Solutions/Answers to NCERT/CBSE CHEMISTRY Class 12(Class XII)textbook
Exercise CHAPTER TWO
SOLUTIONS
EXERCISES

2.32

Calculate the depression in the freezing point of water when 10 g of CH3CH2CHClCOOH is added to 250 g of water. K a = 1.4 × 10–3, Kf = 1.86 K kg mol–1.

Scroll down for answer

Molar Mass of $CH_3CH_2CHClCOOH = 122.5$

10 gms of $CH_3CH_2CHClCOOH = \frac{10}{122.5} = 8.16 \times 10^{-2}$ mole

$$\text{Molality} = \frac{8.16 \times 10^{-2}}{250} \times 1000 = 0.3264$$

$$CH_3CH_2CHClCOOH \rightleftharpoons CH_3CH_2CHClCOO^- + H^+$$

| | | 0 | 0 |
|---|---|---|---|
| Initial | $C\,mol\,L^{-1}$ | | |
| At Eqm | $C(1-\alpha)$ | $C\alpha$ | $C\alpha$ |

$\alpha$ is the degree of dissociation

$$K_a = \frac{[CH_3CH_2CHClCOO^-][H^+]}{[CH_3CH_2CHClCOOH]}$$

$$= \frac{C\alpha \cdot C\alpha}{C(1-\alpha)} = C\alpha^2$$

$$K_a = C\alpha^2, \quad \alpha = \sqrt{K_a/C}$$

$$= \sqrt{\frac{1.4 \times 10^{-3}}{0.3264}} = 0.065$$

Van't Hoff factor

$$i = \frac{1+\alpha}{1} = 1+\alpha$$

$$= 1 + 0.065 = 1.065$$

$$\Delta T_f = iK_f m = 1.065 \times 1.86 \times 0.3264$$

$$= 0.65^\circ$$