

ANSWER TO "TRY YOURSELF" PROBLEM FROM STUDY SECTIONS 8.8

Try Yourself 8.8

What is the pH of a 0.015 M solution of sodium acetate, NaCH_3CO_2 ? K_b for the acetate ion is 5.6×10^{-10}

Try Yourself 8.8

0.015 M sodium acetate, NaCH_3CO_2

$K_b = 5.6 \times 10^{-10}$ pH = ?

$$\text{CH}_3\text{CO}_2^-(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{CH}_3\text{CO}_2\text{H}(\text{aq}) + \text{OH}^-(\text{aq})$$

I	0.015	}	—	}	0	}	0
C	—x	}	—	}	+x	}	+x
E	0.015—x	}	—	}	x	}	x

$$K_b = \frac{[\text{CH}_3\text{CO}_2\text{H}][\text{OH}^-]}{[\text{CH}_3\text{CO}_2^-]}$$

$$\frac{x^2}{0.015 - x} = 5.6 \times 10^{-10}$$

$$x = \sqrt{(5.6 \times 10^{-10})(0.015)}$$

$$= 2.898 \times 10^{-6}$$

$$x = [\text{OH}^-]_E \approx 2.898 \times 10^{-6} \text{ M}$$

$$[\text{H}_3\text{O}^+][\text{OH}^-] = 1 \times 10^{-14}$$

$$[\text{H}_3\text{O}^+] = \frac{1 \times 10^{-14}}{2.898 \times 10^{-6}}$$

$$= 3.45 \times 10^{-9}$$

$$\text{pH} = -\log [\text{H}_3\text{O}^+] = -\log 3.45 \times 10^{-9}$$

$$= 8.46$$