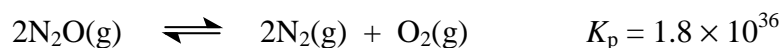


- Nitrous oxide decomposes at 25 °C according to the following equation.



What is the value for  $K_p$  at 40 °C?

Using  $\Delta_r G^\circ = -RT \ln K_p$ , at 25 °C (= 298 K):

$$\Delta_r G^\circ = -(8.314 \text{ J K}^{-1} \text{ mol}^{-1}) \times (298 \text{ K}) \times \ln(1.8 \times 10^{36}) = -207 \text{ kJ mol}^{-1}$$

Assuming that  $\Delta_r G^\circ$  does not change over the temperature range, at 40 °C = 313 K:

$$\ln K_p = \frac{\Delta_r G^\circ}{RT} = \frac{(210 \times 10^3 \text{ J mol}^{-1})}{(8.314 \text{ J K}^{-1} \text{ mol}^{-1})(298 \text{ K})} = 79$$

$$K_p = 3.3 \times 10^{34}$$

Answer:  $3.3 \times 10^{34}$

Is the reaction endothermic or exothermic? Give a reason for your answer.

**The equilibrium constant decreases when the temperature increases. This is consistent with an exothermic reaction since these become less favourable as the temperature increases (Le Chatelier's principle).**