



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF APPLIED BIOLOGY AND BIOCHEMISTRY

BACHELOR OF SCIENCE HONOURS DEGREE

THEORY: ENZYME BIOTECHNOLOGY SBB 4202

AUGUST 2009

3 HOURS (100 MARKS)

INSTRUCTIONS

Answer Four (4) Questions. Each question carries 25 marks. Where a question contains subdivisions, the mark value for each subdivision is given in brackets. Illustrate your answer where appropriate with large, clearly labelled diagrams

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- 1.(a) Define “enzyme immobilization”. [2 marks]
- (b) Describe the benefits of enzyme immobilization [7 marks]
- (c) State the advantages and disadvantages of physical adsorption. [4 marks]
- (d) Write equations showing the chemical reactions for the cyanogen bromide (CNBr), carbodiimide and 3-aminopropyltriethoxysilane methods of binding enzymes to solid support matrix. [12 marks]
- 2.(a) Briefly describe the characteristics of streptokinase and its use as a thrombolytic agent, highlighting the challenges faced in the medical use of this enzyme. [10 marks]
- (b) Asparaginase is an enzyme that catalyses the hydrolysis of L-asparagine, into aspartate and ammonia.
- (i) Write an equation representing a reaction of *de novo* asparagine synthesis in most mammal cells. [5 marks]
- (ii) Describe the application of asparaginase in the management of leukemia explaining the principle or mode of action of the therapeutic enzyme. [10 marks]
- 3.(a) Define the term biotransformation. [2 marks]
- (b) Outline the advantages of biological catalysts as compared to chemical catalysts. [6 marks]
- (c) Describe genetic modifications of existing biocatalysts and give an illustrative example of *in vitro* construction of a biocatalyst. [17marks]

- 4.(a) State the differences between the manufacture of bulk and fine enzymes. [10 marks]
- (b) List the applications of any four industrial enzymes and three analytical enzymes, indicating the sources of the enzymes and the reactions they catalyse. [15 marks]
- 5.(a) Give a generalized overview of downstream processing procedure for producing a finished product (biopharmaceutical/therapeutic enzyme) highlighting purification, and final product formulation. [20 marks]
- (b) State the parameters which are of paramount importance in product quality control. [5 marks]
- 6.(a) (i) Briefly describe the classes, names, distribution and mode of action of pectic enzymes. [7 marks]
- (ii) Give a detailed account of the industrial uses of pectin and pectin degrading enzymes. [6 marks]
- (b) (i) Describe the concept and application of a mobile hetero-bifunctional ligand and include in your answer an illustrative diagram. [6 marks]
- (ii) Describe in detail the stages of chitosan-precipitation assisted purification of a lectin. [6 marks]

END OF EXAMINATION

