Module 11: Mendelian Genetics

Comprehension & Critical Thinking Questions

Part 1: Core Concepts

1. **Mendel's Laws**
    - Define the Law of Segregation.
    - Define the Law of Independent Assortment. Does the inheritance of one trait affect another?

2. **Genotype vs. Phenotype**
    - Explain the difference between homozygous dominant (AA), heterozygous (Aa), and homozygous recessive (aa).
    - If "A" = Tall and "a" = Short, what is the phenotype of "Aa"?

3. **Complex Patterns**
    - Differentiate between incomplete dominance and codominance.
    - Explain polygenic inheritance using human height or skin color as an example.

Part 2: Application

1. **Monohybrid Cross**
    - In peas, Purple flowers (P) are dominant to White flowers (p).
    - Perform a cross: Pp × Pp. What are the expected genotypic and phenotypic ratios?

2. **Blood Typing**
    - Human blood type involves multiple alleles (I^A, I^B, i) and codominance.
    - Can a Type A mother and Type B father have a Type O child? Show the Punnett square.

Part 3: Analysis & Evaluation

1. **Pedigree Analysis**
    - Two unaffected parents have an affected child. Is the trait likely dominant or recessive?
2. **Nature vs. Nurture**
    - Hydrangea flower color changes with soil pH. Does genotype always strictly determine phenotype? How does the environment modify gene expression?