

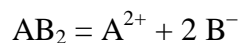
### Problem 13-12 Freezing point depression of electrolyte solution, dissociation degree

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0.44 g of the compound  $\text{AB}_2$  ( $M = 76 \text{ g mol}^{-1}$ ) was dissolved in 200 g of water.  $\text{AB}_2$  is a weak electrolyte, in the aqueous solution of the given concentration dissociated from 80 %. At which temperature the freezing of this solution begins? Cryoscopic constant of water is  $1.86 \text{ K kg mol}^{-1}$ .

[−0.14°C]

Solution:



$$(m_0)_{\text{AB}_2} = 0.44 \text{ g}$$

$$m_{\text{H}_2\text{O}} = 200 \text{ g}$$

$$(\underline{m}_0)_{\text{AB}_2} = \frac{m_{\text{AB}_2}}{M_{\text{AB}_2} \cdot m_{\text{H}_2\text{O}}} = \frac{0.44}{76 \cdot 200 \cdot 10^{-3}} = 0.02895 \text{ mol kg}^{-1}$$

$$\underline{m}_{\text{AB}_2} = \underline{m}_0 \cdot (1 - \alpha)$$

$$\underline{m}_{\text{A}^{2+}} = \underline{m}_0 \cdot \alpha$$

$$\underline{m}_{\text{B}^{-}} = 2 \underline{m}_0 \cdot \alpha$$

$$\Sigma \underline{m} = \underline{m}_0 \cdot (1 + 2 \alpha)$$

$$-\Delta T_f = K_f \cdot \Sigma \underline{m} = K_f \cdot \underline{m}_0 \cdot (1 + 2 \alpha) = 1.86 \cdot 0.02895 \cdot (1 + 2 \cdot 0.8) = 0.14^{\circ}$$