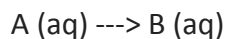


Question #83450

For the reaction



the variation in standard free enthalpy is 3.18 kJ at 25 °C and 4.67 kJ at 45 °C. Calculate the value of the equilibrium constant for this reaction at 75 °C.

Solution:

The equilibrium constant for this reaction is:

$$K = e^{-\frac{\Delta G}{RT}}$$

To calculate the free enthalpy at 75°C, assume that free enthalpy changes linearly in this range of temperature ($\Delta G = -RT \ln K$). So, if we use the method of the least squares, we get the variation in standard free enthalpy at 75 °C:

$$a = \frac{n \sum xy - \sum x \sum y}{n \sum x^2 - (\sum x)^2} = \frac{2 * 2432.7 - 616 * 7.85}{2 * 189928 - (616)^2} = 0.0745$$

$$b = \frac{\sum y \sum x^2 - \sum x \sum xy}{n \sum x^2 - (\sum x)^2} = \frac{7.85 * 189928 - 616 * 2432.7}{2 * 189928 - (616)^2} = -19.021$$

$$\Delta G = aT_3 + b = 0.0745 * 348 - 19.021 = 6.905 \text{ kJ}$$

Now it is possible to calculate the equilibrium constant for this reaction at 75°C:

$$K = e^{-\frac{6.905}{8.314 * 348}} = 0.092$$

Answer:

The value of the equilibrium constant for this reaction at 75°C is 0.092.

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