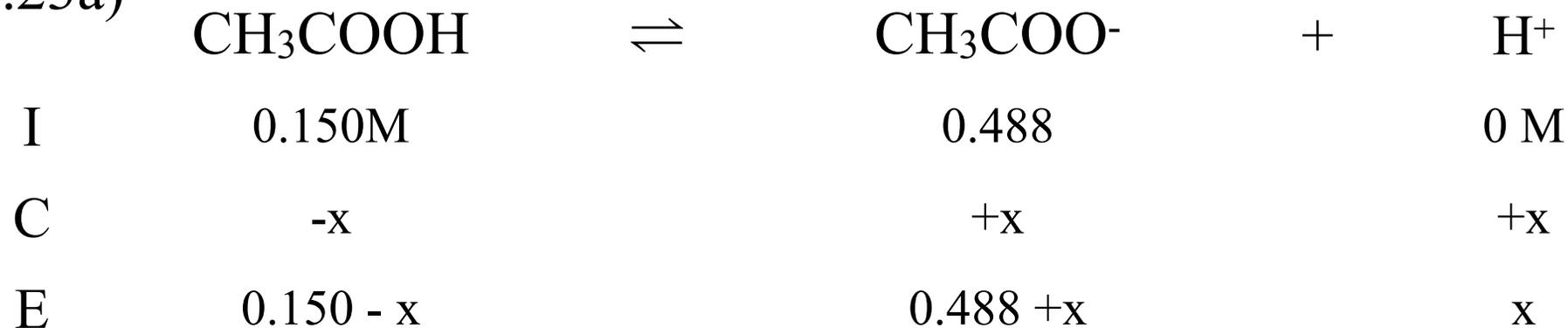


17.23a)

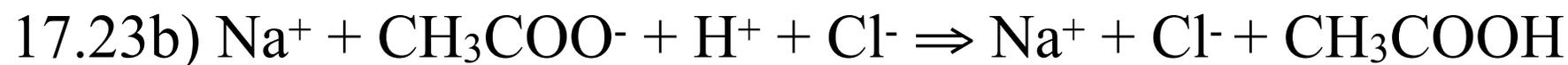


$$\frac{20.0 \text{ g NaCH}_3\text{COO}}{500 \text{ ml}} \left| \frac{1 \text{ mol NaCH}_3\text{COO}}{82.04 \text{ g NaCH}_3\text{COO}} \right| \frac{1000 \text{ ml}}{1 \text{ L}} = 0.488 \text{ M NaCH}_3\text{COO}$$

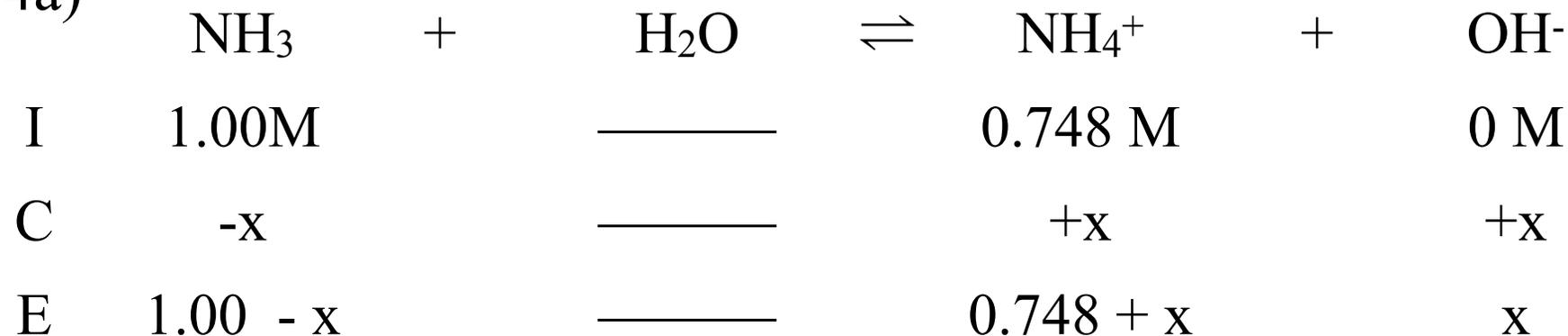
$$K_a = \frac{[\text{CH}_3\text{COO}^-][\text{H}^+]}{[\text{CH}_3\text{COOH}]} \quad 1.8 \times 10^{-5} = \frac{(0.488+x)x}{0.150-x} \approx \frac{0.488x}{0.150}$$

$$x = 5.53 \times 10^{-6}$$

$$\text{pH} = -\log[\text{H}^+] \quad \text{pH} = -\log[5.53 \times 10^{-6}] \quad \text{pH} = 5.26$$



17.24a)



$$\frac{10.0 \text{ g NH}_4\text{Cl}}{250 \text{ ml}} \left| \frac{1 \text{ mol NH}_4\text{Cl}}{53.50 \text{ g NH}_4\text{Cl}} \right| \frac{1000 \text{ ml}}{1 \text{ L}} = 0.748 \text{ M NH}_4\text{Cl}$$

$$K_b = \frac{[\text{NH}_4^+][\text{OH}^-]}{[\text{NH}_3]} \quad 1.8 \times 10^{-5} = \frac{(0.748 + x)x}{1.00 - x} \approx \frac{0.748x}{1.00}$$

$$x = 2.41 \times 10^{-5}$$

$$\text{pOH} = -\log[\text{OH}^-] \quad \text{pOH} = -\log[2.41 \times 10^{-5}] \quad \text{pOH} = 4.62$$

$$\text{pH} + \text{pOH} = 14 \quad \text{pH} = 14 - \text{pOH} \quad \text{pH} = 14 - 4.62 = 9.38$$



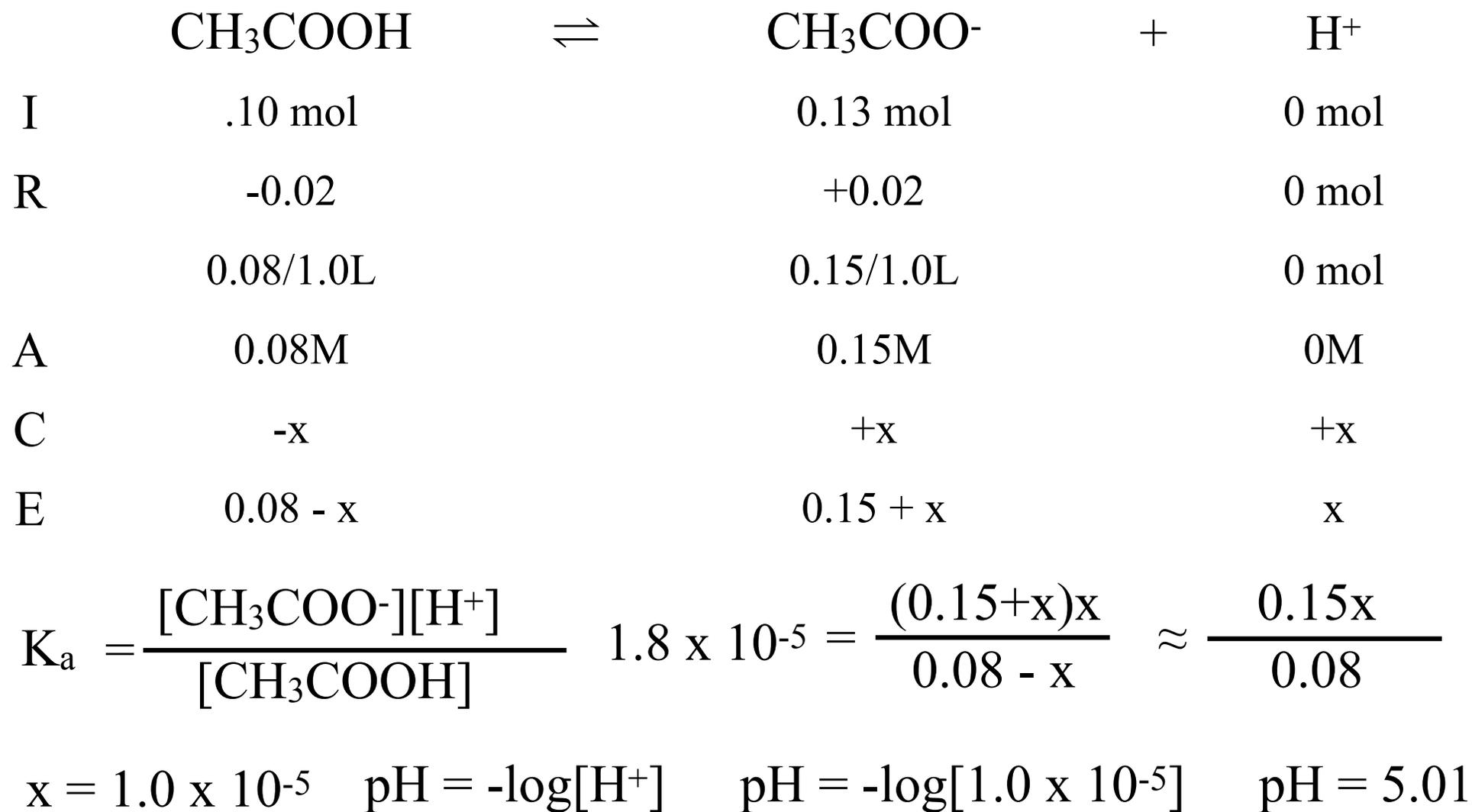
17.25b) $\text{pH} = -\log[\text{H}^+] \quad 3.00 = -\log[\text{H}^+] \quad [\text{H}^+] = 10^{-3} = 0.001$

	HF	\rightleftharpoons	F^-	$+$	H^+
I	1.00M		x		0 M
C	1.00 - 0.001		+ 0.001		+0.001
E	0.999		x + 0.001		0.001

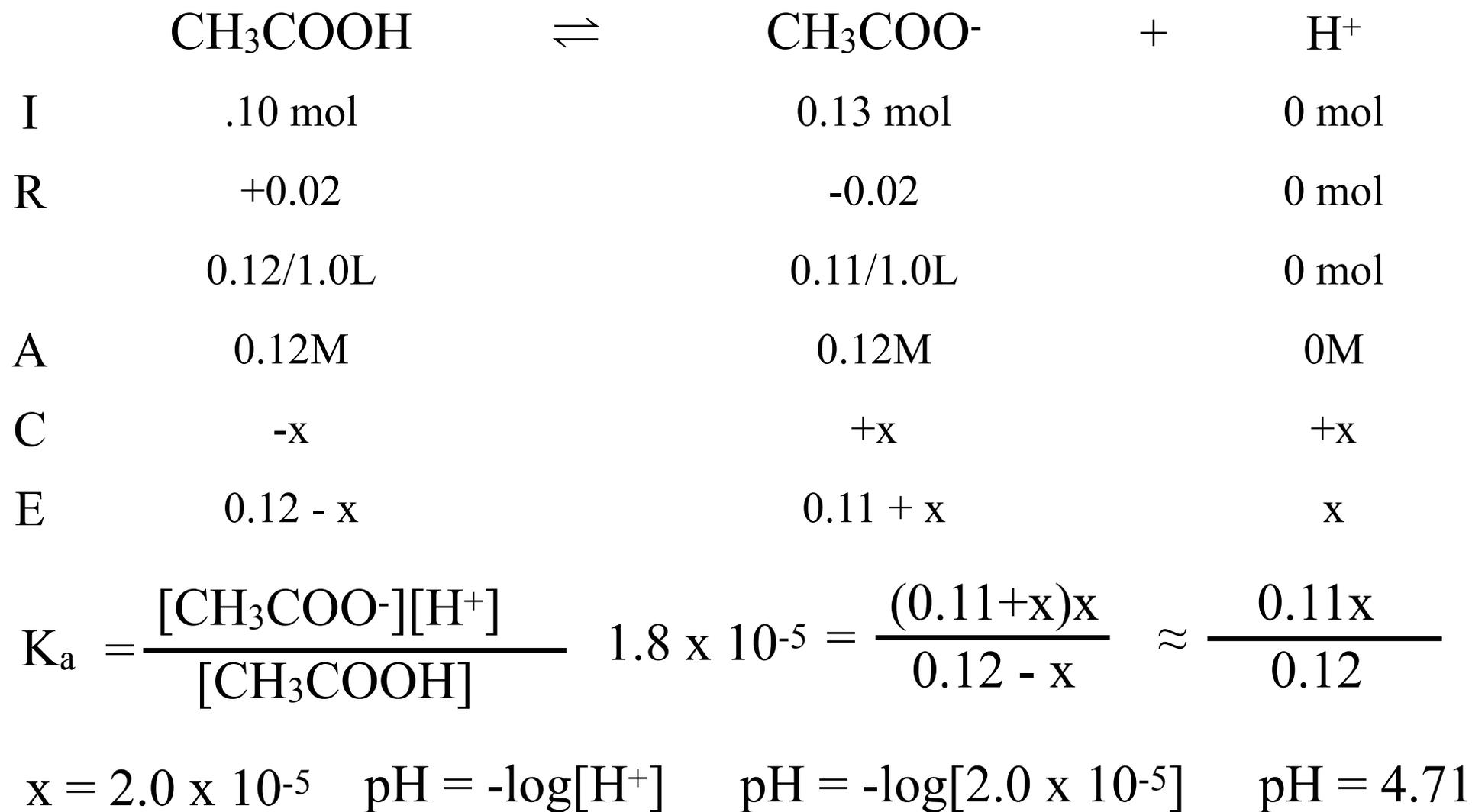
$$K_a = \frac{[\text{F}^-][\text{H}^+]}{[\text{HF}]} \quad 6.8 \times 10^{-4} = \frac{(x + 0.001)0.001}{0.999} \quad x = 0.67\text{M}$$

$$\frac{1.25 \text{ L} \quad | \quad 0.67 \text{ mol NaF} \quad | \quad 42.00 \text{ g NaF}}{\quad | \quad 1 \text{ L} \quad | \quad 1 \text{ mol NaF}} = 35.7 \text{ g NaF}$$

17.27b)



17.27c)



17.28a)

$$M = \frac{\text{moles}}{\text{liters}} = \frac{0.15 \text{ mol}}{1.20 \text{ L}} = 0.125\text{M} \quad \text{Prop Acid}$$

$$M = \frac{\text{moles}}{\text{liters}} = \frac{0.10 \text{ mol}}{1.20 \text{ L}} = 0.083\text{M} \quad \text{Prop Salt}$$



$$\text{I} \quad 0.125 \quad 0.083\text{M} \quad 0 \text{ M}$$

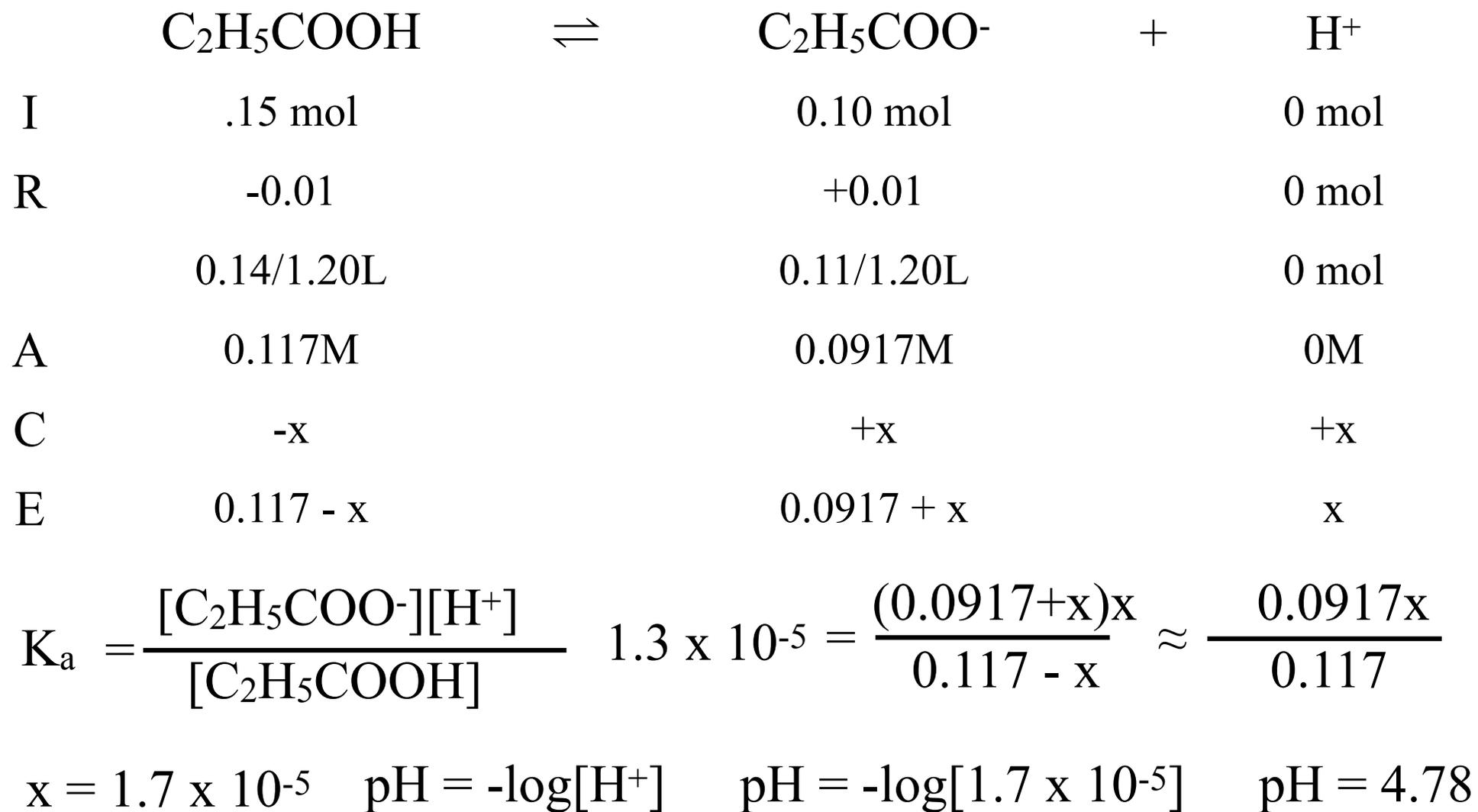
$$\text{C} \quad -x \quad +x \quad +x$$

$$\text{E} \quad 0.125 - x \quad 0.083 + x \quad x$$

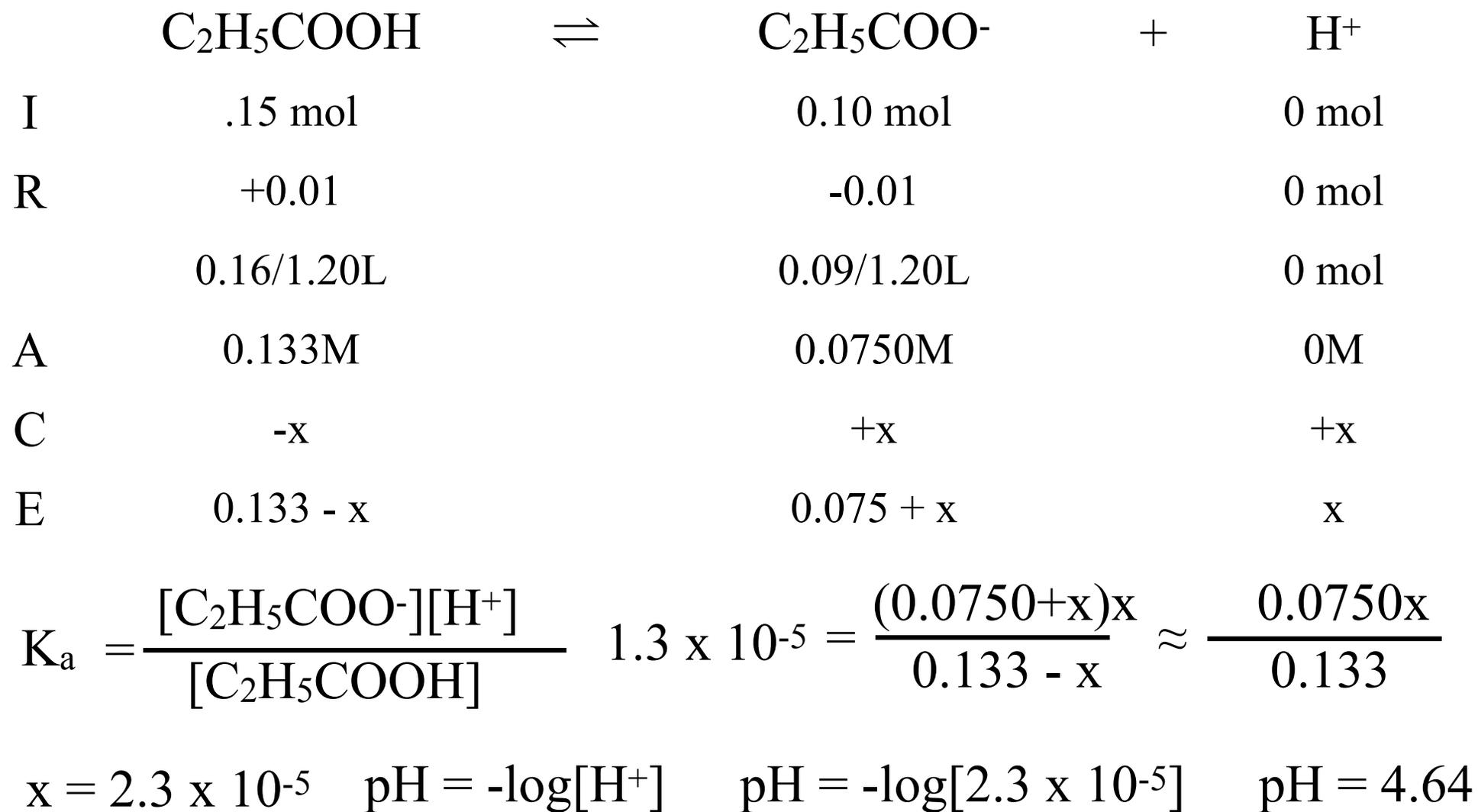
$$K_a = \frac{[\text{C}_2\text{H}_5\text{COO}^-][\text{H}^+]}{[\text{C}_2\text{H}_5\text{COOH}]} \quad 1.3 \times 10^{-5} = \frac{(0.083+x)x}{0.125-x} \approx \frac{0.083x}{0.125}$$

$$x = 2.0 \times 10^{-5} \quad \text{pH} = -\log[\text{H}^+] \quad \text{pH} = -\log[2.0 \times 10^{-5}] \quad \text{pH} = 4.71$$

17.28b)



17.28c)



$$17.29a) \quad \text{pH} = -\log[\text{H}^+] \quad 7.4 = -\log[\text{H}^+] \quad [\text{H}^+] = 10^{-7.4} = 3.98 \times 10^{-8}\text{M}$$



$$K_a = \frac{[\text{HCO}_3^-][\text{H}^+]}{[\text{H}_2\text{CO}_3]} \quad \frac{K_a}{[\text{H}^+]} = \frac{[\text{HCO}_3^-]}{[\text{H}_2\text{CO}_3]} = \frac{4.3 \times 10^{-7}}{3.98 \times 10^{-8}} = 10.8 : 1$$

$$17.29b) \quad \text{pH} = -\log[\text{H}^+] \quad 7.1 = -\log[\text{H}^+] \quad [\text{H}^+] = 10^{-7.1} = 7.94 \times 10^{-8}\text{M}$$



$$K_a = \frac{[\text{HCO}_3^-][\text{H}^+]}{[\text{H}_2\text{CO}_3]} \quad \frac{K_a}{[\text{H}^+]} = \frac{[\text{HCO}_3^-]}{[\text{H}_2\text{CO}_3]} = \frac{4.3 \times 10^{-7}}{7.94 \times 10^{-8}} = 5.42 : 1$$

17.31 In order to create a buffer, you must have a conjugate acid/base pair. The best choice is a weak acid with a pK_a value close to the pH of the buffer you hope to create; in this case 3.50. Given 0.10M solutions of:

HCOOH pK_a = 3.75 CH₃COOH pK_a = 4.74 H₃PO₄ pK_a = 2.12

The HCOOH/NaHCOO acid/conjugate base pair is the best choice, given the desired pH of 3.50.