganic compounds. (3 marks)
- (i) Which elements of life are classified as trace elements. (3 marks)
- (j) Give a definition of tetrapyrroles? Give an example of a tetrapyrrole. (2 marks)

SECTION B

ATTEMPT ANY TWO QUESTIONS

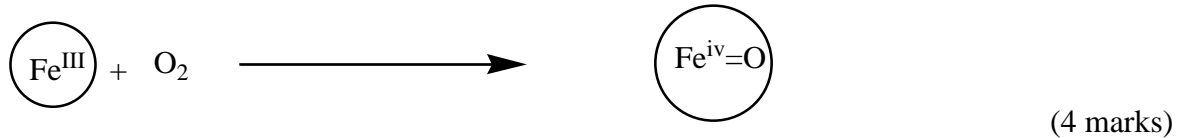
QUESTION 2 (20 MARKS)

- (a) Describe the main features and function of haemoglobin. (4 marks)
- (b) Distinguish between, oxidase, cofactor and cytochrome. (4 marks)
- (c) List the **THREE** compounds which are responsible for iron storage. (3 marks)
- (d) Give a labeled diagram for the visible absorption spectrum which may differentiate an oxygenated and deoxygenated hemoglobin. (5 marks)

(e) During photosynthesis, if one mole of photons struck the P680 centre at two wavelengths, 250 nm and 700 nm, which wavelength will give more energy to the plant? How much will be the energy? (4 marks)

QUESTION 3 (20 MARKS)

(a) Complete the following equation which describes the process of dioxygen binding into hemoglobin.



(b) Show that copper amine oxidase can catalyze the conversion of primary amines to aldehydes. (4 marks)

(c) Show the equilibrium reaction equation of a reversible binding of oxygen to myoglobin. (6 marks)

(d) (i) When one closely examines the absorption spectrum of chlorophyll, one observes several absorption spectra. Explain the observed absorption bands representing the two photocenters in photosynthesis. (2 marks)

(ii) Explain why there is only a single water splitting centre in the light reactions. (2 marks)

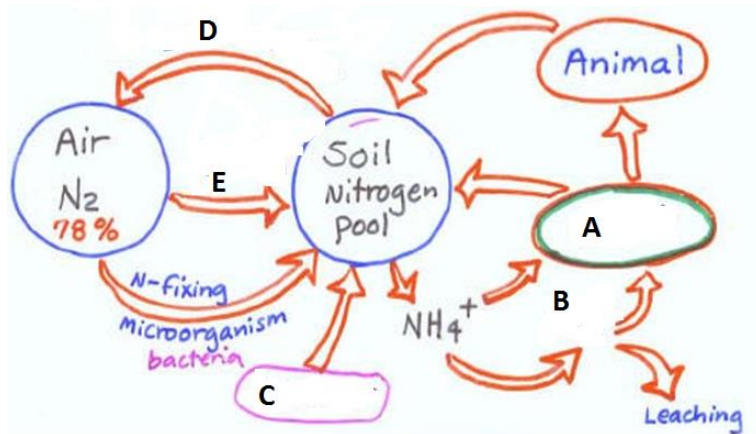
(e) List the forms of the fixed nitrogen which may be easily consumed by plants and then eaten by animals for their needs. (2 marks)

QUESTION 4 (20 MARKS)

(a) Give a labeled diagram for the visible absorption spectrum which may differentiate an oxygenated and deoxygenated hemoglobin. (3 marks)

(b) Higher plants have two photocenters, P680 and P700, so designated by wavelength that gives maximum absorption or O₂ evolution. Design a photosystem in a plant. (5 marks)

(c) Complete the diagram below for soil nitrogen cycle. (5 marks)



(d) Sketch the graph of concentration versus physiological effect of living organism. (7 marks)

QUESTION 5 (20 MARKS)

- (a) Show the equilibrium reaction equation of a reversible binding of oxygen to myoglobin. (5 marks)
- (b) Explain the following in relation to iron chlorosis.
- Explain the meaning of iron chlorosis. (1 mark)
 - Give **TWO** chelates which may be used to treat iron chlorosis. (2 marks)
 - Give a sketch of how iron absorption by plants takes place at high pH. (4 marks)
- (c) Show a summary of how the chemical processes of photosynthesis occur in plants. (4 marks)
- (d) Discuss the iron absorption in the animal stomach. (4 marks)