MCB 102: Principles of Biochemistry and Molecular Biology (Spring 2007)
Discussion Section 111 and 116
January 30, 2007
Quiz 1
Name:_____

Student ID:_____
Equations:
pH= -log $[H^+]$
pK_a = -log K_a
pH= pK_a + log ($[A^-]/[HA]$)

1. Glycine can be used as the main component of a buffer. The amino group of glycine has a pK_a of 9.6 and can exist in the protonated form and as a free base: $R\text{-}NH_3^+$ $R\text{-}NH_2 + H^+$

a. What pH range can glycine be used as an effective buffer? (1 pt.)
pH= pK_a + or – 1.00
Answer: pH range 8.6 – 10.6

b. How much 10 M NaOH is needed to make 600 mL of 0.1 M solution of glycine with pH 9.0? (1 pt.)
Find the ratio of [A-]/[HA]
pH= pK_a + log [A-]/[HA]
9.0= 9.6 + log [A-]/[HA]
-0.6= log [A-]/[HA]
$10^{-0.6}$ = [A-]/[HA]
0.25 = [A-]/HA]

Find total moles of glycine
0.1 moles X 600 ml = 0.06 moles
1000 ml
[A] + [HA] = 0.06 moles
[HA] = 0.06 – [A-]

$0.25 = \frac{[A^-]}{0.06 - [A^-]}$ [A-] = 0.012
Need 0.012 moles of NaOH
1000 ml/ 10 moles X 0.12 moles = Answer: 1.2 ml of 10 M NaOH

c. In a 0.5 M solution at pH 8.0, what fraction of glycine has its amino group in the $R\text{-}NH_3^+$ form? (1 pt.)
pH= pK_a + log [A-]/[HA]
8.0= 9.6 + log [A-]/[HA]
[A] + [HA] = 0.06 moles
$10^{-1.6}$ = [A-]/[HA]= 0.025

[A-] = $R\text{-}NH_2$
[HA] = $R\text{-}NH_3^+$

[A] = 0.025/1.025 [HA] = 1/1.025 Answer: [HA] = 0.9756 or 97.6%

2. What are the three letter codes for the following amino acids? (1 pt.)

F: __Phe_____ E:___Glu_____
Y: __Tyr_____ R:___Arg_____

3. Which amino acids from above do the proteases trypsin, chymotrypsin and cyanogen bromide cleave (spell out full name)? Specify if they cleave the N-terminal or C-terminal side. (1 pt.)

Answer: Trypsin cleaves arginine (and lysine), chymotrypsin cleaves phenylalanine and tyrosine (and tryptophan). Cyanogen bromide doesn't cleave any of the above amino acids (cuts methionine). These proteases cut at the C-terminus side of the amino acids.

4. Which of the following statements most represent the Edman degradation process? (1 pt.)
a) Sanger's reagent is used followed by hydrolysis of a peptide to form free amino acids
b) It is a process commonly used for peptide synthesis
c) The Edman degradation is a 100% efficient
d) The amino-terminal residue is labeled and cleaved without breaking the other peptide bonds
Answer: d