Weak Acid Titrated by Strong BASE

Add 75.0 mL of 0.100 M $NaOH$ to 50.0 mL of a 0.100 M $HC_2H_3O_2$ (HAc)

Using stoichiometry to get rid of all $NaOH$

$$1\ NaOH_{(aq)} + 1\ HAc_{(aq)} \rightarrow 1\ H_2O_{(l)} + 1\ NaAc_{(aq)}$$

$$mol\ OH^{1-}_{add} = (75.0\ mL)\left(\frac{1\ L}{1000\ mL}\right)\left(0.100\ M\ NaOH\right)\left(\frac{1\ mol\ OH^{1-}_{add}}{1\ mol\ NaOH}\right)$$

$$= 7.50 \times 10^{-3}\ mol\ OH^{1-}_{add}$$

$$mol\ HAc_I = (50.0\ mL)\left(\frac{1\ L}{1000\ mL}\right)(0.100\ M\ HAc) = 5.00 \times 10^{-3}\ mol\ HAc$$

Since OH^{1-} & HAc are in 1:1 molar ratio, there is not enough HAc to consume all OH^{1-}.

It is a strong base bucket now

OH^{1-}
H_2O

Strong Base

$$mol\ OH^{1-}_{left} = mol\ OH^{1-}_{add} - mol\ OH^{1-}_{r}$$

$$= 7.50 \times 10^{-3}\ mol\ OH^{1-}_{add} - \left(5.00 \times 10^{-3}\ mol\ HAc_r\right)\left(\frac{1\ mol\ OH^{1-}_{r}}{1\ mol\ HAc_r}\right)$$

$$= 7.50 \times 10^{-3}\ mol\ OH^{1-}_{add} - 5.00 \times 10^{-3}\ mol\ OH^{1-}_{r}$$

$$= 2.5 \times 10^{-3}\ mol\ OH^{1-}_{left}$$

$$V = (75.0\ mL + 50.0\ mL)\left(\frac{1\ L}{1000\ mL}\right) = 0.125\ L$$

$$[OH^{1-}] = \frac{2.5 \times 10^{-3}\ mol\ OH^{1-}}{0.125\ L} = 2.0 \times 10^{-2}\ M$$

$$pOH = -\log[OH^{1-}] = -\log(2.0 \times 10^{-2}\ M) = 1.698$$

$$pH = 14.000 - 1.698 = 12.302$$

$$\boxed{pH = 12.30}$$