17 • Aqueous Equilibria

17.2 Buffers

1. What is the pH of a buffer that is 0.12 M in lactic acid, $HC_3H_5O_3$, and 0.10 M in sodium lactate? For lactic acid, $Ka = 1.4 \times 10^{-4}$.

Think..*what are the starting conditions?*

	$HC_3H_5O_3$	H_3O^+	$C_3H_5O_3^-$
Start			
Change			
Equilibrium			

b) Calculate the pH using the Henderson-Hasselbalch equation

Practice problem #1

Calculate the pH of a buffer composed of 0.12 M benzoic acid ($HC_7H_5O_2$) and 0.20 M sodium benzoate. For benzoic acid Ka = 6.3×10^{-5}

Think.. *what are the starting conditions?*

Start			
Change			
Equilibrium			

b) Calculate the pH using the Henderson-Hasselbalch equation

QUESTION...

How does a buffer respond to the Addition of a Strong Acid or Base?

1. A buffer is made by adding 0.300 mol $HC_2H_3O_2$ and 0.300 mol $NaC_2H_3O_2$ to enough water to make 1.00 L of solution. The pH of the buffer is 4.74.

Acetic Acid Ka=1.8 x 10^{-5}

a) Calculate the pH of this solution after 0.020 mol of NaOH is added (neglect any volume changes)

Start			
Change			
Equilibrium			

Start			
Change			
Equilibrium			

b) after 0.020 mol HCl is added (again, neglect volume changes). **Use initial concentrations for this part.**

Start			
Change			
Equilibrium			

Start			
Change			
Equilibrium			

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1. How many moles of NH_4Cl must be added to 2.0 L of 0.10 M NH_3 to form a buffer whose pH is 9.0? (assume the addition of NH_4Cl does not change the volume)

2. Calculate the concentration of sodium benzoate that must be present in a 0.20 M solution of benzoic acid, $HC_7H_5O_2$, to produce a pH of 4.0.

4. Consider a 1.0 L buffer made by adding 0.140 mol cyanic acid, HCNO, and 0.110 mol potassium cyanate, KCNO, to sufficient water. Calcuate the pH of the buffer.

a) before any acid or base is added

b) after the addition of 0.015 mol HNO_3

c) after the addition of 0.015 mol KOH