Module 11: Mendelian Genetics

Comprehension & Critical Thinking Questions

Part 1: Understanding Core Concepts

1. **Mendel's Laws**
    - Define the **Law of Segregation**. (Hint: How many alleles for a trait does a gamete receive?).
    - Define the **Law of Independent Assortment**. (Hint: Do hair color genes affect eye color genes?).
2. **Genotype vs. Phenotype**
    - Explain the difference between **Homozygous Dominant** (AA), **Heterozygous** (Aa), and **Homozygous Recessive** (aa).
    - If "A" is Tall and "a" is Short, what is the phenotype of "Aa"?
3. **Complex Patterns**
    - Differentiate between **Incomplete Dominance** (Red x White = Pink) and **Codominance** (Red x White = Red & White Spots).
    - Explain **Polygenic Inheritance** using human skin color or height as an example.

Part 2: Applying Biological Principles

1. **The Monohybrid Cross**
    - **Scenario**: In peas, Purple flowers (P) are dominant to White flowers (p).
    - **Apply**: Perform a cross between two Heterozygotes (Pp x Pp). What is the expected Genotypic ratio? What is the expected Phenotypic ratio?
2. **Blood Typing**
    - Human blood type is determined by multiple alleles (IA, IB, i).

- **Apply**: Can a mother with Type A blood and a father with Type B blood have a Type O child? Show the Punnett square.

Part 3: Analyzing & Evaluating

1. **Pedigree Analysis**
    - You are tracing a disease in a family tree. Two healthy parents have an affected child. Is the disease likely Dominant or Recessive? Explain your logic.
2. **Nature vs. Nurture**
    - Hydrangea flowers change color based on soil pH. Analyzing this in the context of genetics: Does Genotype *always* strictly determine Phenotype? How does the environment modify gene expression?