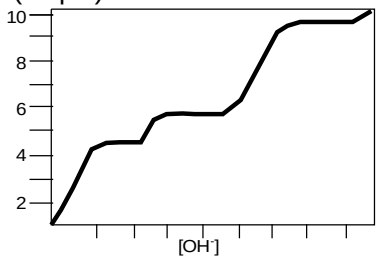
September 16, 2005
Fall 2005
Isom

EXAM 1

Biochemistry I / CHEM 4320

Name: _____

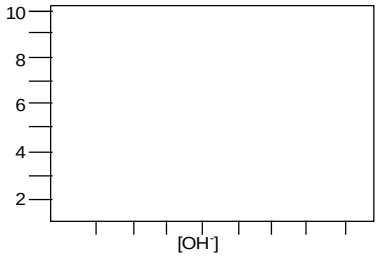
1) a) Draw a molecule, containing **only** the following functional groups (A) one amine, (B) two benzene rings, (C) one amide, (D) one carboxylic acid, and (E) one alcohol, that would have the titration curve shown . You may use as many linking carbons (i.e. aliphatic, $-CH_2-$ or $-CH_3$) as you need to build your molecule. (10 pts)



b) Label each relevant part of the titration curve with the letter of its corresponding functional group (i.e. C for amide, D for carboxylic **acid, etc.).** Explain your reasoning below including any structural considerations and justifying your assignments especially when pka values are similar. (8 pts)

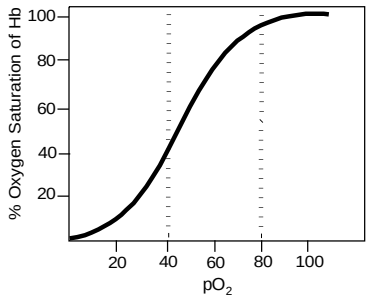
c) You decide to test your molecule's pharmacology. Where would your molecule dissolve and absorb most readily? Why? (6 pts)

d) Briefly describe how you would change your molecule structurally so that it would cross the BBB. Draw the titration curve you would expect from your altered molecule below. Briefly explain. (8 pts)



e) You advantageously discover that your drug treats sickle cell anemia and patients taking your drug have hemoglobin with higher oxygen affinity than those taking a placebo. Offer a possible explanation for this observation. (3pts)

2) a) You have four patients with the following four different defects in RBC or Hb. (A) 4α, (B) 4β, (C) defect in Cl^- transport into cell, (D) His 146 changed to a Lysine. Explain the effect of each defect on Hb conformation and on oxygen transport ability. (12 pts)



b) The oxygen binding curve for normal Hb is shown on the graph above with the vertical lines representing the values for venous and arterial blood respectively. On the graph, draw the oxygen binding curves you would expect from patients B and C in part a above. Label each curve clearly. (4 pts)

3) a) Compare and contrast the effects on blood pH and O_2 transport expected from a patient who (A) has lost the ability to retain HCO_3^- from urine versus a patient who (B) has undergone prolonged vomiting for days. (10 pts)

b) Briefly explain how respiration would be adjusted and how kidneys would respond to each condition above with respect to HCO_3^-, NH_4^+, Na^+ and Cl^- (10 pts)

c) One patient's [CO_2] is 0.752 and [HCO_3^-] is 24. Using these values, set up the equation you would use to calculate the patient's pH. (pKa of CO_2 conversion to HCO_3^- is 6.1) Based on the equation, would you expect this value to be high or low? Why? (normal values: [CO_2] = 1.35, [HCO_3^-] = 25.5) (6 pts)

d) If patient A above developed emphysema and had a hard time exhaling CO_2 how would that affect his blood pH? Would that be a good or bad adjustment as far as pH goes? (3 pts)

4)a) You are investigating the protein folding in two single-celled organisms. Organism A lives in artic water (very cold) and organism B lives in thermal heat vents (very hot) on the ocean floor. If the two organism contained an indentical protein (same sequence and structure), explain how would you expect the spontaneity of the folding of this protein to differ in the two organisms **using an equation.** (5 pts)

b) How is your answer in (a) consistent with what you know conceptually about protein folding? (6 pts)

c) Now assume that the two organisms have proteins that differ in sequence and structure. What sequence differences would favor spontaneity under the natural environmental conditions of each organism? (5 pts)

5) List and briefly explain two ways that LeChatelier's principle is relevant to drug absorption. (4 pts)