Answer on Question #45291 – Chemistry – Physical Chemistry

Question:

For the reaction N_2O_3 gives NO and NO_2, the value of equilibrium constant K_p at fixed temperature is 4. What will be the amount of dissociation at the same temp and 5 atm pressure?

Answer:

The equilibrium equation for the decomposition of N_2O_3 can be written as

$$N_2O_3 \leftrightarrow NO + NO_2$$

$$K_p = \frac{P_{NO} \times P_{NO_2}}{P_{N_2O_3}}$$

where P_{NO}, P_{NO_2} and $P_{N_2O_3}$ are the partial pressures of products and reagents at equilibrium,

$$p_i = P*x_i$$

$$x_i = n_i/\Sigma\ n_i$$

$$\alpha = n_d(N_2O_3)/n_0(N_2O_3)$$

$$N_2O_3 \leftrightarrow NO + NO_2$$

$$(1-\alpha)*n_0 \qquad \alpha*n_0 \qquad \alpha*n_0$$

$$n(N_2O_3) = (1-\alpha)*n_0 \qquad n(NO_2) = n(NO) = \alpha*n_0$$

$$\Sigma\ n_i = (1-\alpha)*n_0 + \alpha*n_0 + \alpha*n_0 = (1+\alpha)*\ n_0$$

$$P(N_2O_3) = P*(1-\alpha)/(1+\alpha) \qquad P(NO_2) = P(NO) = P*\alpha/(1+\alpha)$$

where α is amount of dissociation, P = 5 atm.

$$K_p = \frac{P_{NO} \times P_{NO_2}}{P_{N_2O_3}} = \frac{P * \dfrac{\alpha}{1+\alpha} * P * \dfrac{\alpha}{1+\alpha}}{P * \dfrac{1-\alpha}{1+\alpha}} = \frac{5 * \alpha^2}{1-\alpha^2} = 4$$

After solving α = 2/3

Answer: α = 2/3