Module 1: Biology - The Study of Life

Comprehension & Critical Thinking Questions

Part 1: Core Concepts

1. **The Characteristics of Life**

    - List the seven characteristics shared by all living things.
    - Select a specific organism (e.g., *E. coli*, a sunflower, a wolf) and explain how it demonstrates each characteristic.

2. **Levels of Organization**

    - Define each level of biological organization: Atom, Molecule, Organelle, Cell, Tissue, Organ, Organ System, Organism, Population, Community, Ecosystem, Biosphere.
    - Which level is considered the fundamental unit of life? Justify your answer.

3. **Classification Systems**

    - What is the primary purpose of biological classification (taxonomy)?
    - List the eight taxonomic ranks from most inclusive to most specific: Domain, Kingdom, Phylum, Class, Order, Family, Genus, Species.
    - Explain the rules of Binomial Nomenclature. Why do scientists use scientific names rather than common names?

4. **The Scientific Method**

    - Outline the steps of the scientific method.
    - Define homeostasis and provide a biological example.

Part 2: Application

1. **Energy Dynamics**
    - Contrast how autotrophs and heterotrophs acquire energy.
    - Diagram the one-way flow of energy through an ecosystem versus the cyclic flow of nutrients.
2. **Evolutionary Pressures**
    - **Scenario**: A beetle population contains green and brown individuals. Birds preferentially prey on the beetles.
    - **Apply**: Predict how the presence of birds might shape the beetle population over generations if the environment is predominantly brown leaves.
3. **Scientific Inquiry**
    - **Scenario**: You observe that cellular phones lose battery faster in cold temperatures.
    - **Design**: A controlled experiment including your observation, hypothesis, independent variable, dependent variable, and control group.

Part 3: Analysis & Evaluation

1. **Structure and Function**
    - "Structure determines function" is a unifying theme in biology. Analyze this principle at the cellular level (e.g., red blood cells) and the organ level (e.g., the heart).
2. **Theory vs. Law**
    - Compare and contrast a scientific theory (e.g., Theory of Evolution) with a scientific law (e.g., Law of Thermodynamics). Which explains *why* phenomena occur?

3. **The Three Domains**

   - Compare the three domains of life: Bacteria, Archaea, and Eukarya.
   - Critique the statement: "All bacteria are harmful." Use evidence from biological diversity.