MCB 102 **Quiz #1** **Discussion Section: Monday 10-11am**

ANSWER KEY **January 29, 2007**

Equations you might need:	$pK_a = -\log K_a$
$pH = \log (1/ [H^+])$	$K_a = [H^+][Ac^-] / [HAc]$
$[H^+][OH^-] = 10^{-14}$	$pH = pK_a + \log ([A^-]/[HA])$

Please show your work/calculations! If you need more space, use the back of your paper.

(1 pt.) **1) Write the sequence of the following peptide using 1-letter and 3 letter abbreviations:**
Tyrosine –Threonine –Glutamine –Histidine – Phenylalanine –Proline –Alanine –Lysine

3-letter: **Tyr – Thr – Gln – His – Phe – Pro – Ala – Lys**

1-letter: **Y – T – Q – H – F – P – A – K**

(1 pt.) **2) Phosphoric acid has a pK_a of 2.14 and carbonic acid has a pK_a of 3.77. Which is the weaker acid?**
Carbonic acid is weaker. Lower pKa = stronger acid
Does the weaker acid have a <u>greater</u> OR <u>lesser</u> tendency to lose its proton than the stronger acid? Circle.
Lesser tendency!

(1 pt.) **3) You have just made a solution by combining 100mL of 0.1 M acetic acid (pK_a = 4.76) with 400mL of 0.05 M sodium acetate. Calculate the resulting solution's pH. Please show your work.**

(0.1mol / 1000mL) x (100mL) = <u>0.01</u> moles acetic acid→ weak acid

(0.05 mol / 1000mL) x (400mL) = <u>0.02</u> moles sodium acetate → conjugate base

pH = pKa + log ([A-]/{HA}) => 4.76 + log ([0.02/0.01]) = 5.06

(2 pts.) **4) How would you prepare a 400 mL solution of 0.05 M phosphate buffer (pK_a= 6.86) at pH=7.16, using 0.5 M dihydrogen phosphate and 0.5 M monohydrogen phosphate.**

1) <u>Find total moles of phosphate:</u>

400mL x (0.05 mols/1000mL) = 0.02 moles

So, [A-] + [HA] = 0.02 moles

3) <u>Now solve to give you moles of each:</u>
Since [A-] = 0.02 - [HA] and ([A-] / [HA]) = 2
0.02 - [HA]/ [HA] = 2
[HA] = <u>0.0067 moles</u>

Solving for [A-] = <u>0.0133 moles</u>

2) <u>Calculate the ratio for [A-] and [HA]</u>

pH = pKa + log ([A-]/{HA])
7.16 = 6.86 + log ([A-]/{HA])
([A-] /[HA]) = 2

4) <u>Calculate volume</u>
[HA]: 0.0067 moles / (**X** ·mL) = 0.5moles / 1000 mL
[HA] = **13.4 mL** of 0.5M dihydrogen phosphate

[A-]: 0.0133 moles / (**X** ·mL) = 0.5moles / 1000 mL
[A-] = **26.6** mL of 0.5M monohydrogen phosphate

And don't forget the **360mL** of water!!!

(1 pt.) **5) Which letter in the right column best matches the technique listed on the left?**

a) Cation-exchange chromatography	**<u>bb</u>**	aa. High pressure pumps move proteins down the column
b) Affinity chromatography	**<u>dd</u>**	bb. Contains a synthetic polymer matrix with anionic groups
c) HPLC	**<u>aa</u>**	cc. an ampholyte solution in a gel allows pI determination
d) Isoelectric focusing	**<u>cc</u>**	dd. Separates based on binding specificity