Hydrolysis of Salt (Part A)

What is pH of a 0.10 M $NaCl$ solution?

Step 1 

H_2O, Na^+, Cl^{1-}

$NaCl \rightarrow Na^+ + Cl^{1-}$ (completely dissociate)

both Na^+ (cation of strong base) and Cl^{1-} (anion of strong acid) do not react w/ H_2O.

Step 2 

So, only reaction is

Step 3 $H_2O_{(l)} + H_2O_{(l)} \rightleftharpoons H_3O^+ + OH^{1-}$ $K_w = 1.0 \times 10^{-14} M^2$

Step 4 $K_w = \dfrac{[H_3O^+]_E^1 [OH^{1-}]_E^1}{[H_2O_{(l)}]_E^2} = [H_3O^+]_E^1 [OH^{1-}]_E^1$

ICE Box $1.0 \times 10^{-14} M^2 = (x)(x)$

$x = \sqrt{1.0 \times 10^{-14} M^2}$

$[H^+] = x = 1.0 \times 10^{-7} M$

Step 5 $pH = -\log[H^+] = -\log(1.0 \times 10^{-7} M) = -(-7.000)$

Step 6 $\boxed{pH = 7.00}$