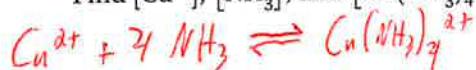


Quiz 15.3 – Formation Reactions

Name: Kay

Question 1

Copper(II) ions will form a $\text{Cu}(\text{NH}_3)_4^{2+}$ complex ion with $K_f = 1.7 \times 10^{13}$ Find $[\text{Cu}^{2+}]$, $[\text{NH}_3]$, and $[\text{Cu}(\text{NH}_3)_4^{2+}]$ for a solution which is 0.200 F in Cu^{2+} and 0.500 F in NH_3 E_{Mak} 

- B 0.2 0.5 Ø
 C -0.125 -0.5 +0.125
 A 0.075 Ø 0.125



- I 0.075 Ø 0.125
 C +x +4x -x

$$1.7 \cdot 10^{13} = \frac{0.125 - x}{(0.075 + 4x)^4}$$

$$1.7 \cdot 10^{13} = \frac{0.125}{0.075 \cdot 4^4 \cdot x^4}$$

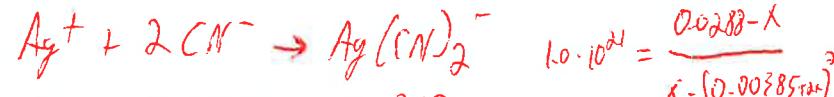
$$X = 1.7 \cdot 10^{-4}$$

$$0.075\text{ M} \quad 5.6 \cdot 10^{-4}\text{ M} \quad 0.125\text{ M}$$

Question 2

Consider the formation of the complex ion $\text{Ag}(\text{CN})_2^-$, with ($K_f = 1.0 \times 10^{21}$)Find $[\text{Ag}^+]$, $[\text{CN}^-]$, and $[\text{Ag}(\text{CN})_2^-]$ in a solution prepared by mixing 25.00 ml of 0.075 M AgNO_3 with 40.00 ml of $0.100\text{ M NaCN} \rightarrow 0.06152\text{ M}$ 

- D 0.02885 0.06152 Ø
 C -0.02885 -0.05769 +0.02885
 A Ø 0.003846 0.02885



$$1.0 \cdot 10^{21} = \frac{0.0288 - x}{x \cdot (0.00385 + 2x)^2}$$

$$1.9 \cdot 10^{-18} \quad 0.00385\text{ M} \quad 0.0288\text{ M} \quad x = 1.9 \cdot 10^{-18}$$

Question 3

 PbI_2 is a sparingly soluble salt with $K_{sp} = 9.8 \times 10^{-9}$, while PbI_4^{2-} is a complex ion with $K_f = 3.0 \times 10^4$ What effect does the formation reaction have on the molar solubility of PbI_2 ?(Bonus for the truly adventurous!: Find $[\text{Pb}^{2+}]$, $[\text{I}^-]$, and $[\text{PbI}_4^{2-}]$ if excess $\text{PbI}_2(s)$ is placed in pure water)

It will increase solubility as dissolved Pb^{2+} and I^- ions are consumed to produce PbI_4^{2-}

$$9.8 \cdot 10^{-9} = (x-y)(2x-y)^2$$

$\text{PbI}_2(s)$	Pb^{2+}	2I^-	Pb^{2+}	2I^-	PbI_4^{2-}
I	Ø	Ø	x	2x	Ø
C	+x	+2x	-y	-2y	+y
E	$x-y$	$2x-2y$	$x-y$	$2x-2y$	y

$$3.0 \cdot 10^4 = \frac{y}{(x-y)(2x-y)^2}$$

2 solutions

$$x = 0.00135 \quad y = 850.34$$

$$y = 2.17 \cdot 10^{-9} \quad y = 850.34$$

$$x-y = 3.39 \cdot 10^{-15}$$