

- Calculate the equilibrium constant for the following reaction.

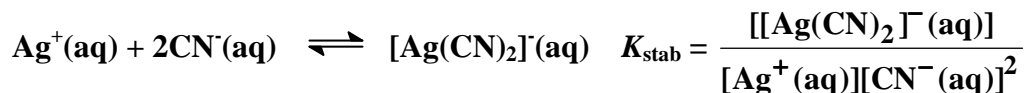


Data: K_{stab} of $[\text{Ag}(\text{CN})_2]^{-} = 3 \times 10^{20}$; K_{sp} of $\text{AgI} = 8.3 \times 10^{-17}$

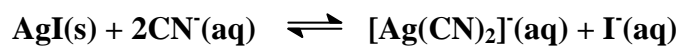
The equations for the dissolution of AgI and the stability constant of the complex $[\text{Ag}(\text{CN})_2]^{-}$ are, respectively:



$$K_{\text{sp}} = [\text{Ag}^{+}(\text{aq})][\text{I}^{-}(\text{aq})]$$



Addition of these reactions gives the required reaction and so the equilibrium constant for the reaction is the product of the individual equilibrium constants:



$$\begin{aligned} K &= K_{\text{sp}} \times K_{\text{stab}} = [\text{Ag}^{+}(\text{aq})][\text{I}^{-}(\text{aq})] \times \frac{[[\text{Ag}(\text{CN})_2]^{-}(\text{aq})]}{[\text{Ag}^{+}(\text{aq})][\text{CN}^{-}(\text{aq})]^2} \\ &= \frac{[[\text{Ag}(\text{CN})_2]^{-}(\text{aq})][\text{I}^{-}(\text{aq})]}{[\text{CN}^{-}(\text{aq})]^2} \end{aligned}$$

Hence,

$$K = K_{\text{sp}} \times K_{\text{stab}} = (8.3 \times 10^{-17}) \times (3 \times 10^{20}) = 2 \times 10^4$$

Answer: 2×10^4