



Practical Physical Pharmacy: Lab 5/ Buffer Solutions



Buffer solutions

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- Definition: solutions that resist changes in pH when acids or bases are added. usually composed of a (weak acid and its salt) or (weak base and its salt)



Buffer equations: By Henderson and Hasselbatch

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- ▶ For acidic buffer, We can use the following equation (before and after the change or addition of a base), :

$$PH = PK_a + \log \frac{[salt]}{[acid]}$$

- ▶ For basic buffer, We can use the following equation (before and after the change or addition of an acid), :

$$POH = PK_b + \log \frac{[salt]}{[base]}$$

Solve the following:

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- ▶ Calculate the pH of a buffer system containing 1.0M CH_3COOH and 1.0M CH_3COONa

- What is the pH of the same buffer system after the addition of 0.10 mol of gaseous HCl to 1L of the solution?
- Note: assume that the volume of the solution does not change when the HCl is added

- ▶ Calculate the pH of the 0.30M NH_3 /0.36 NH_4Cl buffer system. What is the pH after the addition of 20ml of 0.05M NaOH to 80 ml of the buffer solution?

Buffer capacity:

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- ▶ Buffer capacity is the ability of a buffer solution to resist PH change
- ▶ The buffer capacity depends on the quantities of the acid and the base composing i

$$B = \frac{\Delta B}{\Delta PH}$$

Or

$$B = 2.303 C \frac{Ka[H_3O^+]}{(Ka + [H_3O^+])^2}$$

Where C is the total buffer concentration ($C = C_{salt} + C_{acid}$)

Calculating Buffer Capacity

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- ▶ At a hydrogen ion concentration of 1.75×10^{-5} (pH = 4.76), what is the capacity of a buffer containing 0.10 M each of acetic acid and sodium acetate? The total concentration,
- ▶ the dissociation constant is 1.75×10^{-5}

Experimental procedure:-

1. Prepare these buffer
2. Record the volume of reagent (2) that required to prepare above PH .
3. Add to all buffer 0.1ml of 1N HCl .
4. record the new value of PH for all buffer solutions .
5. Calculate the buffer capacity for all buffer solutions by:

$$B = \Delta B / \Delta PH$$

PH	4	7	10
Reagent (1)	8.5ml of 0.1M HOAc	10ml of 0.1M KH ₂ PO ₄	5ml of 0.05M NaHCO ₃
Reagent (2)	Vml of 0.1M NaOAc	Vml of 0.1M NaOH	Vml of 0.1 M NaOH