Class 12 Chemistry – Biomolecules | Study Guide

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1. Theory in Simple Words with Visuals

1.1 What are Biomolecules?

Biomolecules are **organic molecules found in living organisms**, essential for life. They are like the **building blocks of our body**, helping in **structure, function, and energy storage**.

Main types of biomolecules:

1. **Carbohydrates** – Energy source
2. **Proteins** – Body building and function
3. **Lipids** – Energy storage and insulation
4. **Nucleic acids** – Genetic material
5. **Vitamins & Hormones** – Regulatory molecules

Visual Analogy: Think of the body as a **factory**:

- Carbs = Fuel
- Proteins = Machines/Workers
- Lipids = Oil & Storage Tanks
- Nucleic acids = Blueprints
- Vitamins = Supervisors

1.2 Carbohydrates

Type	Monomer	Example	Function
Monosaccharides	Glucose, Fructose	Glucose	Quick energy
Disaccharides	Sucrose, Lactose	Sucrose	Transportable energy
Polysaccharides	Starch, Glycogen, Cellulose	Starch	Storage / Structure

Important Points:

- **Glucose formula:** $C_6H_{12}O_6$
- **Storage:** Starch (plants), Glycogen (animals)
- **Structural:** Cellulose (plants), Chitin (insects)

Mnemonic:
"Mono → one, Di → two, Poly → many sugars"

1.3 Proteins

- **Monomer:** Amino acids (20 types)
- **Polymer:** Polypeptides / Proteins
- **Bond type:** Peptide bond

Levels of Protein Structure:

1. Primary – Sequence of amino acids
2. Secondary – α-helix / β-sheet
3. Tertiary – 3D folding
4. Quaternary – Multiple polypeptides

Functions: Enzymes, hormones, antibodies, structural proteins (collagen, keratin)

Mnemonic:
"**Every Strong Protein Quickly Forms**" → Enzymes, Structure, Protection, Quaternary, Functions

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1.4 Lipids

Type	Examples	Function
Fats	Triglycerides	Energy storage
Phospholipids	Lecithin	Membrane structure
Steroids	Cholesterol, Testosterone	Hormones & regulation

- **Key:** Lipids are **hydrophobic** (don't mix with water)
- **Energy yield:** ~9 kcal/g (double that of carbs/proteins)

1.5 Nucleic Acids

Type	Sugar	Bases	Function
DNA	Deoxyribose	A, T, G, C	Genetic info
RNA	Ribose	A, U, G, C	Protein synthesis

Structure: DNA = Double helix; RNA = Single strand

Mnemonic for bases:
"**A T Good Cow**" → DNA: A-T, G-C
"**A U G Cat**" → RNA: A-U, G-C

1.6 Vitamins & Hormones

Type	Water/Fat Soluble	Function
Vitamin A	Fat	Vision
Vitamin B	Water	Metabolism coenzyme
Vitamin C	Water	Immunity
Vitamin D	Fat	Calcium absorption
Vitamin E	Fat	Antioxidant
Vitamin K	Fat	Clotting

- Hormones: Chemical messengers (e.g., Insulin, Adrenaline)

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2. Key Concepts & Formulas

Biomolecule	Formula / Key Concept	Mnemonic / Tips
Glucose	$C_6H_{12}O_6$	"6C, 12H, 6O = Sweet energy"
Proteins	Amino acids → Peptide bond	"AA linked by peptide chain"
Lipids	CHO (less O)	"Hydrophobic fat storage"
DNA	Nucleotide = Sugar + Phosphate + Base	"Blueprint of life"
RNA	Nucleotide = Sugar + Phosphate + Base	"Messenger for protein"

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3. Solved Numerical / Reaction Problems

Example 1: Carbohydrate Calculation

Problem: Find mass of 1 mole of glucose.
Solution:

- $C_6H_{12}O_6$ = (6×12) + (12×1) + (6×16) = 180 g/mol

Example 2: Protein Peptide Bond

Problem: Dipeptide from 2 glycine molecules – molecular formula?
Solution:

- Glycine = $C_2H_5NO_2$
- Dipeptide loses H_2O in bond → $C_4H_8N_2O_3$

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4. Previous Years' Board Questions (Solved)

- Carbohydrate tests: Benedict's, Barfoed, Molisch
- Protein tests: Biuret, Xanthoproteic
- Lipids: Solubility in organic solvents
- Nucleic acid structure & function
- High-weightage: Classification, reactions, role in metabolism

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5. Quick Revision Notes / Important Points

- **Carbs:** Mono, Di, Poly → Energy / Structure
- **Proteins:** Amino acids → Peptide → Function
- **Lipids:** Fats, Phospholipids, Steroids → Energy & membranes
- **Nucleic acids:** DNA → info, RNA → synthesis
- **Vitamins:** Fat vs Water soluble

Visual Table for Quick Recall:

Biomolecule	Monomer	Function	Test
Carbs	Sugar	Energy	Benedict's, Molisch
Proteins	Amino acid	Structure / enzyme	Biuret
Lipids	Glycerol + FA	Energy, membrane	Solubility in ethanol
DNA/RNA	Nucleotides	Genetic info	Diphenylamine test

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6. Predicted / Likely Questions

1. Tests for biomolecules (carbs, proteins, lipids)
2. DNA vs RNA comparison
3. Role of vitamins & hormones
4. Carbohydrate classification & examples
5. Amino acids and peptide bond formation

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7. Exam Tips & Tricks

- Always **memorize tests and colors** for lab questions
- Use **mnemonics for bases and vitamins**
- Draw **flowcharts for biomolecule classification**
- For numerical: Check **molecular weight step by step**

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8. Visual & Kid-Friendly Learning Style

- **Carbs = Fuel cubes** → Quick energy
- **Proteins = Lego blocks** → Build machines
- **Lipids = Oil droplets** → Store energy
- **DNA = Twisted ladder** → Blueprint of life
- **Vitamins = Supervisors** → Keep factory running

Flowchart Example:

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Biomolecules
├─ Carbohydrates → Energy
├─ Proteins → Structure/Enzymes
├─ Lipids → Storage/Insulation
├─ Nucleic Acids → Genetic info
└─ Vitamins → Regulation
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