

Unit 1: Chemistry of Life

Topic	Learning Objective(s)
1.1 Structure of Water	SYI-1.A Explain how the properties of water that result from its polarity and hydrogen bonding affect its biological function.
1.2 Elements of Life	ENE-1.A Describe the composition of macromolecules required by living organisms.
1.3 Introduction of Biological Macromolecules	SYI-1.B Describe the properties of the monomers and the type of bonds that connect the monomers in biological macromolecules.
1.4 Properties of Biological Macromolecules	SYI-1.B Describe the properties of the monomers and the type of bonds that connect the monomers in biological macromolecules.
1.5 Structure and Function of Biological Macromolecules	SYI-1.C Explain how a change in the subunits of a polymer may lead to changes in structure or function of the macromolecule.
1.6 Nucleic Acids	IST-1.A Describe the structural similarities and differences between DNA and RNA.

Multiple Choice Practice

1. Scientists examined the folded structure of a purified protein resuspended in water and found that amino acids with nonpolar R groups were primarily buried in the middle of the protein, whereas amino acids with polar R groups were primarily on the surface of the protein. Which of the following best explains the location of the amino acids in the folded protein?
 - a. Polar R groups on the surface of the protein can form ionic bonds with the charged ends of the water molecules.
 - b. Polar R groups are too bulky to fit in the middle of the protein and are pushed toward the protein's surface.
 - c. Nonpolar R groups that cannot form hydrogen bonds with water are pushed into the middle of the protein.
 - d. Nonpolar R groups from different parts of the protein form covalent bonds with each other to maintain the protein's structure.
2. Rosalind Franklin's x-ray diffraction images taken in the 1950s most directly support which of the following claims about DNA?
 - a. The ratios of base pairs are constant.
 - b. The nucleotide sequence determines genetic information.
 - c. The two strands of DNA are antiparallel.
 - d. The basic molecular structure is a helix.

Multiple Choice Key

Question	Correct Answer	Unit/Topic	Source
1	C. Nonpolar R groups that cannot form hydrogen bonds with water are pushed into the middle of the protein.	1.4	2020 CED #12
2	D. The basic molecular structure is a helix.	1.5	2013 #6

Multiple Choice Explanations

Q		Explanation:
1	A	Polar groups are formed from polar covalent bonding (unequal sharing of electrons) which gives the polar groups a partial charge. An ionic bond is the attractive bond between an cation and an anion which result from the loss or gain of an electron.
	B	Polar groups will be attracted to the polar nature of water resulting in the polar groups on the surface of the protein.
	C	Nonpolar groups are formed from nonpolar covalent bonding (equal sharing of electrons) which results in no partial charge. The absence of the partial charge inhibits the hydrogen bonding with water molecules which are polar.
	D	Bonding (including covalent) between R groups will allow for covalent bonding (and other bonds). It does not apply to only the nonpolar R groups nor does it explain the location of the polar R groups on surface and nonpolar R groups buried in the middle (as stated in the prompt).
2	A	The images would be unable to show the nitrogenous bases thus unable to determine the ratios
	B	The images would be unable to show the nitrogenous bases thus unable to determine the nucleotide sequence
	C	The images would be unable to show the phosphate versus hydroxyl groups thus unable to determine the directionality (to determine antiparallel)
	D	The image clearly shows a circular shape with an X through the middle. This demonstrates there are two strands or a double helix (circular shape) with binding in the middle of nitrogenous bases (making the X shape).