Answer on Question #76213 - Chemistry - Physical Chemistry

Question:

Derive the expression relating equilibrium constant with temparature

Solution:

The van Gough equation relates the change in the equilibrium constant Ke of the chemical reaction with the change in temperature T with allowance for the standard enthalpy change ΔH for the process.

The van Gough equation is widely used to study the changes in state functions in a thermodynamic system. The Van Hoff graph, which is derived from this equation, is particularly effective for estimating the change in enthalpy, or total energy, and entropy, or the amount of disorder, chemical reaction.

Under standard conditions, the Van 't Hoff equation is

$$\frac{d}{dT} lnK_{eq} = \frac{\Delta H}{RT^2}$$

R is the ideal gas constant. This equation is exact at any one temperature. In practice, the equation is often integrated between two temperatures on the assumption that the enthalpy of the reaction ΔH is constant. Since in reality ΔH and ΔS vary with temperature for most processes, the integrated equation is only approximate.

The main application of the integrated equation is to estimate the new equilibrium constant at a new absolute temperature, assuming a constant change in the standard enthalpy in the temperature range.