CONCEPT: ALPHA HELIX HYDROGEN BONDING

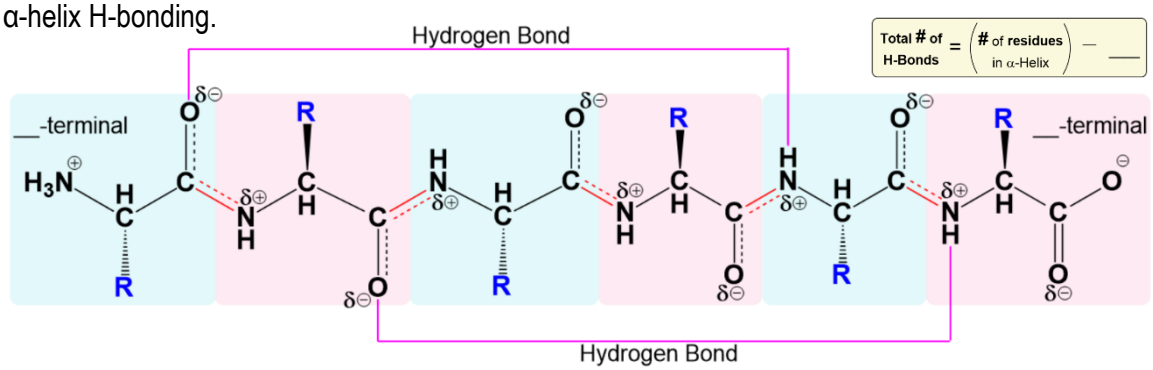
●α-helices are stabilized by intrachain hydrogen bonds between N-H and C=O groups in the peptide _____.

□ R-group hydrogen bonding is _____ involved in α-helix stabilization.

●Each C=O group of a residue hydrogen bonds with the N-H group ____ residues away (residue "X" bonds with X+4).

□ Therefore, first & last *four* residues of an α-helix do _____ fully participate in α-helix hydrogen bonding.

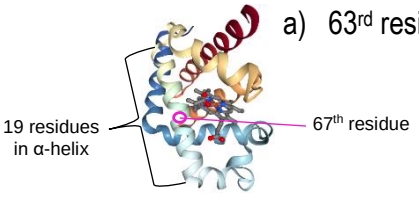
EXAMPLE: α-helix H-bonding.



EXAMPLE: Which residue does the carbonyl group of the 21st residue of a 30 residue α-helix hydrogen bond to?

a) 25th residue. b) 26th residue. c) 32nd residue. d) 33rd residue.

PRACTICE: The oxygen-storage protein myoglobin has 8 α-helices in its single polypeptide chain. Its 67th residue is near the center of a 19 residue α-helix. Which residue does the amino group of myoglobin's 67th residue hydrogen bond to?



a) 63rd residue b) 64th residue c) 71st residue d) 72nd residue

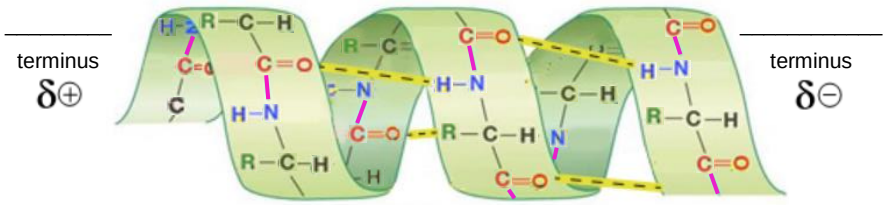
α-Helix Net Dipole

●α-helices have an overall net _____ due to the direction of polar peptide bonds & intrachain hydrogen bonds.

□ Net electron density is shifted towards the ___-terminus.

□ N-terminus of the α-helix has a net _____ charge while the C-terminus has a net _____ charge.

EXAMPLE: α-helix Net Dipole.



PRACTICE: True or False: Negatively charged residues near the α-helix N-terminal are stabilizing due to its net dipole.

a) True. b) False.

CONCEPT: ALPHA HELIX HYDROGEN BONDING

PRACTICE: Triose phosphate isomerase (TPI) is a crucial enzyme involved in the glycolysis pathway and contains 14 α-helices. Considering the net dipole of the α-helix, which of the following would be most destabilizing to TPI's structure?

a) An electric dipole spanning several peptide bonds throughout its α-helices.
b) The presence of Glu residues near the N-terminus of its α-helices.
c) The presence of Arg residues near the C-terminus of its α-helices.
d) The presence of Lys residues near the N-terminus of its α-helices.

PRACTICE: The hemagglutinin protein in influenza virus contains a remarkably long α-helix with 53 residues.

A) How long is the α-helix? _____

B) How many turns does this α-helix have? _____

C) How many hydrogen bonds are present in this α-helix? _____

PRACTICE: Which of the following statements about α-helices is false?

a) Myoglobin & hemoglobin α-helices are right-handed α-helices.
b) Each residue of an α-helix creates a 100˚ turn of the α-helix backbone.
c) The core of an α-helix is tightly packed with backbone atoms.
d) α-helices have an overall macrodipole with a partially positive C-terminus & partially negative N-terminus.
e) Hydrogen bonds that hold the α-helix together are about parallel to the axis of the helix.