



**JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND  
TECHNOLOGY  
SCHOOL OF BIOLOGICAL AND PHYSICAL SCIENCES  
UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF  
SCIENCE (ANIMAL SCIENCE)  
1<sup>ST</sup> YEAR 2<sup>ND</sup> SEMESTER 2016/17  
MAIN REGULAR**

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**COURSE CODE: SCH 3129**

**COURSE TITLE: BIOINORGANIC CHEMISTRY**

**EXAM VENUE:**

**STREAM: (BSC. ANIM. SCI)**

**DATE:**

**EXAM SESSION:**

**TIME: 2:00HRS**

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**Instructions:**

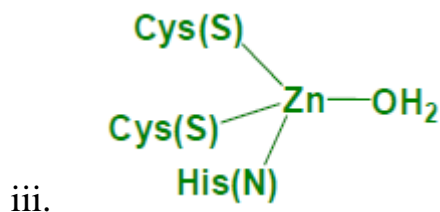
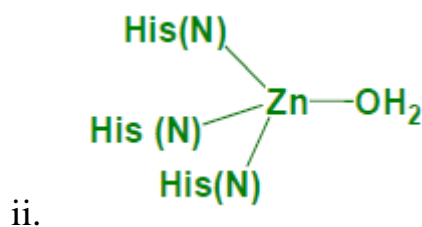
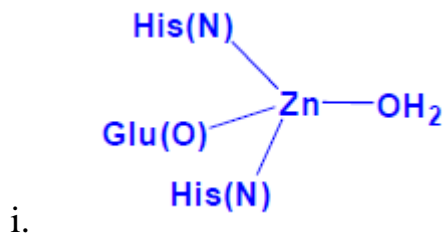
- 1. Answer question 1 (Compulsory) in Section A and ANY other 2 questions in Section B.**
- 2. Candidates are advised not to write on the question paper.**
- 3. Candidates must hand in their answer booklets to the invigilator while in the examination room**

## Section A

### Answer All Questions in Section A

#### Question 1

- a) Using examples, demonstrate the essentiality of elements to different biological functions. (3 marks)
- b) Every essential element follows a dose-response curve; briefly discuss this curve with respect to iron (Fe). (6 marks)
- c) The active site of an enzyme is designed to exclude water ( $H_2O$ ), how is this achieved. (3 marks)
- d) The following enzymes are essential in various biological processes. Briefly discuss these processes. (6 marks)



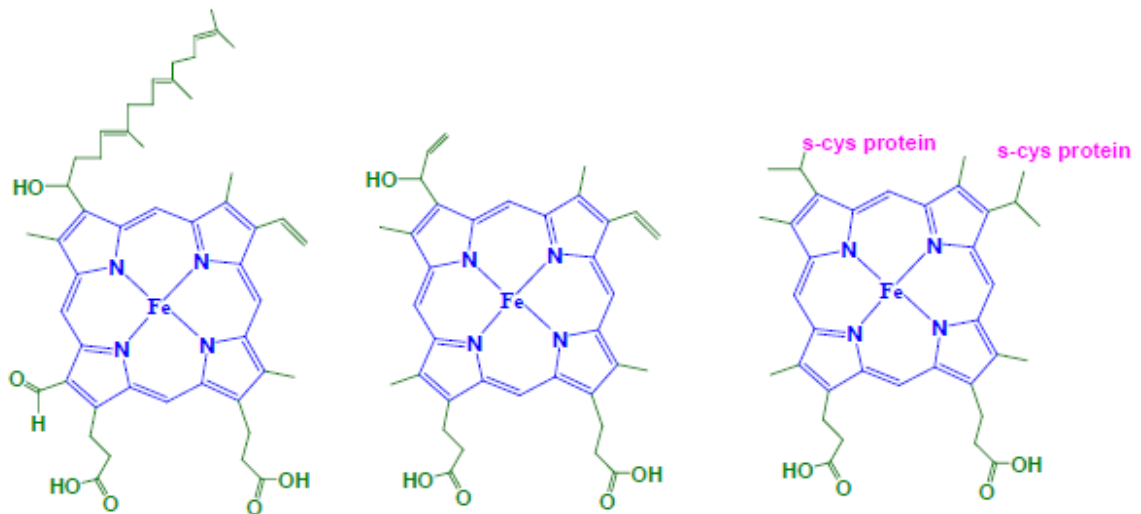
e) Porphyrins are found in many metalloenzymes, briefly discuss the enzymes and functions of the following Porphyrins.

- i. Fe-porphyrin
- ii. Mg-porphyrin

(6 marks)

f) Given the following polyphyrins, distinguish their structural differences and give the name of each of the polyphyrin.

(6 marks)



(30 marks)

## Section B

Answer any Two Questions

Question 2

a) Discuss the active site differences between Hemoglobin and Cytochrome. (10 marks)

b) Briefly describe the Biological functions of following selected metal ions.

- i. Na and K
- ii. Mg and Zn
- iii. V and Mo
- iv. Fe and Cu
- v. Ni

(10 marks)

(20 marks)

### Question 3

a. Briefly describe the toxicity due to  $\text{CN}^-$  on the Cytochrome. (4 marks)

b. Using diagrams describe the intake of oxygen by deoxyhemoglobin and the release of oxygen by hemoglobin.

(16 marks)

(20 marks)

### Question 4

a) Briefly discuss the periodic table of bio-elements essential to life forms under the following categories.

- i. Bulk elements
- ii. Macro-minerals and ions
- iii. Trace elements
- iv. Ultra-trace elements (non-metals)
- v. Ultra-trace elements (metals)

(10 marks)

b) Briefly discuss the significance of the following biologically important elements to organisms.

- i.  $\text{Na}^+$  and  $\text{K}^+$
- ii.  $\text{Mg}^{2+}$
- iii.  $\text{Ca}^{2+}$
- iv.  $\text{V}^{\text{IV}}$ ,  $\text{Mo}^{\text{IV}/\text{VI}}$ ,  $\text{W}^{\text{IV}/\text{VI}}$ ,  $\text{Mn}^{\text{II}/\text{IV}}$ ,  $\text{Fe}^{\text{II}/\text{III}}$
- v. Fe and Cu
- vi.  $\text{Zn}^{2+}$
- vii.  $\text{Si}^{\text{IV}}$
- viii.  $\text{P}^{\text{V}}$
- ix.  $\text{Se}^{\text{II}}$
- x.  $\text{F}^-$
- xi.  $\text{Cl}^-$
- xii.  $\text{I}^-$

(10 marks)

(20 marks)

### Question 5

a) Using examples, discuss the role of biomolecules in the photosynthetic process under the following subtopics. (10 marks)

- vi. Chlorophyll (structure and function)
- vii. Role of Manganese in Photosynthesis
- viii. Mg-porphyrin

b) Discuss the nitrogen fixation of nitrogenase-nitrogen through metal complexes. (10 marks)

(20 marks)

# Periodic table

		Atomic number, Z																18	
		Element symbol																2	
		Relative atomic mass, A <sub>r</sub>																4,00	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18		
1 H 1.008	2 He 4.00	3 Li 6.94	4 Be 9.01	5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18	11 Na 22.99	12 Mg 24.31	13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.06	17 Cl 35.45	18 Ar 39.95		
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.90	23 V 50.94	24 Cr 52.01	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.54	30 Zn 65.41	31 Ga 69.72	32 Ge 72.59	33 As 74.92	34 Se 78.96	35 Br 79.91	36 Kr 83.80		
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc 98.91	44 Ru 101.07	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.40	49 In 114.82	50 Sn 118.71	51 Sb 121.75	52 Te 127.60	53 I 126.90	54 Xe 131.30		
55 Cs 132.91	56 Ba 137.34	57 La-Lu 178.49	58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm 146.92	62 Sm 150.35	63 Eu 151.96	64 Gd 157.25	65 Tb 158.92	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04	71 Lu 174.97			
87 Fr 223	88 Ra 226.03	89 Ac-Lr 227.03	90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np 237.05	94 Pu 239.05	95 Am 241.06	96 Cm 244.07	97 Bk 249.08	98 Cf 252.08	99 Es 252.09	100 Fm 257.10	101 Md 258.10	102 No 259	103 Lr 262			