Biochemistry I Fall 2011 Exam 1 12:00 Dr. Stone Name_____

Ka for acetic acid = 1.74×10^{-5} Ka for formic acid, $CH_2O_2 = 1.78 \times 10^{-4}$ Ka for lactic acid, $C_3H_6O_3 = 1.41 \times 10^{-4}$	Ka = [H+][A-]/[HA]
Kw = [H+][OH-]= 1×10^{-14}	pH = pKa + log [A-]/[HA]
Ka for $H_2PO_4^-$ = 1.38×10^{-7}	Ka for $H_3PO_4 = 7.5 \times 10^{-3}$
Ka for $H_2CO_3 = 2.7 \times 10^{-4}$	Ka for $HPO4^{-2} = 3.98 \times 10^{-13}$
Keq for the formation of carbonic acid from carbon dioxide and water= 0.003 (K_h) at 37°C	K for dissolving CO_2 in water at 37°C: 0.23 (conversion from mPa to mM)

Put your answers on this exam. There are 6 short answer (5 points) questions, 5 problems (5-15 points each) and one table (15 points) to complete for a total of 100 points.

1. (5 points) Put the following solutions in order from lowest pH to highest pH: 0.1 M sodium formate, 0.1 M acetic acid, 0.1 M formic acid, 0.1 M potassium hydroxide, 0.1 M hydrochloric acid

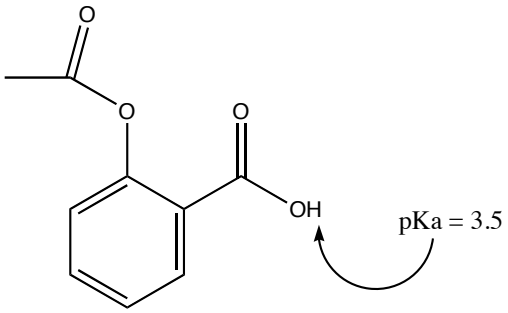
Lowest pH Highest pH

_____ _____ _____ _____ _____

2. (5 points) Carbonic anhydrase is an important enzyme in red blood cells. It is involved in the reaction of carbon dioxide and water to form carbonic acid. Describe the effect of carbonic anhydrase on the equilibrium constant, K_h for this reaction. (Write complete sentences.)

3. (5 points) Fully describe what a buffer is and what it does. (Write complete sentences.)

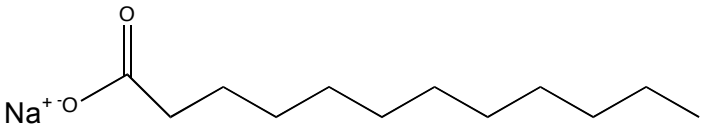
4. (5 points) According to a 1998 report, It is estimated that 45 thousand tons of Aspirin are produced per year, worldwide. (That averaged out to about 80 tablets/person per year.) Using the structure at pH 1, shown below, explain why more aspirin is absorbed in the intestines at pH 6 than in the stomach at pH 1.5. What is the predominant structure in the stomach? In the intestines? What intermolecular forces are involved? (Write complete sentences.)



Acetylsalicylic acid, aspirin

5. (5 points) What is wrong with this order for a severely dehydrated patient: Give 500 ml sterile water by IV (IV = intravenously) (Write complete sentences.)

6. (5 points) Describe the intermolecular forces that are involved when soap molecules form micelles. (Write complete sentences.)



sodium dodecanoate (soap molecule)

Problem section. Show all of your work. No work= no points.

7. (15 points) Draw the titration curve for the titration of 25 mL of a 0.3 M solution of lactic acid with 0.12 M sodium hydroxide. Clearly label the axes of your graph. Be sure to include pH values and volumes for the following: Start of the titration (no sodium hydroxide added), the pH at the volume that is half of the volume of the endpoint, pH and volume at the end point of the titration the pH of the solution when 1 more mL of the sodium hydroxide (past the end point) has been added. Show all of your calculations.

8. (15 points) Give the complete detailed instructions for making 200 mL of a 110 mM phosphate buffer at pH 6.5. All ionic phosphate species are available as sodium salts (e.g NaH_2PO_4, Na_2HPO_4, Na_3PO_4). Phosphoric acid is available an 18% solution (18 g/100 mL)

9. (10 points) An unconscious, 67 year old, 50 kg female is brought into the ER. Dr. Dewgi orders blood gases and blood pH to be determined. The results of the tests indicate that the patient has metabolic acidosis. Dr. Dewgi didn''t take his Chemistry II seriously, so now you need to help him save his patient.

Normal values:	Patient values:
pH 7.4	pH 6.9
HCO_3^- 24 mM	
CO_2 1.2 mM	CO_2 1.3 mM

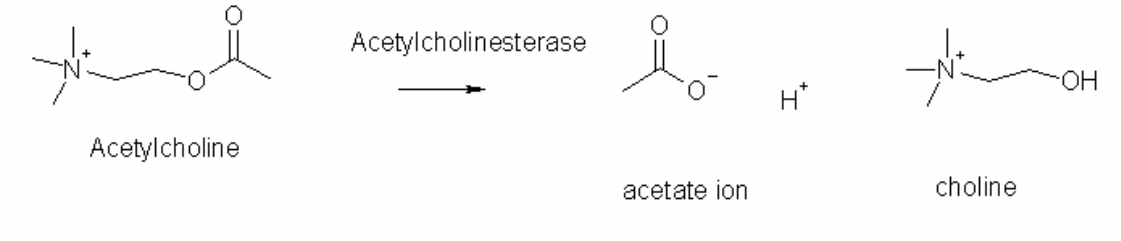
a. What effect does not breathing have on blood pH? Why does this occur?

b. Determine the amount of bicarbonate in the patient's blood.

c. Should he be given bicarbonate? Why or why not? If you should, then calculate how much is needed (the volume of the patient is 5.6L). If not, then what would help the patient? Show relevant reactions.

10. (10 points) If 200 mL of a 0.4M phosphate buffer at pH 6.5 has a new pH of 7.3 after some volume of 0.1M sodium hydroxide was added, what volume of 0.1M sodium hydroxide was added?

11. (5 points) Acetylcholine is a neurotransmitter that is degraded by acetylcholinesterase to fm acetic acid and choline, as shown below. If a 20 mL sample of acetylcholine at pH 7.23 was incubated with acetylcholinesterase and the new pH was 6.54, determine the number of moles of acetylcholine present in the 20 mL sample.



12. (15 points) Draw the **structures** and give the **names** and **one letter codes** for these amino acids. Also, indicate if the R group is polar or non polar and give the pKa for any ionizable R groups

	One letter code	Name	Structure	polar or non polar?	pKa of R group
a. Pro					
b. Lys					
c. Ser					
d. His					
e. Gln					