

NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

SSC2103

FACULTY OF APPLIED SCIENCES

BACHELOR OF SCIENCE HONOURS DEGREE EXAMINATIONS

DEPARTMENT OF SPORTS SCIENCE AND COACHING

**THEORY: SSC2103: PRINCIPLES OF BIOCHEMISTRY**

DECEMBER 2005

3 HOURS (100 MARKS)

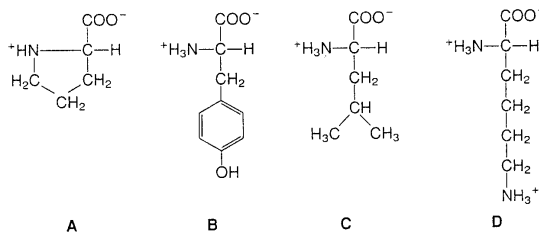
**INSTRUCTIONS**

Answer any four questions only. Each question carries 25 marks. Where a question contains subdivisions, the mark value for each subdivision is given in brackets. In multiple choice questions, some questions may have more than one correct answer and in such cases, negative marking will apply to incorrect answers. Illustrate your answer where appropriate with large clearly labeled diagrams.

1. a) What do you understand by the following?

- |                                   |          |
|-----------------------------------|----------|
| (i) Protein denaturation          | (1 mark) |
| (ii) Primary bond                 | (1 mark) |
| (iii) Peptide bond                | (1 mark) |
| (iv) Primary structure of protein | (1 mark) |
| (v) Protein hydrolysis            | (1 mark) |

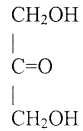
b) Examine the four amino acids given below.



- (i) Which amino acids are associated with the following properties.
- |                                      |          |
|--------------------------------------|----------|
| • Aliphatic side chain               | (1 mark) |
| • Basic side chain                   | (1 mark) |
| • Three ionize groups                | (1 mark) |
| • Most hydrophobic of the four       | (1 mark) |
| • In the same class as phenylalanine | (1 mark) |
| • Secondary amino group              | (1 mark) |
- (ii) Name the four amino acids. (4 marks)

c) Write notes on the structure, properties and function of two connective tissue proteins. (10 marks)

2. a) Name the molecule shown below. (1 mark)



b) What is the character of the central carbon? (1 mark)

c) Draw an enantiomer of the molecule. (2 marks)

d) In the pyranose form of a hexose, ring closure is most commonly between which of the following carbon atoms?

- (i) 1 and 6
- (ii) 1 and 3
- (iii) 1 and 4
- (iv) 2 and 5
- (v) 2 and 6

(2 marks)

e) Which of the following is **true**? To convert from the Fischer representation of an aldohexose to the Haworth representation.

- (i) Hydroxyls to the left must point upwards.
- (ii) Hydroxyls to the left must point downwards.
- (iii) The terminal  $-\text{CH}_2\text{OH}$  must point upwards
- (iv) The terminal  $-\text{CH}_2\text{OH}$  must point downwards.

(4 marks)

f) Compare and contrast the structure of glycogen and starch. (8 marks)

g) Why is hyperventilation (breathing in rapidly and deeply for say about 30 seconds) important before a competitive short distance run? (8 marks)

3. a) What do you understand by the following terms?

- (i) Inhibitor (1 mark)
- (ii) Apoenzyme (1 mark)
- (iii) Coenzyme (1 mark)
- (iv) Cofactor (1 mark)

b) Fluorocitrate inhibits the operation of the citric acid cycle because

- (i) It inactivates the  $-\text{SH}$  groups in enzymes
- (ii) It prevents the formation of citrate by condensing enzyme
- (iii) Its structure is sufficiently like succinate to inhibit succinate dehydrogenase.
- (iv) Fluoride is a general enzyme poison.
- (v) Fluorocitrate is a competitive inhibitor of aconitase.

(6 marks)

- c) What would the Lineweaver Burk Plot look like for an enzyme catalyzed reaction in which:
- (i) A competitive inhibitor is added. (3 marks)
  - (ii) A non competitive inhibitor is added. (3 marks)
  - (iii) An uncompetitive inhibitor is added (3 marks)
- d) Briefly explain how the velocity of an enzyme catalyzed protein is affected by
- (i) pH
  - (ii) Temperature
  - (iii) Time for  $[S] \gg K_m$  (6 marks)
4. Write an essay on properties of water that ensure that temperature fluctuations in the cell and the body are kept at the minimum. (25 marks)
5. a) What do you understand by the following terms. (1 mark)
- (i) Gluconeogenesis (1 mark)
  - (ii) Glycogenolysis (1 mark)
  - (iii) Hypoglycemia (1 mark)
  - (iv) Lipogenesis (1 mark)
  - (v) Ketosis (1 mark)
  - (vi) Glycogenesis (1 mark)
  - (vii) Glucosuria (1 mark)
  - (viii) Negative nitrogen balance (1 mark)
  - (ix) Essential amino acid (1 mark)
- c) Which of the following statements concerning events related to the power stroke of muscle contraction are correct?
- (i) The hydrolysis of ATP to ADP and  $P_i$  by myosin is fast compared to be released of ADP and  $P_i$  from the protein.
  - (ii) The binding of actin to myosin stimulates the ATPase activity of myosin by facilitating the release of ADP and  $P_i$ .
  - (iii) Actin and myosin are joined by cross-bridges that are stabilized by the binding of ATP to the myosin head domain.
  - (iv) Repeated cycles of ATP binding ATP hydrolysis and the resulting association and dissociation of cross-bridges and conformational changes in myosin contribute to the contractile process.
  - (v) In the region of overlapping thick and thin filaments of a sarcomere, the crossbridges will either all be formed or all be dissociated depending upon the phase of power stroke. (6 marks)
- d) (i) Write notes on why the body goes to such metabolic effort to use glycogen for energy storage when fat, which is far more abundant in the body serves the same purpose. (5 marks)
- (ii) Briefly outline glycogen breakdown. (5 marks)
6. Write an essay on the levels of protein organization. In your essay, highlight the types of bonds that are present and their significance. (25 marks)

**END OF EXAMINATION QUESTION PAPER**