



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF APPLIED BIOLOGY AND BIOCHEMISTRY

MSc APPLIED MICROBIOLOGY AND BIOTECHNOLOGY

IMMUNOLOGY SBB 5207

JUNE 2011

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. (a) With emphasis on morphology, development and granule content, outline the characteristics and biological functions of eosinophils, basophils and mast cells. (8 marks)
- (b) Give a detailed description of phagocytic pathways of microbial degradation. (7 marks)
- (c) Describe in detail the characteristics, composition, genetic mutations of the NADPH oxidase system and the mutation-associated immunological implications. (10 marks)
2. (a) Briefly outline the structure and role of the MHC class I molecule. (7 marks)
- (b) Give a detailed account of peptide loading and antigen presentation on classical MHC class II molecules. (18 marks)
3. (a) Outline the distinct mechanisms by which antibodies can elicit organ-specific autoimmunity. (6 marks)
- (b) Using myasthenia gravis, pemphigus vulgaris, type 1 diabetes mellitus and autoimmune thyroiditis (Hashimoto's thyroiditis), briefly describe the manifestations of antibody-mediated and cell-mediated organ-specific autoimmune diseases. (19 marks)
4. (a) Discuss the limitations of monoclonal antibodies in their use as therapeutic agents. (10 marks)
- (b) Describe in detail, how genetic engineering has made it possible to produce antibody fragments without the need to immunise an animal. (15 marks)

5. (a) You are provided with a monoclonal antibody that recognizes a new macrophage surface antigen, ICAM107, which is expressed in response to cytokines. Your intention is to study the surface expression and distribution of ICAM 107 among macrophage populations. Give a detailed account of a technique that would allow you to do this study and also obtain pure populations of cells expressing the antigen ICAM107. **(15 marks)**
- (b) Explain the mechanisms behind the precipitin reaction. **(10 marks)**
6. A virology research team has provided you with 3 envelope glycoproteins gp34, gp60 and gp120 from a recently discovered virus infecting and causing mortality in sheep. You are informed that gp120 is structurally similar to a gp120 of a non-lethal virus also found in sheep. Your task as a research and development scientist in a biotechnology company is to develop an immunoassay that would differentiate the two viruses. Describe the procedure that you would follow in developing and validating this assay. (NB you are expected to develop all immunoreagents in-house).

END OF EXAMINATION