BCH 4053 **HOUR TEST 1** **NAME**_____
February 9, 2001

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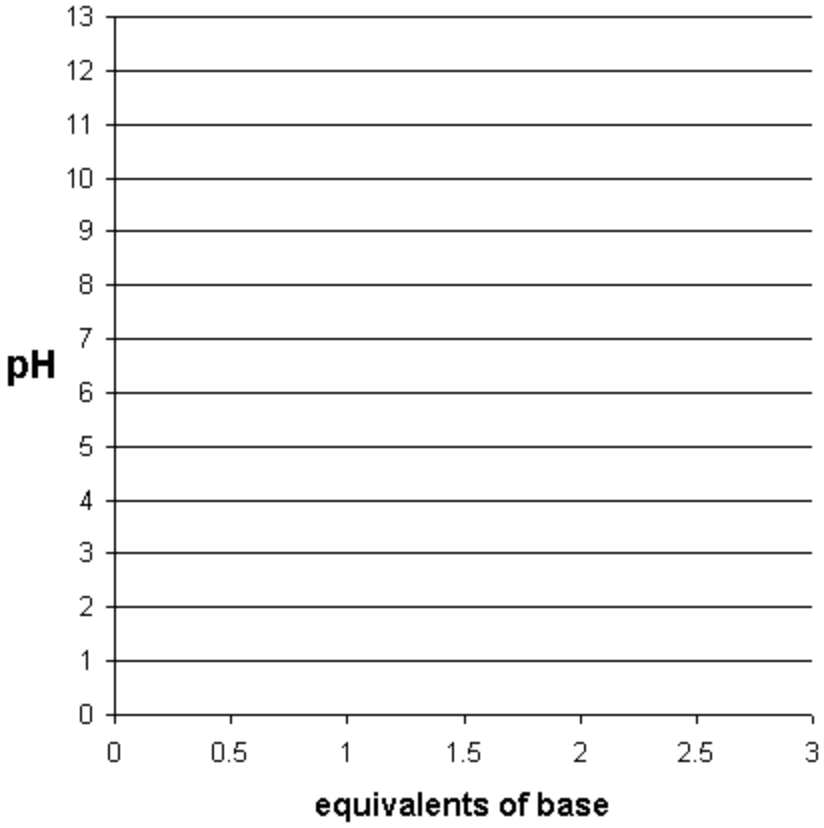
(10) 1. Formic acid has a pK of 3.8. If formic acid were detected in the urine of a patient, and the urine had a pH of 4.5, what **fraction** of the formic acid would be protonated? (Note: I am asking for a **fraction** and not a **ratio**).

(14) 2. Draw a titration curve for **glutamic acid** on the graph below.
(a) Locate and identify the points on the curve corresponding to **pK_1**, **pK_2**, and **pK_3**.
(b) Calculate the approximate **pI** value and locate its position on the curve.
(c) Indicate the pH region of the graph in which the **side chain functional group** is >90% charged.



(8) 3. **Underline** the following peptides which are negatively charged at pH 7.0. **Circle** each amino acid which is **aromatic**.

gln.val.tyr.ala lys.arg.glu.trp

met.his.leu.asp cys.pro.gly.asn

(12) 4. You have a solution of 500 mL of 0.24 M acetate buffer with a pH of 4.8, which is the pK of acetic acid. To this solution you add 20.0 mL of 1.0 M sodium hydroxide. What is the final pH of the solution? (Show your work).

(10) 5. You have isolated an octapeptide with the amino acid composition

(Lys_2, Asp, Tyr, Phe, Gly, Ser, Ala)

Reaction of the intact peptide with FDNB yields DNP-alanine. Cleavage with trypsin yields peptides with compositions (Lys, Ala, Ser) and (Gly, Phe, Lys) plus a dipeptide. Reaction with chymotrypsin releases free aspartic acid, a tetrapeptide with composition (Lys, Ser, Phe, Ala) and a tripeptide with composition (Gly, Lys, Tyr). What is the sequence? (Explain your reasoning).

Use the following standard free energy values to answer questions **6 and 7**.

Compound	**¥G°' (kJ/mol)**
phosphoenolpyruvate	-62
acetyl phosphate	-43
creatine phosphate	-43
ATP	-31
glucose-1-phosphate	-21
glucose-6-phosphate	-14
glycerol-3-phosphate	-9

(12) 6. Muscle "stores" energy in the form of creatine phosphate according to the following reaction:

creatine + ATP ¾ creatine phosphate + ADP

(a) Calculate **¥G°'** and **K'** for this reaction as written. (**R = 8.315 J/mol-K. Assume body temperature --37 °C or 310 K**)

(b) What would **Q'** and **DG** be for the reaction if the [ATP]/[ADP] ratio were 2 and the [creatine phosphate]/[creatine] ratio were 0.01?

(6) 7. Tell whether each of the following reactions is **spontaneous** or **non-spontaneous** as written.

_____ (a) glucose + glycerol-3-phosphate ¾ glucose-6-phosphate + glycerol

_____ (b) glucose-1-phosphate ¾ glucose-6-phosphate

_____ (c) acetyl-phosphate + pyruvate ¾ acetate + phosphoenolpyruvate

(10) 8. Given the following data on three different proteins:

Protein	**hemoglobin**	**chymotrypsinogen**	**urease**
Molecular Weight (M)	64,500	23,250	482,000
Diffusion Coefficient (D)	6.9	9.5	3.5
Isolectric pH (pI)	6.8	9.5	5.0

Indicate in the blanks which of the three proteins will:

_____(a) Elute first from a gel filtration column.

_____(b) Elute first from a diethylaminoethyl cellulose ion exchange column.

_____(c) Have the smallest frictional coefficient (f).

_____(d) Migrate fastest upon electrophoresis in sodium dodecyl sulfate (SDS).

_____(e) Migrate fastest to the anode in an electrophoresis experiment at pH 6.0.

(6) 9. Draw a Ramachandran map, label the axes properly, and indicate on the map the conformational location of (a) an alpha helix, (b) a beta sheet, (c) collagen.

(12) 10. Explain the role of each of the following reagents in sequencing a protein:

(a) cyanogen bromide

(b) dithiothreitol

(c) iodoacetate

(d) performic acid