1. Cell Biology

- **Cell Theory:**
  - All living organisms are composed of one or more cells.
  - The cell is the basic unit of life.
  - All cells arise from pre-existing cells.
- **Prokaryotic vs. Eukaryotic Cells:**
  - *Prokaryotes*: Simple cells without a nucleus (e.g., bacteria).
  - *Eukaryotes*: Complex cells with membrane-bound organelles (e.g., plant and animal cells).
- **Organelles & Functions:**
  - **Nucleus:** Contains genetic material (DNA).
  - **Mitochondria:** Powerhouse of the cell; site of ATP production.
  - **Chloroplasts:** Present in plants; conduct photosynthesis.
  - **Endoplasmic Reticulum & Golgi Apparatus:** Involved in protein and lipid synthesis/transport.

2. Genetics and Molecular Biology

- **DNA Structure:**
  - Double helix composed of nucleotides (A, T, C, G).
  - Carries genetic instructions.
- **Gene Expression:**
  - **Transcription:** DNA → mRNA.
  - **Translation:** mRNA → Protein.
- **Mendelian Genetics:**
  - Traits are inherited in patterns described by dominant and recessive alleles.
  - Concepts of genotype vs. phenotype.
- **Mutations:**
  - Changes in DNA sequence that can affect protein function.

3. Evolution

- **Natural Selection:**
  - Organisms better adapted to their environment tend to survive and reproduce.
  - Leads to gradual changes in species over time.
- **Genetic Drift & Gene Flow:**
  - Random changes in allele frequencies (genetic drift).
  - Movement of genes between populations (gene flow).
- **Speciation:**
  - Process by which new species arise, often due to geographic isolation.

4. Ecology and Organismal Biology

- **Ecosystems:**
  - Communities of living organisms interacting with their physical environment.
- **Food Webs:**
  - Interconnected food chains showing energy flow from producers to various levels of consumers.
- **Biodiversity:**
  - Variety of life forms and their roles in ecosystems.
- **Homeostasis:**
  - Maintenance of internal stability (e.g., temperature regulation, pH balance).

5. Biochemistry

- **Macromolecules:**
  - **Proteins:** Made of amino acids; perform structural and enzymatic functions.
  - **Carbohydrates:** Provide energy and structural support (e.g., cellulose, glycogen).
  - **Lipids:** Fats and oils; energy storage, insulation, and cell membranes.
  - **Nucleic Acids:** DNA and RNA; store and transmit genetic information.
- **Enzymes:**
  - Biological catalysts that speed up chemical reactions without being consumed.