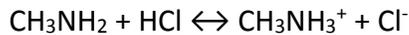## Answer on Question #48074 - Chemistry – Inorganic Chemistry

Question

Calculate the pH at equivalence point for the titration of 0.220M methylamine with 0.220M of HCl. The Kb of methylamine is 5.0x10^-4
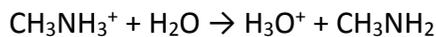
Answer:

The reaction of titration of methylamine with HCl:

$CH_3NH_2 + HCl \leftrightarrow CH_3NH_3^+ + Cl^-$

The equivalence point is a point where the moles of hydrochloric acid added is equal to initial moles of methylamine in solution.

$$K_a = \frac{K_w}{K_b} = \frac{1 \times 10^{-14}}{5.0 \times 10^{-4}} = 2.0 \cdot 10^{-11}$$

After equivalence point (x – number of $CH_3NH_3^+$ moles reacted):

$CH_3NH_3^+ + H_2O \rightarrow H_3O^+ + CH_3NH_2$

at end 0.220 – x   x   x

$$K_a = \frac{x \cdot x}{0.220 - x} = 2.0 \cdot 10^{-11}$$

$$x^2 - 4.40 \cdot 10^{-12} + 2.0 \cdot 10^{-11} x = 0$$

$$x = 2.1 \cdot 10^{-6}$$

So, concentration of H_3O^+ is 2.1·10^{-6} M. Therefore, pH at equivalence point is:

pH = -log[H_3O^+] = -log(2.1·10^{-6}) = 5.68

Answer: pH = 5.68