

*Note: All questions are compulsory. Marks are indicated against each question in square brackets.*

Q1. You are an energetic immunology student, who has isolated protein X, which you believe is a new isotype of human immunoglobulin. What structural features would protein X have to have in order to be classified as an immunoglobulin? [3]

Q2. For each pair of antigens listed below, indicate which is likely to be more immunogenic and why? Explain your answer. [3]

- A protein with same amino acid sequence (-Gly-Gly-Gly-Gly-Gly-)  
A protein with different amino acid sequence (-Gly-Trp-Lys-Cys-Ala-)
- A protein with a molecular weight of 30,000  
A protein with a molecular weight of 150,000
- BSA in Freund's complete adjuvant  
BSA in Freund's incomplete adjuvant

Q3. Adaptive immunity has evolved in vertebrates but they have also retained innate immunity. What would be the disadvantages of having only an adaptive immune system? Comment on how possession of both types of immunity enhances protection against infection. [2]

Q4. With respect to Monoclonal Antibody production using hybridoma technology answer the following:

[2 X 2 = 4]

- Significance of Aminopterin for selection of Hybridoma cells.
- Need of using HGPRT<sup>-</sup> myeloma cells for production of hybridoma cells.

Q5. A company used murine monoclonal antibodies for therapy against cancer in humans. The therapy suffered from serious drawbacks. Provide a critical evaluation of the problem and suggest all possible strategies to combat the limitations of the therapy. Draw diagrams if required. [4]

Q6. Illustrate with diagrams the maturation and development of a progenitor B-cell, showing sequence of Ig-gene rearrangements that contribute to expression and production of antibodies. [4]

Q7. In context of Antibody diversity and gene rearrangement write short notes on the following:

[Any Five] [1 X 5 = 5]

- One-gene-one-protein hypothesis for antibody diversity
- One-turn/two-turn joining rule
- Allelic exclusion theory and its significance
- Junctional flexibility and its role in producing antibody diversity
- Arrangement of Heavy Chain constant gene segments and its significance
- Alternative splicing of a long primary mRNA and its significance in expression of antibody
- Significance of having multiple gene segments for coding of single antibody molecule