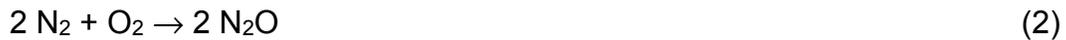


AFCoKaRE Practice Problem 3.3 Solution

Purpose: This problem allows you to practice calculating equilibrium constants, calculating equilibrium composition and solving sets of algebraic equations.

Problem Statement: If air (78% N₂, 22% O₂) reacts at 600 °C and atmospheric pressure and reactions (1) through (3) reach equilibrium, what will the mole percentages of N₂O, NO and NO₂ equal? Heat capacity expressions (cal mol⁻¹ K⁻¹) for the reagents are given in equations (4) through (8); the standard heats of formation at 298 K of N₂O, NO and NO₂ are 19.49, 21.6 and 8.09 kcal mol⁻¹, respectively; their standard Gibbs free energies of formation at 298 K are 24.77, 20.72 and 12.42 kcal mol⁻¹, respectively.



$$\hat{C}_{p,\text{N}_2} = 7.440 - 3.24 \times 10^{-3} T + 6.4 \times 10^{-6} T^2 - 2.79 \times 10^{-9} T^3 \quad (4)$$

$$\hat{C}_{p,\text{O}_2} = 6.713 - 8.79 \times 10^{-3} T + 4.17 \times 10^{-6} T^2 - 2.544 \times 10^{-9} T^3 \quad (5)$$

$$\hat{C}_{p,\text{NO}} = 7.009 - 2.24 \times 10^{-3} T + 2.328 \times 10^{-6} T^2 - 1.0 \times 10^{-9} T^3 \quad (6)$$

$$\hat{C}_{p,\text{N}_2\text{O}} = 5.164 + 1.739 \times 10^{-2} T - 1.38 \times 10^{-5} T^2 + 4.371 \times 10^{-9} T^3 \quad (7)$$

$$\hat{C}_{p,\text{NO}_2} = 5.788 + 1.155 \times 10^{-2} T - 4.97 \times 10^{-6} T^2 + 7.0 \times 10^{-11} T^3 \quad (8)$$