Answer on Question #56265 - Chemistry - Physical Chemistry

Question:

500 ml of 0.2 M aqueous solution of acetic acid is mixed with 500ml of 0.2 M HCl at 25 degree celcius

i) calculate the degree of dissociation of acetic acid in the resulting solution and pH of the solution

ii)if 6gm NaOH is added to the above solution determine the final pH(there is no change in volume on mixing)Ka of acetic acid is 1.75*10^-5mol L-1

Solution:

We have, Meq. of CH_3COOH = 500×0.2 = 100

Meq. of HCl = 500×0.2 = 100

Therefore, [HCl] = 100/1000 = 0.1

And [CH_3COOH] = 100/1000 = 0.1

For CH_3COOH :

	CH_3COOH	↔	CH_3COO^-	+	H^+
Before dissociation	0.1		0		0.1
After dissociation	0.1 – x		x		0.1 + x

Therefore, K_a = $\{[CH_3COO^-][H+]\}/[CH_3COOH] = \{x(0.1 + x)\}/(0.1 – x)$

Due to common ion effect dissociation of CH_3COOH is very small in presence of HCl. Thus 0.1 + x = 0.1 and 0.1 – x = 0.1

$K_a = (x\times0.1)/0.1$

Or, $x = K_a = 1.75\times10^{-5}$

Therefore, degree of dissociation, $\alpha = x/0.1= (1.75\times10^{-5})/0.1$

= 0.0175 %

Also, $[H^+] = 0.1 + x = 0.1$

Therefore, $pH = – \log [H^+] = – \log (0.1) = 1$