Module 14: Biotechnology and Genomics

Comprehension & Critical Thinking Questions

Part 1: Core Concepts

1. **The Toolbox**
    - What is a restriction enzyme? How do "sticky ends" facilitate ligation?
    - What is a vector (e.g., plasmid)? How is it used to introduce foreign DNA into bacteria?
2. **PCR (Polymerase Chain Reaction)**
    - Describe the three steps of PCR: Denaturation, Annealing, Extension.
    - Why is PCR called "molecular photocopying"? Why is it useful for forensics?
3. **Visualizing DNA**
    - Explain how gel electrophoresis separates DNA fragments.
    - Do smaller fragments migrate faster or slower? Why?

Part 2: Application

1. **Genetic Engineering**
    - Define transgenic organism (GMO).
    - Outline the steps to produce insulin-secreting bacteria.
2. **DNA Fingerprinting**
    - In a paternity test, a child has bands at positions A and B. The mother has band A.
    - Must the biological father have band B? Explain.

Part 3: Analysis & Evaluation

1. **Gene Therapy**
    - Differentiate ex vivo (cells treated outside the body) and in vivo (treatment inside the body) gene therapy.
    - What are the major challenges? (Delivery, immune response, targeting)
2. **Genomics**
    - We have sequenced the human genome. Why doesn't knowing the sequence immediately reveal gene function?
    - What is functional genomics?