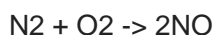


Question #61309 – Chemistry – General Chemistry

Question

1. What is the concentration of NO gas at equilibrium if you mix 0.20 mol of N₂ and 0.15 mol of O₂ in a 1.0 L container at 2000 °C? The K_c for the reaction at 2000 °C is .



Solution

Solution is difficult because K_c is not given by customer.

$$K_c = \frac{[\text{NO}]^2}{[\text{N}_2][\text{O}_2]}$$

If x mol of N₂ react with O₂

$$K_c = \frac{[2x]^2}{[0.2-x][0.15-x]}$$

$$(K_c - 4) * x^2 - 0.35K_c x + K_c * 0.03 = 0$$

$$x = \frac{4 - K_c + (0.35^2 - 4(K_c - 4) * K_c * 0.03)^{0.5}}{2(K_c - 4)} - \text{typical solution of quadratic equation}$$

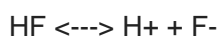
$$[\text{NO}] = 2x = \frac{2 * (4 - K_c + (0.35^2 - 4(K_c - 4) * K_c * 0.03)^{0.5})}{2(K_c - 4)}$$

$$\text{Answer: } [\text{NO}] = \frac{2 * (4 - K_c + (0.35^2 - 4(K_c - 4) * K_c * 0.03)^{0.5})}{2(K_c - 4)}$$

Question:

2. What would be the equilibrium pH if 200 milligrams of Hydrofluoric acid (HF) were dissolved in 1 liter of solution? The pK_a for the acid is equal to 3.2. (Hint: Convert pK_a to K_a)

Solution:



$$[\text{H}^+] = [\text{F}^-] + [\text{OH}^-]$$

$$C_{\text{HF}} = [\text{HF}] + [\text{F}^-]$$

$$K_a = \frac{[\text{H}^+][\text{F}^-]}{[\text{HF}]}$$

$$[\text{H}^+] = \frac{K_a C_{\text{HF}}}{[\text{H}^+] + K_a} + \frac{K_w}{[\text{H}^+]}$$

$$C_{\text{HF}} = \frac{0.2}{20 * 1} = 0.01 \text{ mol/l}$$

$$K_a = 10^{-3.2} = 6.3 * 10^{-4}$$

$$[\text{H}^+] = 0.00222 \text{ mol/l}$$

$$\text{pH} = 2.65$$

$$\text{Answer: pH} = 2.65$$