Answer on Question #79510, Chemistry/ General Chemistry

Calculate the percent ionization of HA in a 0.10 M solution.

Solution

To answer this question we should know not only concentration of HA in a solution but also Ka of the acid. As this value is not given we can take any value of Ka and show calculations.

For example Ka for HA is 6.7×10^{-7}

$$\%\ ion = \frac{[H_3O]^+}{[HA]_{initial}} \times 100\%$$

Where $[HA]_{initial}$ – is the initial concentration of HA

$[H_3O^+]$ is equilibrium concentration of H^+.

$HA + H_2O \leftrightarrow H_3O^+ + A^-$

We should use ICE table to find equilibrium concentrations of all species:

	HA	H_3O^+	A^-
Initial	0.10 M	0	0
Change	-x	+x	+x
Equilibrium	0.10 – x	x	x

$$K_a = \frac{[H_3O^+][A^-]}{[HA]}$$

$$K_a = \frac{x^2}{(0.10 - x)}$$

As Ka is very small, we make an assumption that x is very small. Then

$0.10 - x \cong 0.10$

$$K_a = \frac{x^2}{0.10}$$

$$6.7 \times 10^{-7} = \frac{x^2}{0.10}$$

$$x = 2.59 \times 10^{-4}$$

Select the smallest concentration for the 5% rule.

$$\frac{2.59 \times 10^{-4}}{0.10} \times 100\% = 0.259\%$$

This value is much less than 5%, so the assumptions are valid.

Find % ion :

$$\%\ ion = \frac{2.59 \times 10^{-4}}{0.1} \times 100\% = 0.259\ \%$$

Answer: 0.259 %