following data is given for the reaction

$$CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$$

$\Delta H_f^{\circ} [CaCO_3] = -1206.9 \text{ kJ mol}^{-1}$

$\Delta H_f^{\circ} [CO_2] = -393.5 \text{ kJ mol}^{-1}$

$\Delta H_f^{\circ} [CaO] = -635.1 \text{ kJ mol}^{-1}$

Predict the effect of temperature on the equilibrium constant of the reaction.

Sol.

The enthalpy of the reaction is given by:

$$\Delta H_r^{\circ} = \Delta H_f^{\circ}[CO_2] + \Delta H_f^{\circ}[CaO] - \Delta H_f^{\circ}[CaCO_3]$$

$$= -393.5 - 635.1 + 1206.9$$

$$= +178.3 \text{ kJ/mol}$$

Since $\Delta H_r^{\circ} > 0 \Rightarrow$ the reaction is endothermic.

So, the Equilibrium constant increases on increasing temperature and decreases on decreasing temperature.