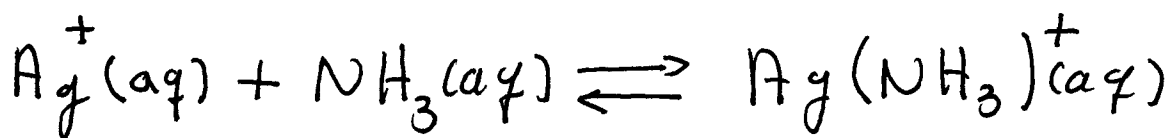
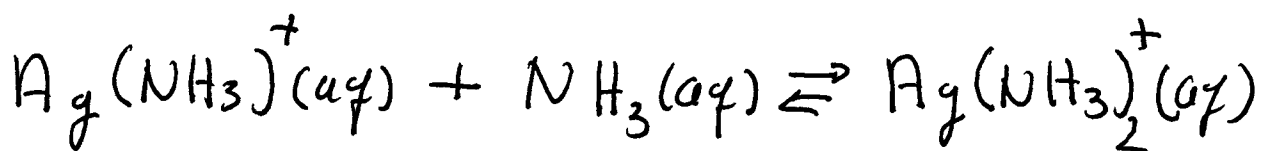


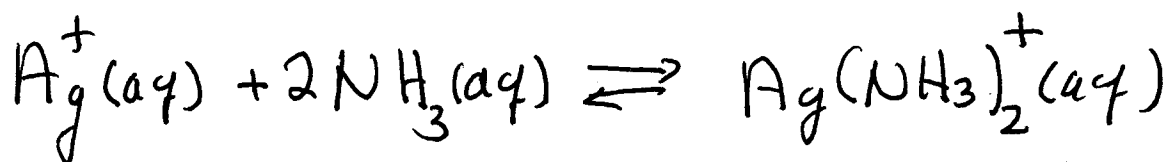
COMPLEX ION



$$K_1 = \frac{[\text{Ag}(\text{NH}_3)^+]}{[\text{Ag}^+][\text{NH}_3]} = 2.1 \times 10^3$$



$$K_2 = \frac{[\text{Ag}(\text{NH}_3)_2^+]}{[\text{Ag}(\text{NH}_3)^+][\text{NH}_3]} = 8.0 \times 10^3$$



$$K_f = K_1 K_2 = 1.7 \times 10^7 \quad \text{FORMATION CONSTANT}$$

$$K_f \gg 1$$

CONSIDER 0.200 mol of AgNO_3 AND DISSOLVE IT IN 0.500 L OF A 1.000 M NH_3 .

ASSUMPTION: ALL THE Ag^+ FORMS A COMPLEX ION $\text{Ag}(\text{NH}_3)_2^+$

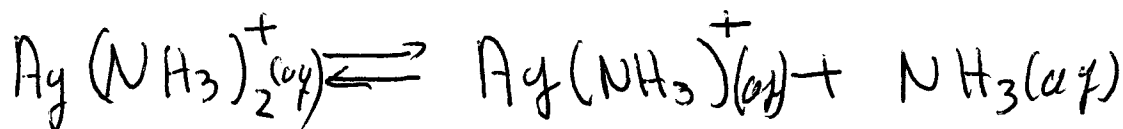
FIRST WE NEED TO CALCULATE THE CONC.

$$[\text{Ag}(\text{NH}_3)_2^+] = \frac{0.200 \text{ mol Ag}(\text{NH}_3)_2^+}{0.500 \text{ L}} = \underline{\underline{0.400 \text{ M}}}$$

$$[\text{NH}_3] = \frac{0.500 \text{ mol NH}_3 - 2(0.200 \text{ mol NH}_3)}{0.500 \text{ L}}$$

$$[\text{NH}_3] = 0.200 \text{ M}$$

SECOND WE CALCULATE $[\text{Ag}(\text{NH}_3)_2^+]$



I	0.400	—	0.200
C	-x	x	x
E	0.400-x	x	0.200+x

$$\frac{1}{K_2} = \frac{x(0.200+x)}{(0.400-x)}$$

$$\frac{1}{K_2} \approx \frac{0.200}{0.400} X = \frac{X}{2.00}$$

$$X \approx \frac{2.00}{K_2} = \frac{2.00}{8.0} 10^{-3}$$

$$X = 2.5 \times 10^{-4}$$

$$\boxed{[\text{Ag}(\text{NH}_3)_2^+] = 2.5 \times 10^{-4} \text{ M}}$$

FINALLY

NOW WE CAN USE THE FIRST EQUILIBRIUM
AND

$$[\text{Ag}^+] = \frac{1}{K_1} \frac{[\text{Ag}(\text{NH}_3)^+]}{[\text{NH}_3]}$$

$$= \frac{2.5 \times 10^{-4}}{2.1 \times 10^3} \frac{1}{0.200}$$

$$= \frac{2.5}{4.2} \times 10^{-6} = 6.0 \times 10^{-7}$$

$$\boxed{[\text{Ag}^+] = 6.0 \times 10^{-7} \text{ M}}$$

$$[\text{Ag}(\text{NH}_3)_2^+] \gg [\text{Ag}(\text{NH}_3)^+] \gg [\text{Ag}^+]$$