Find the pH and the degree of ionization for an 0.10 M solution of formic acid: $HCHO_2$

$$HCHO_2 + H_2O \rightleftharpoons H_3O^+ + CHO_2^- \quad K_a = 1.7 \times 10^{-4}$$

$$K_a = \frac{[H_3O^+][CHO_2^-]}{[HCHO_2]} = 1.7 \times 10^{-4}$$

Constant's value at 25C was obtained from the chart in Ebbing on page A-13

Species	[Initial]	Δ	[Equlibrium]
H_3O^+	0	+X	X
CHO_2^-	0	+X	X
$HCHO_2$	0.10	−X	0.10 − X

$$\frac{(x)(x)}{0.10 - x} = 1.7 \times 10^{-4}$$

$$\frac{X^2}{0.10 - X} = 1.7 \times 10^{-4}$$

$$\frac{x^2}{0.10 - x} = 1.7 \times 10^{-4}$$

$\downarrow$ $x << 0.10$

$$\frac{x^2}{0.10} = 1.7 \times 10^{-4}$$

$x = 0.004123106 = [H_3O^+]$

$pH = -\log_{10}(0.004123106)$

$pH = 2.38$

DEGREE OF IONIZATION is the fraction of a weak acid or base that ionizes in water:

$$\frac{[CHO_2^-]}{[HCHO_2]_{initial}} = \frac{[H_3O^+]}{[HCHO_2]_{initial}} = \frac{0.004123106}{0.10}$$

$= 0.041 = D.O.I.$

Sometimes, we express this as PERCENT IONIZATION.

$\% = D.O.I. \times 100\% = 4.1\%$ ionized

Check in experiment 16A: A more dilute solution of acid should have a HIGHER degree of ionization than a more concentrated one due to Le Chateleir's principle (you're adding water - a reactant - by diluting). This is true EVEN THOUGH THE pH WILL INCREASE in the diluted solution!