USEFUL EQUATIONS FOR TRANSITION METAL REACTIONS

- $[M(H_2O)_6]^{2+}_{(aq)} + H_2O_{(l)} \rightleftharpoons [M(OH)(H_2O)_5]^{+}_{(aq)} + H_3O^{+}_{(aq)}$
- $[M(H_2O)_6]^{3+}_{(aq)} + H_2O_{(l)} \rightleftharpoons [M(OH)(H_2O)_5]^{2+}_{(aq)} + H_3O^{+}_{(aq)}$

1. $[Co(H_2O)_6]^{2+}_{(aq)} + 2OH^{-}_{(aq)} \longrightarrow [Co(OH)_2(H_2O)_4]_{(s)} + 2H_2O_{(l)}$
2. $[Co(H_2O)_6]^{2+}_{(aq)} + 2NH_{3(aq)} \longrightarrow [Co(OH)_2(H_2O)_4]_{(s)} + 2NH_4^{+}_{(aq)}$
3. $[Co(OH)_2(H_2O)_4]_{(s)} + 6NH_{3(aq)} \longrightarrow [Co(NH_3)_6]^{2+}_{(aq)} + 4H_2O_{(l)} + 2OH^{-}_{(aq)}$
4. $[Co(NH_3)_6]^{2+}_{(aq)} \longrightarrow [Co(NH_3)_6]^{3+}_{(aq)} + e^{-}$
5. $[Co(H_2O)_6]^{2+}_{(aq)} + CO_3^{2-}_{(aq)} \longrightarrow CoCO_{3(s)} + 6H_2O_{(l)}$ *or* $Co^{2+}_{(aq)} + CO_3^{2-}_{(aq)} \longrightarrow CoCO_{3(s)}$
6. $[Co(H_2O)_6]^{2+}_{(aq)} + 4Cl^{-}_{(aq)} \longrightarrow [CoCl_4]^{2-}_{(aq)} + 6H_2O_{(l)}$
7. $[Cu(OH)_2(H_2O)_4]_{(s)} + 4NH_{3(aq)} \longrightarrow [Cu(NH_3)_4(H_2O)_2]^{2+}_{(aq)} + 2H_2O_{(l)} + 2OH^{-}_{(aq)}$
8. $2Cu^{2+}_{(aq)} + 4I^{-}_{(aq)} \longrightarrow 2CuI_{(s)} + I_{2(aq)}$
9. $[Cr(H_2O)_6]^{3+}_{(aq)} + 3OH^{-}_{(aq)} \longrightarrow [Cr(OH)_3(H_2O)_3]_{(s)} + 3H_2O_{(l)}$
10. $[Cr(OH)_3(H_2O)_3]_{(s)} + 3H^{+}_{(aq)} \longrightarrow [Cr(H_2O)_6]^{3+}_{(aq)}$
11. $[Cr(OH)_3(H_2O)_3]_{(s)} + 3OH^{-}_{(aq)} \longrightarrow [Cr(OH)_6]^{3-}_{(aq)} + 3H_2O_{(l)}$
12. $2\,[Cr(H_2O)_6]^{3+}_{(aq)} + 3CO_3^{2-}_{(aq)} \longrightarrow 2\,[Cr(OH)_3(H_2O)_3]_{(s)} + 3H_2O_{(l)} + 3CO_{2(g)}$
13. $[Cr(H_2O)_6]^{3+}_{(aq)} + 3NH_{3(aq)} \longrightarrow [Cr(OH)_3(H_2O)_3]_{(s)} + 3NH_4^{+}_{(aq)}$
14. $[Cr(OH)_3(H_2O)_3]_{(s)} + 6NH_{3(aq)} \longrightarrow [Cr(NH_3)_6]^{3+}_{(aq)} + 3H_2O_{(l)} + 3OH^{-}_{(aq)}$
15. $2Cr^{3+}_{(aq)} + 3H_2O_{2(l)} + 10OH^{-}_{(aq)} \longrightarrow 2CrO_4^{2-}_{(aq)} + 8H_2O_{(l)}$
16. $2\,[Cr(H_2O)_6]^{3+}_{(aq)} + Zn_{(s)} \longrightarrow 2\,[Cr(H_2O)_6]^{2+}_{(aq)} + Zn^{2+}_{(aq)}$
17. $Cr_2O_7^{2-}_{(aq)} + 2OH^{-}_{(aq)} \rightleftharpoons 2CrO_4^{2-}_{(aq)} + H_2O_{(l)}$
18. $2\,CrO_4^{2-}_{(aq)} + 2H^{+}_{(aq)} \rightleftharpoons Cr_2O_7^{2-}_{(aq)} + H_2O_{(l)}$
19. $Cr_2O_7^{2-}_{(aq)} + 14H^{+}_{(aq)} + 6e^{-} \longrightarrow 2Cr^{3+}_{(aq)} + 7H_2O_{(l)}$
20. $MnO_4^{-}_{(aq)} + 8H^{+}_{(aq)} + 5e^{-} \longrightarrow Mn^{2+}_{(aq)} + 4H_2O_{(l)}$
21. $Fe(OH)_{2(s)} + OH^{-}_{(aq)} \longrightarrow Fe(OH)_{3(s)} + e^{-}$
22. $[Fe(H_2O)_6]^{3+}_{(aq)} + SCN^{-}_{(aq)} \longrightarrow [Fe(SCN)(H_2O)_5]^{2+}_{(aq)} + H_2O_{(l)}$
23. $AgCl_{(s)} + 2NH_{3(aq)} \longrightarrow [Ag(NH_3)_2]^{+}_{(aq)} + Cl^{-}_{(aq)}$
24. $AgBr + 2S_2O_3^{2-} \longrightarrow [Ag(S_2O_3)_2]^{3-} + Br^{-}$

These examples can be used to work out equations for reactions involving different metal ions