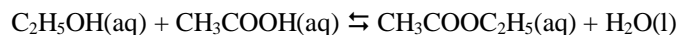


## ANSWER TO "TRY YOURSELF" PROBLEM FROM STUDY SECTION 7.3

### Try Yourself 7.3 a

An aqueous solution containing ethanol and acetic acid, both at an initial concentration of  $0.810 \text{ mol}\cdot\text{L}^{-1}$ , is heated to  $100^\circ\text{C}$ . Reaction occurs between the alcohol and the carboxylic acid to form the ester, ethyl acetate:



At equilibrium, the acetic acid concentration is  $0.748 \text{ mol}\cdot\text{L}^{-1}$ . Calculate  $K$  for the reaction at  $100^\circ\text{C}$ .

$\text{C}_2\text{H}_5\text{OH}(\text{aq}) + \text{CH}_3\text{COOH}(\text{aq}) \rightleftharpoons \text{CH}_3\text{COOC}_2\text{H}_5(\text{aq}) + \text{H}_2\text{O}(\text{l})$

(A) I	$0.810 \text{ M}$	$0.810 \text{ M}$	$0$	$-$
(V) C	$-x$	$-x$	$+x$	$-$
(E) E		$0.748 \text{ M}$		$-$

$K = ?$       we can calculate  $x$  from the acetic acid concentration at equilibrium

$$0.810 + x = 0.748$$

$$\therefore 0.810 - x = 0.748$$

$$-x = -0.062$$

$$\therefore \underline{x = 0.062 \text{ M}}$$

Replace  $x$  into the table to calculate the equilibrium concentrations.

$$[\text{C}_2\text{H}_5\text{OH}]_E = 0.810 - 0.062 = \underline{0.748 \text{ M}}$$

$$[\text{CH}_3\text{COOH}]_E = 0.81 - 0.062 = \underline{0.748 \text{ M}}$$

$$[\text{CH}_3\text{COOC}_2\text{H}_5]_E = x = \underline{0.062 \text{ M}}$$

$$\therefore K = \frac{[\text{CH}_3\text{COOC}_2\text{H}_5]}{[\text{C}_2\text{H}_5\text{OH}][\text{CH}_3\text{COOH}]}$$

$$= \frac{0.062}{(0.748)^2} = \frac{0.062}{0.5595}$$

$$K = \underline{0.111}$$