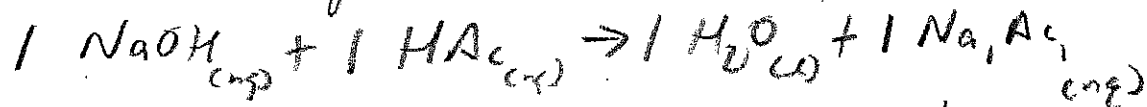


Weak Acid Titrated by Strong Base

Add 10.0ml of 0.100M NaOH to 50.0ml of 0.100M $\text{HC}_2\text{H}_3\text{O}_2$ (HAc)

Using stoichiometry to get rid of all NaOH



$$\text{mol OH}^{-}_{\text{Add}} = (10.0 \text{ ml}) \left(\frac{1 \text{ L}}{1000 \text{ ml}} \right) (0.100 \text{ M NaOH}) \left(\frac{1 \text{ mol OH}^{-}}{1 \text{ mol NaOH}} \right)$$

$$= 1.00 \times 10^{-3} \text{ mol OH}^{-}_{\text{Add}}$$

$$\text{mol HAc}_{\text{left}} = \text{mol HAc}_I - \text{mol HAc}_r$$

$$= \left[(50.0 \text{ ml}) \left(\frac{1 \text{ L}}{1000 \text{ ml}} \right) (0.100 \text{ M HAc}) \right] - \left[(1.00 \times 10^{-3} \text{ mol OH}^{-}_r) \left(\frac{1 \text{ mol HAc}_r}{1 \text{ mol OH}^{-}_r} \right) \right]$$

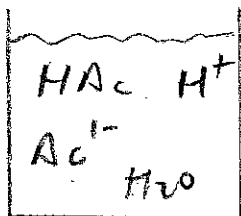
$$= 5.00 \times 10^{-3} \text{ mol HAc}_I - 1.00 \times 10^{-3} \text{ mol HAc}_r$$

$$= 4.00 \times 10^{-3} \text{ mol HAc}_{\text{left}}$$

Enough HAc to react all NaOH

$$V = 10.0 \text{ ml} + 50.0 \text{ ml} = 60.0 \text{ ml} \left(\frac{1 \text{ L}}{1000 \text{ ml}} \right)$$

$$V = 0.060 \text{ L}$$



Acid Buffer

$$\begin{aligned} \text{mol Ac}^{-}_{\text{left}} &= \text{mol Ac}^{-}_I + \text{mol Ac}^{-}_r \\ &= 0 + (1.00 \times 10^{-3} \text{ mol OH}^{-}_r) \left(\frac{1 \text{ mol Ac}^{-}_r}{1 \text{ mol OH}^{-}_r} \right) \\ &= 1.00 \times 10^{-3} \text{ mol Ac}^{-}_{\text{left}} \end{aligned}$$

$$[\text{Ac}^{-}]_{\text{NI}} = \frac{1.00 \times 10^{-3} \text{ mol Ac}^{-}}{0.06 \text{ L}} = 0.01667 \text{ M}$$

$$[\text{HAc}]_{\text{NI}} = \frac{4.00 \times 10^{-3} \text{ mol HAc}_{\text{left}}}{0.060 \text{ L}} = 0.0667 \text{ M}$$

H-H
Equation

$$\text{pH} = \text{p}K_a + \log \frac{[\text{Ac}^{-}]}{[\text{HAc}]} = -\log(1.8 \times 10^{-5}) + \log \frac{0.01667 \text{ M}}{0.0667 \text{ M}}$$

$$= 4.744 + (-0.602)$$

$$\text{pH} = 4.142$$

$$\boxed{\text{pH} = 4.14}$$

$$\Rightarrow [\text{H}^{+}] = 10^{-\text{pH}} = 10^{-4.14} = 7.24 \times 10^{-5} \text{ M}$$

5% rule ✓
 $\frac{7.24 \times 10^{-5} \text{ M}}{0.01667 \text{ M}} \times 100\% < 5\%$