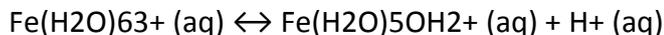


Answer on Question #56915 - Chemistry - Other

Question:

2. A sample containing 0.0500 mol of $\text{Fe}_2(\text{SO}_4)_3$ is dissolved in enough water to make 1.00 L of solution. This solution contains hydrated SO_4^{2-} and $\text{Fe}(\text{H}_2\text{O})_6^{3+}$ ions. The latter behaves as an acid according to the equation:

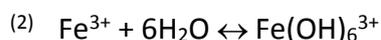


a. Calculate the expected osmotic pressure of this solution at 25° C if this acid dissociation is negligible.

b. The actual osmotic pressure of the solution is 6.80 atm at 25° C. Calculate the K_a for the acid dissociation reaction of $\text{Fe}(\text{H}_2\text{O})_6^{3+}$, assuming no ions cross the semipermeable membrane.

a)

Solution:



$$n(\text{SO}_4^{2-}) = 0.15 \text{ mole}$$

$$n(\text{Fe}(\text{H}_2\text{O})_6^{3+}) = 0.1 \text{ mole}$$

$$\text{Total: } 0.15 + 0.1 = 0.25 \text{ mole}$$

$$P_0 = CRT = 0.25 \cdot 1000 \cdot 8.314 \cdot 298 = 0.62 \text{ MPa.}$$

Answer: 0.62 MPa (6.11 atm).

b)

Solution:



$$i = P/P_0 = 6.8/6.11 = 1.11$$

$$\alpha = (i-1)/(n-1); n = 2 \text{ ions}$$

$$\alpha = 0.11 - \text{dissociation degree}$$

$$K_a = \alpha^2 C = 6 \cdot 10^{-4}$$

Answer: $6 \cdot 10^{-4}$.