Activity 7B: Complex ion equations

Ans p. 32

1. Complete the following equations for the formation of complex ions:

a. ___ + ___ ⟶ $[Cu(NH_3)_4]^{2+}$

b. $Pb(OH)_2(s) + 2OH^- \longrightarrow$ ___

c. $Zn^{2+}(aq) + 4NH_3(aq) \longrightarrow$ ___

d. ___ + ___ ⟶ $[Al(OH)_4]^-$

e. $Fe^{3+}(aq) + SCN^-(aq) \longrightarrow$ ___

f. ___ + ___ ⟶ $[Ag(NH_3)_2]^+$

2. Write balanced equations for all the reactions described in each of the following observations using the information in the table *Appearance and solubility of compounds formed from cations and anions* on pages 75 and 76.

a. Sodium hydroxide is added to a precipitate of zinc hydroxide. The precipitate disappears.

b. A solution of copper sulfate has a small amount of ammonia solution added to it. A blue precipitate forms. When excess ammonia solution is added, the precipitate disappears.

c. A solution of lead nitrate has a small amount of aqueous sodium hydroxide added to it. A precipitate forms which disappears when excess of the hydroxide solution is added.

d. When silver nitrate is added to aqueous potassium chloride, a white precipitate forms. When aqueous ammonia is added, the precipitate disappears.

e. When a small amount of sodium hydroxide solution is added to a solution of aluminium nitrate, a white precipitate is observed. On the addition of excess sodium hydroxide solution, the precipitate dissolves.

f. When a few drops of potassium thiocyanate solution are added to a solution of iron(III) nitrate, a blood red colour is observed.

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1. a. $Cu^{2+} + 4NH_3$

b. $[Pb(OH)_4]^{2-}$

c. $[Zn(NH_3)_4]^{2+}$

d. $Al^{3+} + 4OH^-$ *or* $Al(OH)_3 + OH^-$

e. $[FeSCN]^{2+}$

f. $Ag^+ + 2NH_3$

2. a. $Zn(OH)_2 + 2OH^- \longrightarrow [Zn(OH)_4]^{2-}$

b. $Cu^{2+} + 2OH^- \longrightarrow Cu(OH)_2(s)$

$Cu^{2+} + 4NH_3 \longrightarrow [Cu(NH_3)_4]^{2+}$

or $Cu(OH)_2 + 4NH_3 \longrightarrow [Cu(NH_3)_4]^{2+} + 2OH^-$

c. $Pb^{2+} + 2OH^- \longrightarrow Pb(OH)_2$

$Pb(OH)_2 + 2OH^- \longrightarrow Pb(OH)_4^{2-}$

d. $Ag^+ + Cl^- \longrightarrow AgCl$

$AgCl^- + 2NH_3 \longrightarrow [Ag(NH_3)_2]^+ + Cl^-$

or $Ag^+ + 2NH_3 \longrightarrow [Ag(NH_3)_2]^+$

e. $Al^{3+} + 3OH^- \rightarrow Al(OH)_3(s)$

$Al(OH)_3 + OH^- \rightarrow [Al(OH)_4]^-$

Or: $Al^{3+} + 4OH^- \rightarrow [Al(OH)_4]^-$

f. $Fe^{3+} + SCN^- \rightarrow [FeSCN]^{2+}$

RESOURCES

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