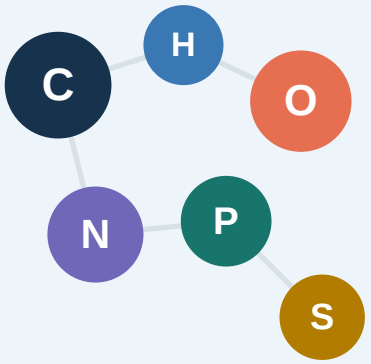
AP BIOLOGY | UNIT 1

TOPIC 1.2

Elements of Life

Living systems obtain atoms from the environment and rearrange them into the molecules needed for growth, repair, and reproduction.



CHNOPS

THE CORE CAUSAL CHAIN

ENVIRONMENT
source of atoms

→

CHNOPS
key elements

→

MOLECULES
matter rearranged

→

LIFE
growth and repair

BY THE END, YOU SHOULD BE ABLE TO...

1. Identify the elements most common in biological molecules.
2. Match nitrogen, phosphorus, and sulfur to key cell materials.
3. Explain how carbon supports molecular diversity.

BIG IDEA

A small set of elements can be combined in many ways. Their bonding patterns let cells build carbohydrates, lipids, proteins, and nucleic acids.

1 CHNOPS builds macromolecules

Carbon, hydrogen, and oxygen are most prevalent; nitrogen, phosphorus, and sulfur add essential structures.

C — CARBON
Backbone of biological molecules

H — HYDROGEN
Common in all four macromolecule groups

O — OXYGEN
Common in all four macromolecule groups

N — NITROGEN
Nucleic acid bases and amino groups

P — PHOSPHORUS
Phospholipids and nucleic acids

S — SULFUR
Sulfur-containing amino acids in proteins

REMEMBER **CHO are most prevalent. N, P, and S are still essential even when present in smaller proportions.**

ELEMENT PATTERNS IN MACROMOLECULES

CARBOHYDRATES

MAIN ELEMENTS
C, H, O

BIOLOGICAL ROLE
Energy sources and structural materials.

Element clue: CHO

LIPIDS

MAIN ELEMENTS
C, H, O (+ P)

BIOLOGICAL ROLE
Long-term energy, signaling, and membranes.

P appears in phospholipids.

PROTEINS

MAIN ELEMENTS
C, H, O, N (+ S)

BIOLOGICAL ROLE
Enzymes, transport, structure, and movement.

S occurs in some amino acids.

NUCLEIC ACIDS

MAIN ELEMENTS
C, H, O, N, P

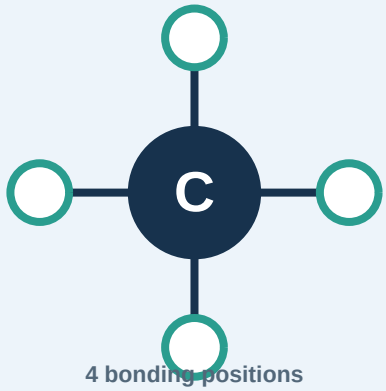
BIOLOGICAL ROLE
Store and transmit genetic information.

N in bases; P in the backbone.

2 Why carbon creates diversity

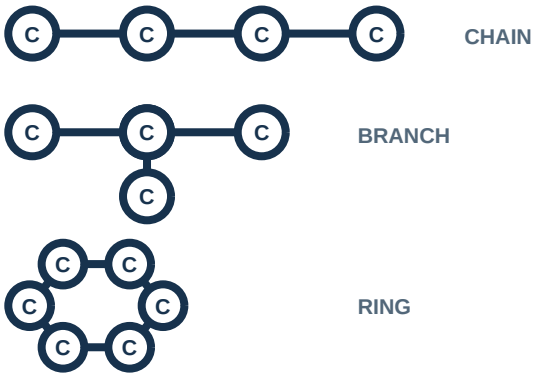
Four bonding positions let carbon form stable skeletons with many shapes and attached groups.

FOUR COVALENT BONDS



4 bonding positions

CARBON SKELETONS



STRUCTURE SUPPORTS FUNCTION

4 BONDS → bonding capacity

SKELETONS → chains and rings

3D SHAPES → attached groups

FUNCTION → specific interactions

MATTER BECOMES BIOMASS

$CO_2 + H_2O$ (plant inputs) → **FOOD + IONS** (animal inputs) → **CELL MOLECULES** (growth and repair)

Atoms are conserved and rearranged into new combinations.

COMMON ERROR

Organisms do not create elements, and energy does not turn into matter. Cells obtain atoms from the environment and rearrange them through chemical reactions.