

Module 3: Organic Molecules

Keys to Success & Study Guide

Learning Objectives

By the end of this module, you should be able to:

1. **Classify** the four major groups of biological macromolecules and identify their constituent monomers.
2. **Explain** the chemical reactions (dehydration synthesis and hydrolysis) that build and break polymers.
3. **Correlate** the structural levels of proteins with their specific functions and vulnerability to denaturation.
4. **Differentiate** between DNA, RNA, and ATP in terms of structure and function.

Key Terminology Checklist

Define these terms in your own words to ensure mastery.

- [] **Macromolecule:** A large organic molecule formed by the polymerization of smaller subunits (monomers).
- [] **Hydrophobic:** Repelling water; characteristic of non-polar molecules like lipids.
- [] **Peptide Bond:** The covalent bond linking two amino acids together.
- [] **Nucleotide:** The monomer of nucleic acids, composed of a sugar, phosphate group, and nitrogenous base.
- [] **Enzyme:** A protein catalyst that accelerates biochemical reactions.
- [] **Phospholipid:** An amphipathic lipid with hydrophilic heads and hydrophobic tails; the structural basis of cell membranes.

Concept Check

1. Carbohydrates

- **Question:** What is the primary function of carbohydrates?
- **Key Answer:** Energy storage (starch, glycogen) and structural support (cellulose, chitin).
- **Distinction:** Storage polysaccharides (glycogen) are branched for rapid glucose release; structural polysaccharides (cellulose) form linear, rigid fibers.

2. Lipids

- **Question:** What defines a lipid?
- **Key Answer:** Lipids are hydrophobic or amphipathic molecules including fats, phospholipids, and steroids. They share insolubility in water, not structural similarity.

3. Proteins

- **Question:** What roles do proteins serve?
- **Key Answer:** Enzymes, structural components, transport carriers, antibodies, hormones, and motor proteins. A single amino acid change (e.g., sickle cell mutation) can disrupt protein folding and function.

4. Nucleic Acids

- **Question:** How do the two strands of DNA remain associated?
- **Key Answer:** Complementary base pairing via hydrogen bonds: Adenine-Thymine (2 bonds) and Guanine-Cytosine (3 bonds). This follows Chargaff's Rules: %A = %T and %G = %C.