This is ACA # 26. It is OK to use your textbook, but if you can answers the questions without it that is OK too.

I recommend you print out this page and bring it to class. Click here to show a set of five ACA26 student responses, randomly selected from all of the student responses thus far, in a new window.

John , here are your responses to the ACA and the Expert's response.

1. K_a for $HC_2H_3O_2$ is 1.8 x 10^{-5} and K_b for $C_2H_3O_2^-$ is 5.6 x 10^{-10}. Which has the larger K?

HC2H3O2 95%

K_a for $HC_2H_3O_2$ is larger compared to K_b for $C_2H_3O_2^-$.

2. Based on your response in Q1 if we have a solution that is 0.100 M $HC_2H_3O_2$ and 0.100 M $NaC_2H_3O_2$ will the solution be acidic or basic?

acidic 100%

The solution will be acidic.

3. Calculate the pH of 1.00 L of a solution that is 0.100 M $HC_2H_3O_2$ and 0.100 M $NaC_2H_3O_2$.

pH = 4.74 70%

	$HC_2H_3O_2(aq)$ +	⇄	$C_2H_3O_2^-(aq)$ +	$H^+(aq)$
I	0.100		0.100	~0
C	-x		+x	+x
E	0.100 - x		0.100 + x	+x

$K_a = [C_2H_3O_2^-][H^+]/[HC_2H_3O_2]$

$1.75 \times 10^{-5} = [0.100 + x][x]/[0.100 - x]$

assume 0.1 - x = 0.1

$1.75 \times 10^{-5} = [0.100][x]/[0.100]$

$1.75 \times 10^{-5} = [x] = [H^+]$

The pH of the solution is 4.74, so it is acidic as we predicted. In a solution of a weak acid and its conjugate base we know whether the solution is acidic or basic by comparing the K's for the two components. The component with the larger K determines the acid/base character of the solution.

4. The solution in Q3 is called a buffer solution. The important charateristic of a buffer solution is ability to resist large changes in pH when small amounts of strong acid or strong base are added. Consider the pH calculated in Q3, if a small amount of HCl is added to the solution will the pH increase or decrease? Provide a short response explaining your answer.

95%

decrease. Adding strong acid to the buffer will result in a reaction with the conjugate base of the buffer to increase the amount of acid in the buffer...more acid, lower the pH

Adding an acid to the solution will cause the pH of the solution to decrease...become more acidic.

5. In 1.00 Liter of solution that is 0.100 M $HC_2H_3O_2$ and 0.100 M $NaC_2H_3O_2$ what is the formula of the weak acid and the formula of the weak base in the solution.

The formula of the weak acid is HC2H3O2 95%

The formula of the weak acid is $HC_2H_3O_2$.

The formula of the weak base is C2H3O2^- 100%

The formula of the weak base is $C_2H_3O_2^-$.

6. If some HCl is added to the buffer solution in Q5 write a chemical equation that

describes how the buffer solution neutralizes the added HCl. 30%

$HCl + C_2H_3O_2^- \rightarrow HC_2H_3O_2 + H_2O$

H^+ + C2H3O2^- --> HC2H3O2 35%

$H^+ + C_2H_3O_2^- \rightarrow HC_2H_3O_2$

7. If some NaOH is added to the buffer solution in Q5 write a chemical equation that describes how the buffer solution neutralizes the added NaOH.

OH^- + HC2H3O2 --> C2H3O2^- + H2O 70%

$HC_2H_3O_2 + OH^- \rightarrow C_2H_3O_2^- + H_2O$

8. What is the pH of a 100 mL sample of distilled water at 25 degrees Celsius?

pH = 7 75%

Since the sample is pure water the pH should be 7.

9. If 0.0100 mol of HCl is added to the 100 mL sample of distilled water in Q8, calculate the pH of the solution. Assume no volume change occurs after mixing.

pH = 1 50%

Adding 0.0100 mL to 0.100 L will yield a 0.100 M HCl solution. HCl is a strong acid so the HCl will completely dissociate so [H^+] = 0.100 M and the pH is 1. So adding 0.0100 moles to 100 mLs of water causes a pH change of 6 pH units!

10. Is there anything about the questions that you feel you do not understand? List your concerns/questions.

nothing

11. If there is one question you would like to have answered in lecture, what would that question be?

nothing

neutralization reactions!
Where is H_2O?