Chemistry 3.6 AS 91392 Demonstrate understanding of equilibrium principles in aqueous systems

Writing Excellence answers to **Titration Curve – Start pH** questions

Titration Curve – Start pH QUESTION	
Question: A titration was carried out by adding hydrobromic acid, HBr, to 20.0 mL of aqueous methylamine, CH_3NH_2, solution. The equation for the reaction is: $CH_3NH_2 + HBr \rightarrow CH_3NH_3^+ + Br^-$ $K_a(CH_3NH_3^+) = 2.29 \times 10^{-11}$ $K_w = 1.00 \times 10^{-14}$ The aqueous methylamine, CH_3NH_2, solution has a pH of 11.8 before any HBr is added. Show by calculation that the concentration of this solution is 0.0912 mol L^{-1}.	
ANSWER	
1. determine if starting solution is acid or base (will it accept or donate H^+) – strong or weak And write down all available information	CH_3NH_2 is a weak base pH = 11.8 $K_a(CH_3NH_3^+) = 2.29 \times 10^{-11}$
2. calculate $[H_3O^+]$ $[H_3O^+] = 10^{-pH}$ *3sgf and units*	$[H_3O^+] = 10^{-pH}$ $[H_3O^+] = 10^{-11.8}$ $[H_3O^+] = 1.58 \times 10^{-12}$ molL^{-1}
3. write out K_a expression $K_a = \frac{[base][H_3O^+]}{[conj\ acid]}$ And then $K_a = \frac{[base][H_3O^+]}{[OH^-]}$	$K_a = \frac{[base][H_3O^+]}{[conj\ acid]}$ $K_a = \frac{[CH_3NH_2][H_3O^+]}{[CH_3NH_3^+]}$ And $K_a = \frac{[CH_3NH_2][H_3O^+]}{[OH^-]}$
4. rearrange to calculate $[CH_3NH_2]$ $[CH_3NH_2] = \frac{K_a \times K_w}{[H_3O^+]^2}$ *Assumptions: [base] = $[H_3O^+]$* *$[OH^-] = K_w / [H_3O^+]$* *3sgf and units*	$[CH_3NH_2] = \frac{K_a \times K_w}{[H_3O^+]^2}$ *Assumptions: [base] = $[H_3O^+]$* *$[OH^-] = K_w / [H_3O^+]$* $[CH_3NH_2] = \frac{2.29 \times 10^{-11} \times 1.00 \times 10^{-14}}{(1.58 \times 10^{-12}\ mol L^{-1})^2}$ $[CH_3NH_2] = 0.0912$ mol L^{-1}

NOTE: The white column is how your answer would appear on your test paper so make sure you **write out complete sentences**. The grey area is just to help you structure your answer and would not appear in the question.