

## Prelab Questions--Experiment 10: Buffers

Everyone answer the same first two questions then:

Answer **one** (1) of the following questions, based on the last digit of your student ID number.\*

ID ending in: 0 or 1: a, 2 or 3: b, 4 or 5: c, 6 or 7: d, 8 or 9: e

(However, you will find answering all the questions excellent preparation for the lab exercise.)

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Two Questions for everyone:

1. Derive the Henderson-Hasselbalch equation from the  $K_a$  equilibrium expression:



Express your final result in terms of the nominal concentrations:  $c_A$  for the acid and  $c_B$  for the conjugate base. Since the answer is well-known, carefully describe each step in your derivation. In particular, describe the approximation that is required to use just the nominal concentrations in the final result. (*Just writing down the Henderson-Hasselbalch equation alone will receive no credit.*)

2. A buffer is prepared using 50.0 mL of 0.100 M acetic acid and 50.0 mL of 0.100 M sodium acetate. The pH is recorded. The pH is then recorded after addition of 0.500 mL of 1.000 M NaOH. Calculate the pH of the buffer before and after the addition of the strong base. The  $K_a$  of acetic acid is  $1.75 \times 10^{-5}$ .

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a. What volume of 0.100 M HCl is required to produce a 50:50 buffer starting with 50.0 mL of a 0.200 M solution of sodium acetate?

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b. The pH of a  $1.0 \times 10^{-3}$  M sodium chloride solution at 25 °C that is prepared using boiled deionized water is expected to be \_\_\_\_\_

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c. Consider the theoretical treatment of buffers Chapter 16 of Olmstead and Williams. A 50:50 buffer using 0.1 M acetic acid and 0.1 M sodium acetate is prepared. After a 10-fold dilution the pH of the buffer (*choose one*): *increases, decreases, stays the same*

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d. The experiment that is designed to determine the buffer range for an acetic acid-acetate buffer is (*choose one*): *Part 1, Part 2A, Part 2B, Part 2C, Part 3A, Part 3B*

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e. Calculate the mass of sodium acetate·trihydrate required to prepare 50.0 mL of a 0.200 M acetate solution.

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