Ionization Constant Calculations

Given → K_a → $[H_3O^+]$

Given → [acid] → K_a (K_b)

Ex. 1 Find $[H_3O^+]$ in a 0.010 mol/L solution of CH_3COOH

$K_a = 1.8 \times 10^{-5}$

$$CH_3COOH + H_2O \rightleftharpoons H_3O^+ + CH_3COO^-$$

	CH_3COOH	H_3O^+	CH_3COO^-
I	0.010	0	0
C	$-x$	$+x$	$+x$
E	$0.010-x$	x	x

$$K_a = \frac{x \cdot x}{0.010 - x}$$

$$K_a = \frac{x^2}{0.010 - x}$$ ← assume x is small

$$1.8 \times 10^{-5} = \frac{x^2}{0.010 - x}$$

$$1.8 \times 10^{-5} \cdot 0.010 = x^2$$

$$1.8 \times 10^{-5} \times 0.010 = x^2$$

$$\sqrt{1.8 \times 10^{-7}} = \sqrt{x^2}$$

$$4.2 \times 10^{-4} = x = [H_3O^+]$$

mol/L

Ionization Constant Calculations Continued

Ex 2. Calculate K_a for a 0.15 mol/L acid HA which has $[H_3O^+]$ of 0.0080 mol/L.

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

	HA		H_3O^+	A^-
I	0.15		0	0
C	-0.0080		0.0080	0.0080
E	0.142		0.0080	0.0080

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

$$K_a = \frac{0.0080 \times 0.0080}{0.142}$$

$$= 4.5 \times 10^{-4}$$

Handout 18B, 18C A/B extra pract.

See p. 850 (text) table