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

Writing Excellence answers to **pH Calculations** questions

pH Calculations QUESTION 1. (4 steps excellence)	
Question: Calculate the pH of a 0.109 mol L^{-1} solution of ethanamine. p$K_a(CH_3CH_2NH_3^+)$ = 10.6 K_w = 1.00×10^{-14}	
ANSWER	
1. determine if the solution is acid or base (will it accept or donate H^+) – strong or weak And write down all available information	Ethanamine is a weak base c(ethanamine) = 0.109 mol L^{-1} p$K_a(CH_3CH_2NH_3^+)$ = 10.6 K_w = 1.00×10^{-14}
2. convert pK_a to K_a $K_a = 10^{-pKa}$	$K_a = 10^{-pKa}$ $K_a = 10^{-10.6}$ $K_a = 2.51 \times 10^{-11}$
3. calculate $[H_3O^+]$ $[H_3O^+] = \sqrt{\frac{Ka \times Kw}{[base]}}$ *3sgf and units*	$[H_3O^+] = \sqrt{\frac{Ka \times Kw}{[base]}}$ $[H_3O^+] = \sqrt{\frac{2.51 \times 10^{-11} \times 1.00\times10^{-14}}{0.109 \text{ mol } L^{-1}}}$ $[H_3O^+] = 1.52\times10^{-12}$ molL^{-1}
4. calculate pH pH = -log $[H_3O^+]$ *3sgf* *Double check answer against expected pH for your solution*	pH = -log $[H_3O^+]$ pH = -log $[1.52\times10^{-12}$ mol$L^{-1}]$ pH = 11.8 *(pH range for weak base is 8-12) yes*
pH Calculations QUESTION 2. (3 steps Merit)	
Question: Calculate the pH of 0.0152 mol L^{-1} CH_3NH_3Cl solution. $K_a(CH_3NH_3^+) = 2.29 \times 10^{-11}$	
ANSWER	
1. determine if the solution is acid or base (will it accept or donate H^+) – strong or weak And write down all available information	CH_3NH_3Cl is a weak acid (salt) c(CH_3NH_3Cl) = 0.0152 mol L^{-1} $K_a(CH_3NH_3^+) = 2.29 \times 10^{-11}$
2. calculate $[H_3O^+]$ $[H_3O^+] = \sqrt{Ka \times c(HA)}$ *3sgf and units*	$[H_3O^+] = \sqrt{Ka \times c(HA)}$ $[H_3O^+] = \sqrt{2.29 \times 10^{-11}} \times 0.0152$ mol L^{-1} $[H_3O^+] = 5.90 \times 10^{-7}$ mol L^{-1}
3. calculate pH pH = -log $[H_3O^+]$ *3sgf* *Double check answer against expected pH for your solution*	pH = -log $[H_3O^+]$ pH = -log $[5.90 \times 10^{-7}$ mol $L^{-1}]$ pH = 6.23 *(pH range for weak acid is 3-6.9) yes*

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.