

AP BIOLOGY CHEAT SHEET

Unit 1: Chemistry of Life

Quick Overview

- Focus:** polarity and hydrogen bonding, macromolecule structure to function, bond types, synthesis vs breakdown.
- Exam lens:** link structure to function and use correct bond vocabulary.

Water: Properties you must know

- Polarity:** O is more electronegative. Partial charges create hydrogen bonds between water molecules.
- Cohesion:** water sticks to water. Surface tension helps insects stand on water.
- Adhesion:** water sticks to other polar surfaces. Drives capillary action.
- High specific heat:** resists temperature change. Stabilizes ocean and body temps.
- High heat of vaporization:** evaporative cooling.
- Ice is less dense than liquid:** hydrogen bonds hold molecules farther apart when frozen.
- Universal solvent:** dissolves ions and polar molecules. Hydrophobic substances do not dissolve.
- Acids, bases, buffers:** weak acid-base pairs maintain pH in cells and blood.

Carbohydrates

- Alpha vs beta glucose:** alpha 1→4 in starch is digestible. Beta 1→4 in cellulose is not.
- Storage:** plants starch, animals glycogen.
- Structure:** cellulose fibers for plant cell walls.

Lipids

- Not true polymers. Hydrophobic.**
- Saturated fatty acids:** no double bonds. Straight. Solid at room temp.
- Unsaturated fatty acids:** at least one double bond. Kinked. Liquid at room temp.
- Phospholipids:** amphipathic. Form bilayers. Heads polar. Tails nonpolar.
- Steroids:** four fused rings. Example cholesterol and some hormones.

Proteins

- Amino acid parts:** amino group, carboxyl group, R group.
- Levels:** primary sequence, secondary alpha helix and beta sheet, tertiary overall 3D, quaternary multiple chains.
- R group interactions drive folding:** hydrogen bonds, ionic bonds, hydrophobic interactions, disulfide bridges.
- Denaturation:** heat or pH disrupts shape and function.

Nucleic Acids

- DNA vs RNA:** DNA deoxyribose and T, RNA ribose and U.
- Antiparallel strands. 5' phosphate end to 3' hydroxyl end.**
- A pairs T, G pairs C. Hydrogen bonds hold base pairs. Phosphodiester bonds hold the backbone.**

Bond types and reactions

- Covalent bonds:** share electrons. Nonpolar share equally. Polar share unequally.
- Ionic bonds:** electron transfer and attraction of ions.
- Hydrogen bonds:** weak attractions between partial charges. Critical in water and DNA base pairing.
- Van der Waals and hydrophobic interactions:** weak but important when many.
- Dehydration synthesis:** builds polymers by removing water.
- Hydrolysis:** breaks polymers by adding water.

Common exam pitfalls

- Students often confuse hydrogen bonds between separate water molecules with covalent bonds inside a water molecule.**
- Students often label lipids as true polymers. They are not.**
- Students often mix up dehydration synthesis and hydrolysis. Build removes water. Break adds water.**
- Students often mix up peptide bonds with hydrogen bonds in protein secondary structure. Peptide bonds hold amino acids in the backbone. Hydrogen bonds form helices and sheets.**

Type	Monomer or parts	Bonds formed	Elements (core)
Carbohydrates	Monosaccharides	Glycosidic linkage	C H O
Lipids	Glycerol + fatty acids. Phospholipid has phosphate head	Ester linkage	C H O P (phospholipids)
Proteins	Amino acids	Peptide bond	C H O N S (sometimes)
Nucleic Acids	Nucleotides	Phosphodiester bond	C H O N P

Mini formula box

- $pH = -\log_{10}[H^+]$
- $pOH = -\log_{10}[OH^-]$
- $pH + pOH = 14$ at 25°C
- A one unit change in pH equals a 10 fold change in $[H^+]$**

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