

UNIVERSITY OF ESWATINI

FINAL EXAMINATION PAPER: MAY 2019

TITLE OF PAPER: BIOCHEMISTRY & CELL BIOLOGY

COURSE CODE: BIO 352

TIME ALLOWED: THREE HOURS

INSTRUCTIONS:

1. ANSWER ANY FOUR QUESTIONS
2. ANSWER A TOTAL OF 4 (FOUR) QUESTIONS
3. EACH QUESTION COUNTS TWENTY FIVE (25) MARKS
4. ILLUSTRATE YOUR ANSWERS WITH LARGE AND CLEARLY LABELLED DIAGRAMS WHERE APPROPRIATE

SPECIAL REQUIREMENTS: CANDIDATES MAY USE CALCULATORS

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

[PLEASE TURN OVER]

**Question 1**

- a) List three aspects in which different types of cells within one organism may differ from each other. [3 marks]
- b) List the structural characteristics common to all amino acids found in naturally occurring proteins? [4 marks]
- c) Briefly explain why amino acids in water are referred to as zwitterions? [3 marks]
- d) Briefly explain the biological functions of the pentose phosphate pathway? [2 marks]
- e) Name and explain the three stages of signal transduction. [8 marks]
- f) If a 0.1 M solution of glucose 1-phosphate is incubated with a catalytic amount of phospho-glucomutase, the glucose 1-phosphate is transformed to glucose 6-phosphate until equilibrium is reached. At equilibrium, the concentration of glucose 1-phosphate is  $4.5 \times 10^{-3}$  M and that of glucose 6-phosphate is  $8.6 \times 10^{-2}$  M. Set up the expressions for the calculation of  $K_{eq}$  and  $\Delta G^\circ$  for this reaction (in the direction of glucose 6-phosphate formation). ( $R = 8.315 \text{ J/mol}\cdot\text{K}$ ;  $T = 298 \text{ K}$ ). [5 marks]

**Total Marks= 25****Question 2**Briefly discuss **any 5** of the following:

- a. Differential centrifugation
- b. Dialysis
- c. Column chromatography
- d. Gel-filtration
- e. Ion-exchange chromatography
- f. Affinity chromatography
- g. SDS-PAGE
- h. Isoelectric focusing [25 marks]

**Question 3**

- a) Briefly explain the process of gluconeogenesis and how do animals convert pyruvate to phosphoenolpyruvate? [6 marks]
- b) Provide four possible reasons why it might be advantageous to the cell, if all of the intermediate metabolites in the glycolytic pathway are phosphorylated. [4 marks]

- c) Briefly describe three ways in which the synthesis and breakdown of fatty acids differ from each other. [5 marks]
- d) Describe the source of O<sub>2</sub> during photosynthesis, and explain, using chemical equations or schematic diagrams, why O<sub>2</sub> production occurs only during daylight hours. [10 marks]

#### Question 4

Using the following data draw a Lineweaver-burk plots for data sets (a) and (b) and determine K<sub>m</sub> and V<sub>max</sub> in the absence and presence of the inhibitor, and identify the type of inhibitor in (a) and (b). [25 marks]

(a)			(b)		
[S] ( $\mu$ M)	Velocity ( $\mu$ mol/minute)		[S] ( $\mu$ M)	Velocity ( $\mu$ mol/minute)	
	No inhibitor	Inhibitor		No inhibitor	Inhibitor
3	10.4	4.1	3	10.4	2.1
5	14.5	6.4	5	14.5	2.9
10	22.5	11.3	10	22.5	4.5
30	33.8	22.6	30	33.8	6.8
90	40.5	33.8	90	40.5	8.1

#### Question 5

Defend the assertion that the Krebs's cycle is central to cellular metabolism.

[25 marks]

The end