

4/3/2019

Conceptual connection 17.2

weak acid, $pK_a = 4.82$

need to make buffer w/ pH 4.25.

Will we need:

(*) A) $[HA] > [A^-]$

B) $[HA] < [A^-]$

C) $[HA] = [A^-]$

$\frac{[base]}{[acid]} = 1, \log \frac{b}{a} = 0, pH = pK_a$

$pH = pK_a + \log \frac{[base]}{[acid]}$
so, need $\log \frac{b}{a} < 0$
so, $\frac{b}{a} < 1$
 $\Rightarrow a > b$

Calculating pH changes in a buffer when we add some acid/base.

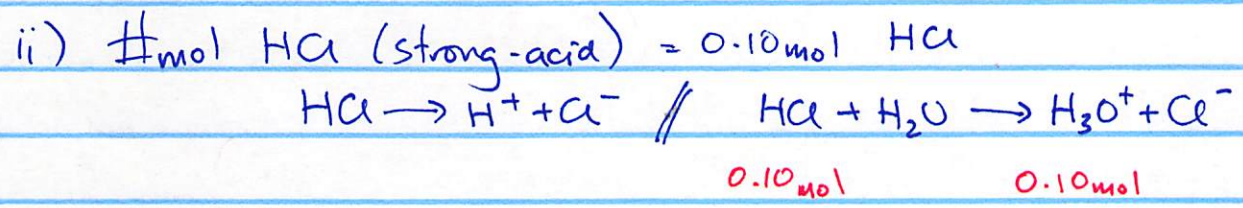
- Plan:
- (i) Calculating #mol of buffer components.
 - (ii) " " " " added acid/base. (strong)
 - (iii) Do stoichiometry! Assume added acid/base gets neutralized by our buffer. (LR problem)
 ↓ ↓
 neut by: A^- neut by: HA
 - (iv) Use H-H

Ex: What's pH of a buffer if we add 0.10 mol HCl to a 2.00-L soln that is 1.00 M HC₂H₃O₂(aq) }
 1.25 M NaC₂H₃O₂(aq) }

$K_a(\text{HC}_2\text{H}_3\text{O}_2) = 1.8 \times 10^{-5}$

i) #mol HC₂H₃O₂ = 2.00 L × $\frac{1.00 \text{ mol HC}_2\text{H}_3\text{O}_2}{1 \text{ L}}$ = 2.00 mol HC₂H₃O₂

#mol C₂H₃O₂⁻ = 2.00 L × $\frac{1.25 \text{ mol } \text{C}_2\text{H}_3\text{O}_2^-}{1 \text{ L}}$ = 2.50 mol C₂H₃O₂⁻



iii) Stoichiometry

		(LR)	H ⁺			
			↘			
#mol	I	0.10	2.50	2.00	—	
	C	-0.10	-0.10	+0.10	—	
	Final	0	2.40 (Base)	2.10 (Acid)	—	

iv) H-H $\text{pH} = \text{p}K_a + \log \frac{[\text{base}]}{[\text{acid}]}$

(2dp)

$\text{p}K_a = -\log(K_a) = 4.744 + \log \left(\frac{2.40 \text{ mol } \frac{2}{3} V_{\text{TOTAL}}}{2.10 \text{ mol } \frac{1}{3} V_{\text{TOTAL}}} \right)$

$\downarrow 1.8 \times 10^{-5}$ \downarrow \downarrow
 (2sf.) 2dp 3dp

$= 4.744 + 0.0580$
 $= 4.80 \text{ (2dp)}$

Q: What's orig buffer pH? (use H-H)

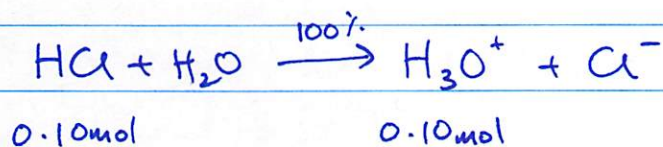
$\text{pH} = \text{p}K_a + \log \frac{b}{a} = 4.744 + \log \frac{1.25 \text{ M}}{1.00 \text{ M}} = 4.84 \text{ (2d.p.)}$

Q: What would pH of 2.00L pure H₂O change by if we added 0.10mol HCl? (25.0 °C)

Pure water @ 25°C : 7.00.

$$\text{pH} = -\log[\text{H}_3\text{O}^+]$$

↑ ??



$$[\text{H}_3\text{O}^+] = \frac{\# \text{mol}}{\# \text{L}} = \frac{0.10 \text{mol}}{2.00 \text{L}} = 0.050 \text{M}$$

$$\text{pH} = -\log[0.050] = 1.30$$

5.70
unit
decrease.

vs.

0.04
for
buffer!