Ionic Equilibriums in Water

#1

In a volumetric flask of 500,0 mL we put 2,456 g NaOAc. We add 25.0 mL HOAc 1.00 mol/L. We fill with water. Calculate pH.

Solution

NaOAc:

$$2.456\ \text{g} = \frac{2.456\ \text{g}}{82.0\ \frac{\text{g}}{\text{mol}}} = 0.0300\ \text{mol}$$

25.0 mL HOAc 1.00 mol/L contains 0.0250 mol HOAc.

The concentrations in the mixture are:

NaOAc: $\frac{0.0300\ \text{mol}}{0.500\ \text{L}} = 0.0600\ \frac{\text{mol}}{\text{L}}$

HOAc: $\frac{0.0250\ \text{mol}}{0.500\ \text{L}} = 0.0500\ \frac{\text{mol}}{\text{L}}$

NaOAc is a salt, completely dissociated: $NaOAc(aq) \rightarrow Na^+(aq) + OAc^-(aq)$

Na^+ = weak acid, weaker than water

OAc^- = weak base B

HOAc = conjugate weak acid A

The mixture is a buffer solution.

$$pH_{buffer} = pK_{a_{HOAc}} + \log\frac{[B]}{[A]} = 4.75 + \log\frac{0.0600\ \frac{\text{mol}}{\text{L}}}{0.0500\ \frac{\text{mol}}{\text{L}}} = \mathbf{4.83}$$