

NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

SSC2103

FACULTY OF APPLIED SCIENCES

BACHELOR OF SCIENCE HONOURS DEGREE SUPPLEMENTARY EXAMINATIONS

DEPARTMENT OF SPORTS SCIENCE AND COACHING

THEORY: SSC2103: PRINCIPLES OF BIOCHEMISTRY

OCTOBER 2009

3 HOURS (100 MARKS)

INSTRUCTIONS

Answer 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) Which of the following are properties of primary structure of collagen?

- (i) One third of the amino acids and hydroxyproline.
- (ii) One third of the amino acids and glycine.
- (iii) Hydroxyproline and hydroxylysine are present.
- (iv) The sequence gly-pro-hydroxylysine recurs frequently.
- (v) Proline residues are more abundant in collagen than in most other proteins.
- (vi) The sugars glucose and galactose are often found attached to serine residues.

(6 marks)

b) Hydroxylation increases the stability of the collagen triple helix because it:

- (i) promotes hydrogen bonding with water.
- (ii) increases hydrogen bonding between peptide chains.
- (iii) Decreases the t_m of tropocollagen.
- (iv) neutralizes the change on lysine residues.

(4 marks)

c) Describe the structure and biological function of testosterone.

(15 marks)

2. a) Sketch the following curves and label fully.

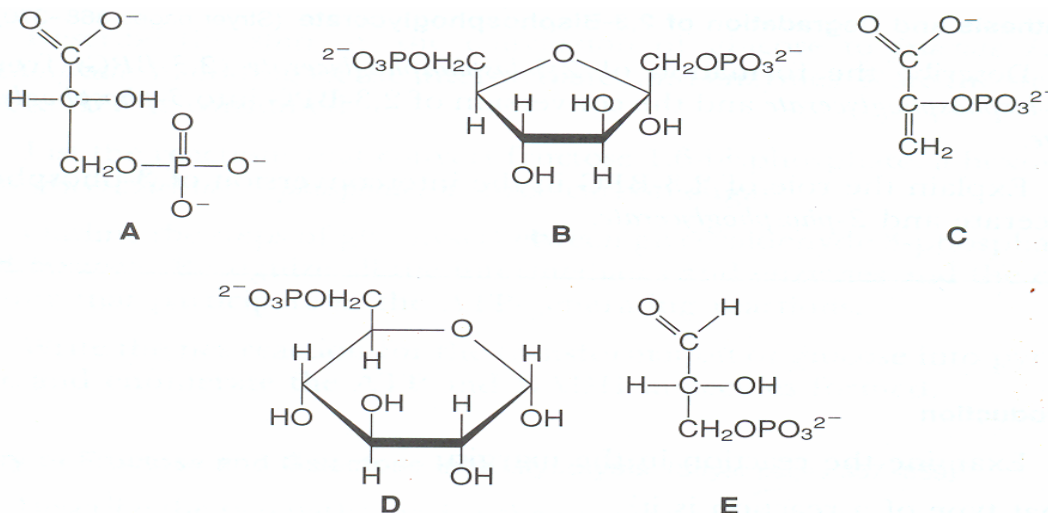
- (i) [P] vs time for [S] \gg Km (1 mark)
- (ii) V vs pH (1 mark)
- (iii) V vs temperature (1 mark)
- (iv) V vs [S] (1 mark)
- (v) $\frac{1}{V}$ vs $\frac{1}{[S]}$ (1 mark)

b) Reciprocals of a reaction velocity (V^{-1}) plotted against reciprocals of substrate concentration $[S]^{-1}$ were obtained cutting the V^{-1} axis at 0.015 hr per μg and the $[S]^{-1}$ at 0.15 per μg .

- (i) What was the maximum velocity (V_{max})? (2 marks)
- (ii) What was the K_m of the reaction? (2 marks)
- (iii) How is K_m related to V_{max} ? (1 mark)

c) Give an account on how enzyme activity can be regulated. (15 marks)

3. a) Examine the following chemical structures of five of the intermediates of glycolysis.



- (i) Name the five intermediates designated A – E.
- (ii) Give the order in which these intermediates occur in glycolysis.
- (iii) Name the enzyme or enzymes that produce the following intermediates
- (iv) Which of these intermediates is a “high energy” compound, that is, has a large phosphate group transfer potential?
- (v) Name the intermediate precursor of intermediate A.

(15 marks)

c) Write notes on bonds that are responsible for maintaining protein structure. (10 marks)

4. a) What do you understand by the following terms:

- (i) Racemization
- (ii) Absorption spectrum
- (iii) Enantiomer
- (iv) Bronsted acid
- (v) Ampholyte

(5 marks)

b) A solution of valine (MW 117) contains 249 g in 1 L solvent.

- (i) Calculate its molarity (2 marks)
- (ii) How many moles of valine are there in this solution? (3 marks)

d) Discuss the biochemical features of muscle contraction. (15 marks)

5. a) Explain what is meant by the following terms:

- (i) Gluconeogenesis (1 mark)
- (ii) Ketogenesis (1 mark)
- (iii) Aldose (1 mark)
- (iv) Ketose (1 mark)

b) Which of the following statements about glycogen storage are **incorrect?**

- (i) Glycogen is stored in muscles and liver.
- (ii) Glycogen is stored in brain and adipose tissue.
- (iii) Glycogen reserves can exceed the equivalent of 19 000 kcal in the average human being.
- (iv) Glycogen essentially fills cells that specialize in glycogen storage.
- (v) Glycogen storage occurs in the form of dense granules in the cytoplasm of cells. (3 marks)

c) i) Compare and contrast the chemical structures of glycogen and starch. (15 marks)

ii) What are the biological functions of starch and glycogen? (3 marks)

6. a) What do you understand by the following terms:

- (i) Lipogenesis
 - (ii) Rancidity
 - (iii) Saponification
 - (iv) Unsaturation
 - (v) Ketosis
- (5 marks)

b) Describe the β -oxidation of fats. (20 marks)

END OF EXAMINATION