Answer on the question #63575, Chemistry / Physical Chemistry

Question :

Mass of CN ION in 1.5 l of 1 M HCN so.l K of hcn =4.9×10^-10

Solution:

The reaction of HCN dissociation is:

$$HCN \leftrightarrow H^+ + CN^-$$

Constant of dissociation is:

$$K_a = \frac{[H^+][CN^-]}{[HCN]}.$$

Let's say, we have the concentration of CN^- equal to x. Then, the concentration of H^+ is also x, and the concentration of HCN is $1 - x$. We can rewrite the expression for dissociation constant:

$$K_a = \frac{x \cdot x}{1 - x} = 4.9 \cdot 10^{-10}.$$

Let's assume that x is much less than 1. Then we get:

$$x = \sqrt{4.9 \cdot 10^{-10}} = 2.2 \cdot 10^{-5} M.$$

As we see, our assumption is right.

Now, we can get the number of the moles of CN^- and its mass in 1.5L of solution:

$$n(CN^-) = [CN^-]V = 2.2 \cdot 10^{-5}(mol\ L^{-1}) \cdot 1.5(L) = 3.3\ \cdot 10^{-5} mol$$

$$m(CN^-) = n(CN^-) \cdot M(CN^-) = 3.3\ \cdot 10^{-5}(mol) \cdot 26.0174(g\ mol^{-1}) = \ 8.64\ \cdot 10^{-4} g.$$

Answer: $8.64\ \cdot 10^{-4} g$