CONCEPT: AMINO ACIDS AND HENDERSON-HASSELBALCH

●Recall: *Henderson-Hasselbalch equation* expresses relationship between pH & _____.

□ Used to determine: 1) final _____ of a weak acid solution after it reaches equilibrium.

2) _____ of [conjugate base] to [conjugate acid] when given pH.

●Henderson-Hasselbalch equation is applied *independently* to each _____ group of an amino acid.

□ [conjugate base] to [conjugate acid] ratio can be used to calculate average net _____ of ionizable groups.

Henderson-Hasselbalch Equation

$$\mathbf{pH} = \mathbf{pK_a} + \log\frac{[\text{Conjugate Base}]_f}{[\text{Conjugate Acid}]_f}$$

EXAMPLE: Calculate the percentage of NH_3^+ in the R-group of Lysine at pH 9.8. (Lys pK_R = 10.8).

a) 66%
b) 91%
c) 74.8%
d) 32%

PRACTICE: At pH 11.8, what is the % of protonated amino group in the R-group of Lysine. (Lysine's pK_R = 10.8)?

a) 9%
b) 45%
c) 3%
d) 86%

PRACTICE: Draw Glu & calculate the % of -COOH in the R-group of Glu at pH 3.2. (Glu pK_R = 4.1).

a) 88.8%
b) 58.1%
c) 97.3%
d) 21.6%

PRACTICE: Draw Asp & calculate the pH at which two thirds (2/3) of Asp's R-group is dissociated. (Asp pK_R = 3.9).

a) 4.2
b) 3.5
c) 7.4
d) 8.9

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PRACTICE: Draw Arg & calculate the pH at which 23% of Arg's R-group is dissociated. (Arg pK_R = 12.5).

a) 11.98

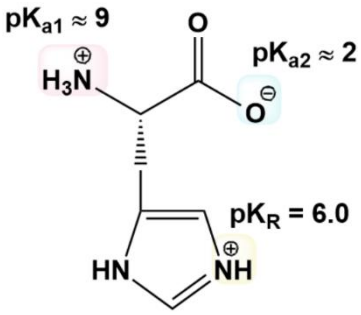
b) 9.93

c) 8.41

d) 12.67

PRACTICE: What is the ratio of [conjugate base] to [conjugate acid] for each of Histidine's three ionizable groups at pH 7?

A) Amino group ratio: _____



B) Carboxyl group ratio: _____

C) R-group ratio: _____

D) Use the ratios above to determine the average net charges of the ionizable groups & the entire His molecule at pH 7.

1. Net charge of Amino groups: _____

2. Net charge of Carboxyl groups: _____

3. Net charge of R-groups: _____

4. Net charge of His: _____

(Hint: sum previous 3 charges).