

UNIVERSITY OF SWAZILAND

SUPPLEMENTARY EXAMINATION PAPER: JULY 2013

TITLE OF PAPER: BIOCHEMISTRY & CELL BIOLOGY

COURSE CODE: B203

TIME ALLOWED: THREE HOURS

- INSTRUCTIONS:**
- 1. ANSWER QUESTION 1 (COMPULSORY) AND ANY THREE OTHER QUESTIONS.**
 - 2. ANSWER A TOTAL OF 4 (FOUR) QUESTIONS**
 - 2. EACH QUESTION CARRIES TWENTY FIVE (25) MARKS**
 - 3. ILLUSTRATE YOUR ANSWERS WITH LARGE AND CLEARLY LABELLED DIAGRAMS WHERE APPROPRIATE**

SPECIAL REQUIREMENTS:

- 1. GRAPH PAPER**
- 2. CANDIDATES MAY USE CALCULATORS**

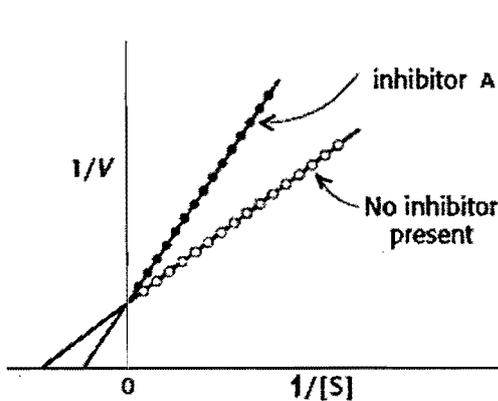
THIS PAPER SHOULD NOT BE OPENED UNTIL PERMISSION HAS BEEN GRANTED BY THE INVIGILATORS

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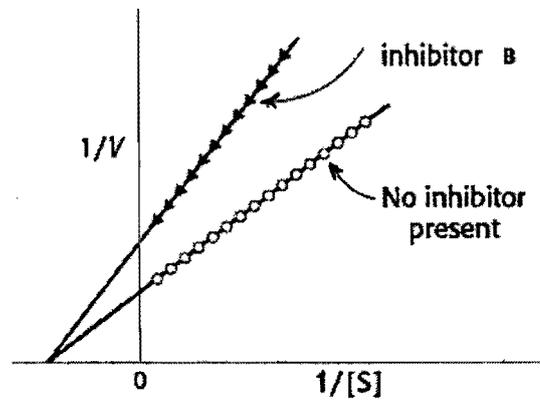
Section A (Compulsory)
 Answer all questions in this section

Question 1 (compulsory)

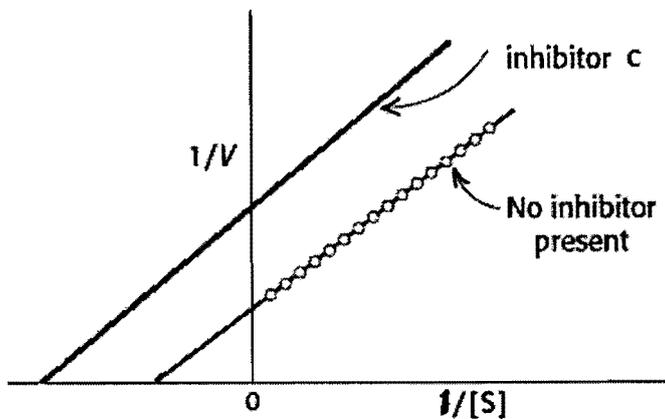
- (a) Explain what you understand by pI and how it is determined for amino acids that have non-ionizable R groups. (2 marks)
- (b) The amino acid histidine has a side chain for which the pK_a is 6.0. Calculate the fraction of the histidine side chains that will carry a positive charge at pH 5.4. Be sure to show your work. (5 marks)
- (c) Outline the Edman degradation method for peptide sequencing (12 marks)
- (d) Identify the type of inhibitor A, B and C shown in the following plots. (6 marks)



(i) Plot A



(ii) Plot B



(ii) Plot C

[TOTAL MARKS = 25]

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Section BAnswer **any three** questions from this Section.**Question 2**

- (a) Explain the following terms
- (i) Operon, (1 mark)
 - (ii) Constitutive gene, (1 mark)
 - (iii) Polycistronic mRNA. (1 mark)
- (b) Identify any 5 proteins/enzymes involved in DNA replication and explain their roles. (10 marks)
- (c) Outline the process of aminoacyl-tRNA formation. (6 marks)
- (d) Explain in what sense and to what extent the genetic code is
- (i) degenerate, (2 marks)
 - (ii) ordered, (2 marks)
 - (ii) universal. (*You may refer to page 5*) (2 marks)

[TOTAL MARKS = 25]**Question 3**Write notes on **any two** the following

- (a) β -oxidation fatty acids. (12 ½ marks)
- (b) The urea cycle. (12 ½ marks)
- (c) Lipid biosynthesis. (12 ½ marks)

Question 4

- (a) Describe and explain the ATP synthesis by photophosphorylation (15 marks)
- (b) Explain the role of named micronutrients in fight against reactive oxygen species. (10 marks)

Question 5

Shown below are catalytic data for enzyme X on substrate S in the absence and presence of an inhibitor. Investigate the type of inhibition underway. Hence explain the interaction of the inhibitor and the enzyme during of this inhibition. (25 marks).

[S] (μM)	Velocity ($\mu\text{mol/minute}$)	
	No inhibitor	Inhibitor present
3	10.4	4.1
5	14.5	6.4
10	22.5	11.3
30	33.8	22.6
90	40.5	33.8

[TOTAL MARKS = 25]

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Question 6

- (a) During strenuous activity, the demand for ATP in muscle tissue is vastly increased. In rabbit leg muscle or turkey flight muscle, the ATP is produced almost exclusively by lactic acid fermentation. ATP is formed in the payoff phase of glycolysis by two reactions, promoted by phosphoglycerate kinase and pyruvate kinase. Suppose skeletal muscle were devoid of lactate dehydrogenase. Could it carry out strenuous physical activity (that is, could it generate ATP at a high rate by glycolysis)? Explain. (9 marks)
- (b) If the oxidation of glucose 6-phosphate via the pentose phosphate pathway were being used primarily to generate NADPH for biosynthesis, the other product, ribose 5-phosphate, would accumulate. Explain the problems this might cause. (8 marks)
- (c) Individuals with a thiamine deficient diet have relatively high levels of pyruvate in their blood. Explain this in biochemical terms. (8 marks)

[TOTAL MARKS 25]

THE END OF QUESTION PAPER

The Genetic code

		Second letter				
		U	C	A	G	
First letter	U	UUU } Phe	UCU } Ser	UAU } Tyr	UGU } Cys	U C A G
		UUC } Phe	UCC } Ser	UAC } Tyr	UGC } Cys	
		UUA } Leu	UCA } Ser	UAA Stop	UGA Stop	
		UUG } Leu	UCG } Ser	UAG Stop	UGG Trp	
	C	CUU } Leu	CCU } Pro	CAU } His	CGU } Arg	U C A G
		CUC } Leu	CCC } Pro	CAC } His	CGC } Arg	
		CUA } Leu	CCA } Pro	CAA } Gln	CGA } Arg	
		CUG } Leu	CCG } Pro	CAG } Gln	CGG } Arg	
	A	AUU } Ile	ACU } Thr	AAU } Asn	AGU } Ser	U C A G
		AUC } Ile	ACC } Thr	AAC } Asn	AGC } Ser	
		AUA } Ile	ACA } Thr	AAA } Lys	AGA } Arg	
		AUG Met	ACG } Thr	AAG } Lys	AGG } Arg	
	G	GUU } Val	GCU } Ala	GAU } Asp	GGU } Gly	U C A G
		GUC } Val	GCC } Ala	GAC } Asp	GGC } Gly	
		GUA } Val	GCA } Ala	GAA } Glu	GGA } Gly	
		GUG } Val	GCG } Ala	GAG } Glu	GGG } Gly	

Third letter