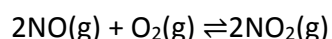




5. The following reaction is performed at 298 K



The standard free energy of formation of NO (g) is 86.6 kJ/mol at 298 K. What is the standard free energy of formation of NO<sub>2</sub> (g) at 298 K? (K<sub>P</sub> = 1.6 × 10<sup>12</sup>)

- (1)  $R(298) \ln(1.6 \times 10^{12}) - 86600$       (2)  $86600 + R(298) \ln(1.6 \times 10^{12})$   
 (3)  $86600 - \frac{\ln(1.6 \times 10^{12})}{R(298)}$       (4)  $0.5 [2 \times 86,600 - R(298) \ln(1.6 \times 10^{12})]$

**Answer:** We know that Standard Free Energy of reaction

$$(\Delta G^0) = (\Delta G^0)_{\text{Product}} - (\Delta G^0)_{\text{Reactant}}$$

$$-RT \ln K_p = 2(\Delta G^0)_{\text{NO}_2} - 2(\Delta G^0)_{\text{NO}} \quad [\text{Assumed } (\Delta G^0)_{\text{O}_2} = 0]$$

$$2(\Delta G^0)_{\text{NO}_2} = 2(\Delta G^0)_{\text{NO}} - RT \ln K_p$$

$$2(\Delta G^0)_{\text{NO}_2} = 2 \times 86600 - R \times 298 \times \ln 1.6 \times 10^{12}$$

$$(\Delta G^0)_{\text{NO}_2} = 0.5 [2 \times 86600 - R \times 298 \times \ln 1.6 \times 10^{12}]$$

**Correct option is (4)  $0.5 [2 \times 86,600 - R(298) \ln(1.6 \times 10^{12})]$**