

NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF APPLIED SCIENCES

BACHELOR OF SCIENCE HONOURS DEGREE EXAMINATIONS

DEPARTMENT OF APPLIED BIOLOGY AND BIOCHEMISTRY

THEORY: MOLECULAR GENETICS AND BIOTECHNOLOGY SBB 4105

DECEMBER 2002

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.

1. Write short notes on:

- (a) Type II restriction endonucleases; (12.5 marks)
(b) Homologous recombination. (12.5 marks)

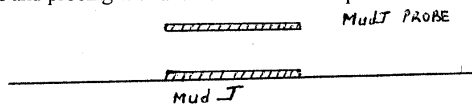
2. What is the basis for the generation of millions of distinct antibodies by mammals? Cite relevant evidence. (25 marks)

3. (a) The human β -haemoglobin gene is approximately 1.5 kb, while the haploid genome is about 3×10^6 kb. How many different restriction fragments 1.5 kb in length, have to be cloned to ensure 95% certainty that the β -globin gene will be represented at least once among the recombinant transformants?

Clark and Carbon mathematical relationship:

$$N = \ln(1 - P) / \ln(1 - f) \quad (9 \text{ marks})$$

(b) The orientation and distance of restriction sites from a chromosomal MudJ insertion is determined by Southern blots and probing with a radiolabelled MudJ probe as shown below.



The following size fragments are generated by single and double digestions using:

EcoRI and *Sal I*

ENZYME	SIZE FRAGMENTS (kb)
<i>EcoRI</i>	18 + 5.5
<i>Sal I</i>	12.7 + 9.0
<i>EcoRI + Sal</i>	9.0 + 5.5 + 4.2

Note that each enzyme has a restriction site within the MudJ sequence. (16 marks)

Construct a map consistent with all the data, giving your reasoning. Are there any circumstances which would require additional restriction digests?

4. Discuss the concept of restriction fragment length polymorphism (RFLP) and its use in the diagnosis of a hereditary disease. (25 marks)
5. You are sent a sample of purified mRNA from pancreatic cells that predominantly produce insulin. Discuss in detail an experiment you would carry out to produce large amounts of insulin from this mRNA. (25 marks)
- 6.(a) Describe the structure of a Ti plasmid and explain the function of the associated regions. (15 marks)
- (b) Using clearly labeled diagrams, describe the transformation of potato stem explants with *Agrobacterium*. (10 marks)

END OF EXAMINATION

odd no's

(10 marks)