Buffer Lab

Background:

Buffers are compounds that resist changes in pH upon the addition of limited amounts of acids or bases. Buffer systems are usually composed of a weak acid or base and its conjugate salt. The components act in such a way that addition of an acid or base results in the formulation of a salt causing only a small change in pH.

The pH of a buffer system is given by the Henderson-Hasselbach equation:

(for a weak acid and its salt)

$$pH = pKa + \log\frac{[salt]}{[acid]}$$

(for a weak base and its salt)

$$pH = pKw - pKb + \log\frac{[base]}{[salt]}$$

where [salt], [acid] and [base] are the *molar* concentrations of salt, acid and base.

Materials:

10mL DI H_2O w/ 10 drops of Bogen Indicator

10 mL of .1M Sodium Acetate w/ 10 drops of Bogen Indicator

10 mL of .1M Acetic Acid w/ 10 drops of Bogen Indicator

5 mL Hydrochloric Acid w/ 1 drop of Universal Indicator

15 mL Sodium Hydroxide w/ 1 drop of Universal Indicator

Labeled flasks and pipettes for all the solutions above

spotplate

Pre-Lab Calculations:

Using the solutions of 0.1M Acetic Acid and 0.1M Sodium Acetate, and the Henderson-Hasselbach equation below, determine the volumes of the acid and the CB (from the salt) required to prepare 10.0 mL of buffer of each of the following pH values. (pK_a Acetic Acid = 4.74).

$$pH = pKa + \log\frac{[salt]}{[acid]}$$

a. pH 3.7

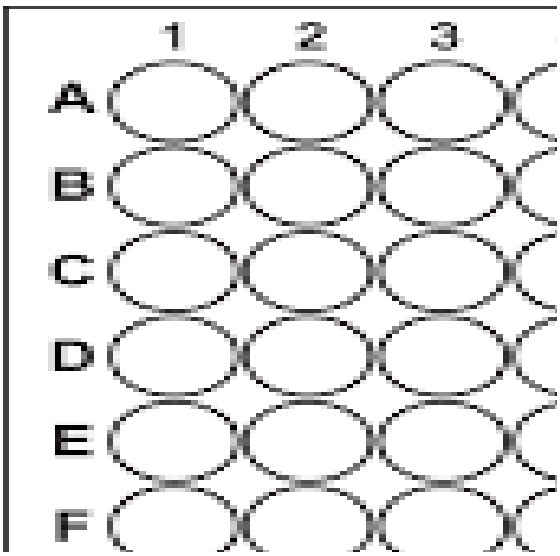
b. pH 4.7

c. pH 5.7

Procedure Part 1:

1. Make the buffer solutions using the ratios found in the pre-lab calculations. Label these appropriately.

2. Fill the 24-well plate with 1mL of each solution per well in each row as specified below.



3. Add 1 drop of Bogen Indicator to each inkwell.

4. Add the following amounts of each solution per well as specified below.

<u>Rows:</u>

A – acetic acid	C- sodium acetate	E – 4.7 buffer
B – water	D- 3.7 buffer	F – 5.7 buffer

<u>Columns:</u>

1 – keep this column as reference	3 – add 1 drop 0.1M NaOH
2 – add 1 drop 0.1M HCl	4 – add 10 drops 0.1M NaOH

5. Record the color/pH in the picture above. Be sure to color the picture to match your results.

6. What affect does a buffer have on the solution? Cite specific examples from your results above.

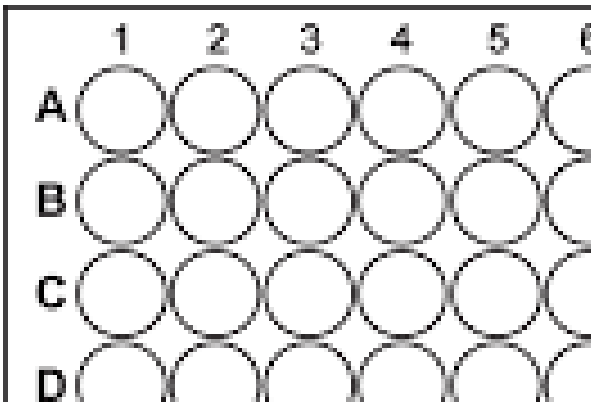
Procedure Part 2:

1. Prepare 20mL of the 4.7 buffer using the appropriate pre-lab calculations ratio.

2. Prepare 3 Serial Dilutions of the 4.7 buffer you prepared in step 1.

- 1st Dilution: Take 5mL of the 4.7 buffer from step 1 and dilute with DI H_2O (w/ Bogen indicator) to 20mL.
- 2nd Dilution: Take 5mL of the 1st dilution of the 4.7 buffer from above and dilute with DI H_2O (w/ Bogen indicator) to 20mL.
- 3rd Dilution: Take 5mL of the 2nd dilution of the 4.7 buffer from above and dilute with DI H_2O (w/ Bogen indicator) to 20mL.

3. Fill the 24-well plate with 2mL of each buffer solution per well in each row as specified below.



4. Add 1 additional drop of Bogen Indicator to each inkwell.

5. Add the following amounts of each solution per well as specified below.

<u>Rows:</u>

A – undiluted buffer

B- 1st dilution

C- 2nd dilution

D- 3rd dilution

<u>Columns:</u>

1-keep this column as reference

2- 1 drop of .1M NaOH

3-2 drops .1M NaOH

4- 3 drops .1M NaOH

5- 4 drops .1M NaOH

6- 5 drops .1 M NaOH

6. Record the color/pH in the picture above. Be sure to color the picture to match your results.

7. How do your results compare to those in part 1? What effect does diluting the buffer have? Cite specific examples from your results above.

On turnitin.com, submit: Type: Title, Purpose, and conclusion. Conclusion will be answering Q5&6 from Part I and Q 6 &7. Compare and contrast the 2 Parts to the lab. Add your pictures to your report with proper labels. Refer to any errors or any references consulted.