CONCEPT: DETERMINING NET CHARGE OF A PEPTIDE

●Net charge of a protein: dictated by net charges of all _____ groups.

□ Recall: compare each pK_a to the solution _____ to determine ionization.

□ Only first & last amino acid residues in a chain have _____ α-amino or α-carboxyl groups.

●Net charge of a known polypeptide chain can only be *estimated* because of the *unique* _____ effect.

□ *Microenvironment*: immediate _____ surrounding an atom or molecule.

□ Affects the polarity & can shift ____ values of amino acid residues by several units, which affects the net charge.

□ Be sure to use pK_a values for amino acid _____, *not* pK_a's for free amino acids.

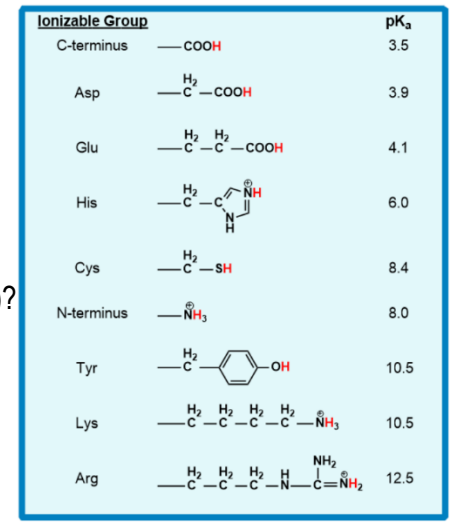
EXAMPLE: Estimate the net charge of the peptide at physiological pH (7.4). Arg-His-Asp-Gln.

a) -1

b) 0

c) +1

d) +2



PRACTICE: What is the net charge if you drop the peptide above into bleach (pH 12)?

a) -1

b) 0

c) +1

d) +2

PRACTICE: Answer the following questions (A, B & C) relating to the 4 tripeptides.

i) Tyr-Lys-Met ii) Asp-Trp-Tyr iii) Asp-His-Glu iv) Leu-Val-Phe

A) Which tripeptide is most negatively charged at pH = 7? _____

B) Which tripeptide contains the largest number of nonpolar R groups? _____

C) Which tripeptide contains sulfur? _____

PRACTICE: Estimate the net charge for a His-His-His-His peptide at pH 6 (His pK_R = 6).

a) -1 b) 0 c) +1 d) +2 e) +4

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PRACTICE: Estimate the net charge for the following peptide at pH 7: ATLDAK.

a)-1 b) 0 c) +1 d) +2

PRACTICE: A) Draw the predominant structure of the following peptide at pH 9: Asn-Arg-Cys. What is its net charge?

(Asn pK_{a1} = 8.8, Arg pK_R = 12.48, Cys pK_{a2} = 1.96, Cys pK_R = 8.18).

B) What is the net charge of the same peptide if the pH is lowered to pH = 2? Draw the newly ionized peptide.

C) Within what pH range would the net charge on the peptide above be approximately +1?

pH: _____