

UNIVERSITY OF SWAZILAND

MAIN EXAMINATION PAPER: MAY 2017

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. CANDIDATES MAY USE CALCULATORS**

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

[PLEASE TURN OVER]

Section A (Compulsory)
Answer all questions in this section

Question 1

- (a) Explain the differences between the following:
- (i). Isoelectric point and pKa, (1 mark)
 - (ii). Competitive inhibition and non-competitive inhibition, (1 mark)
 - (iii). Coenzyme and prosthetic group, (1 mark)
 - (iv). Zwitterion and an acidic amino acid, (1 mark)
 - (v). Apoenzyme and holoenzyme, (1 mark)
 - (vi). Carcinogen and mutagen, (1 mark)
 - (vii). Anabolism and catabolism. (1 mark)
- (b) Sketch a labelled typical titration curve for a weak acid, HA, whose pK_a is 3.2. Indicate on the curve, with an arrow, where the 20% of HA has dissociated and indicate pH value on your sketch. (4 marks)
- (c) State any 2 ways by which a nascent RNA can be processed. (2 marks)
- (d) Explain the role of aminoacyl-tRNA synthetase in gene expression. (2 marks)
- (e) Explain the role of named micronutrients in fight against reactive oxygen species. (5 marks)
- (f) Explain in biochemical terms, why individuals with a thiamine deficient diet have relatively high levels of pyruvate in their blood. (5 marks)

[Total marks = 25]

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Section B

Answer any three questions from this Section.

Question 2

Discuss the expression and control of the *lac* and *trp* operons, highlighting the difference between negative and positive control. (25 marks)

Question 3

Give a detailed outline of steps during the Edman degradation method of amino acid sequencing, including the determination of C- and N-termini. (25 marks)

Question 4

- (a) Distinguish between *de novo* and salvage pathways for nucleotide biosynthesis. (5 marks)
- (b) The Krebs's cycle is a central hub of cellular metabolism. Discuss. (20 marks)

Question 5

Explain how cytosolic pyruvate from glycolysis results in the formation of ATP in the mitochondria, highlighting the stages where substrate-level phosphorylation and oxidative phosphorylation occur. (25 marks)

Question 6

Explain the production of ATP and NADPH during the coupling of photosystems I and II. Illustrate how these high-energy molecules are central to carbon dioxide fixation and reduction during photosynthesis. (25 marks)

END OF QUESTION PAPER