

UNIT 2 – THE ESSENTIAL EQUATIONS

Group 7, The Halogens

- $\text{Cl}_2(\text{aq}) + 2\text{Br}^-(\text{aq}) \rightarrow \text{Br}_2(\text{aq}) + 2\text{Cl}^-(\text{aq})$ displacement
- $\text{Cl}_2(\text{aq}) + 2\text{I}^-(\text{aq}) \rightarrow \text{I}_2(\text{aq}) + 2\text{Cl}^-(\text{aq})$ displacement
- $\text{Br}_2(\text{aq}) + 2\text{I}^-(\text{aq}) \rightarrow \text{I}_2(\text{aq}) + 2\text{Br}^-(\text{aq})$ displacement
- $\text{H}_2\text{SO}_4 + \text{Cl}^- \rightarrow \text{HSO}_4^- + \text{HCl}$ acid-base
- $\text{H}_2\text{SO}_4 + 2\text{H}^+ + 2\text{e}^- \rightarrow \text{SO}_2 + 2\text{H}_2\text{O}$ reduction (by Br^- or I^-)
- $\text{H}_2\text{SO}_4 + 6\text{H}^+ + 6\text{e}^- \rightarrow \text{S} + 4\text{H}_2\text{O}$ reduction (by I^-)
- $\text{H}_2\text{SO}_4 + 8\text{H}^+ + 8\text{e}^- \rightarrow \text{H}_2\text{S} + 4\text{H}_2\text{O}$ reduction (by I^-)
- $2\text{I}^-(\text{aq}) \rightarrow \text{I}_2(\text{aq}) + 2\text{e}^-$ oxidation by conc. H_2SO_4
- $2\text{Br}^-(\text{aq}) \rightarrow \text{Br}_2(\text{aq}) + 2\text{e}^-$ oxidation by conc. H_2SO_4
- $\text{Ag}^+(\text{aq}) + \text{Cl}^-(\text{aq}) \rightarrow \text{AgCl}(\text{s})$ precipitation
- $\text{Ag}^+(\text{aq}) + \text{Br}^-(\text{aq}) \rightarrow \text{AgBr}(\text{s})$ precipitation
- $\text{Ag}^+(\text{aq}) + \text{I}^-(\text{aq}) \rightarrow \text{AgI}(\text{s})$ precipitation
- $\text{Cl}_2(\text{g}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{HCl}(\text{aq}) + \text{HClO}(\text{aq})$ sterilising water
- $\text{Cl}_2(\text{g}) + 2\text{OH}^-(\text{aq}) \rightarrow \text{Cl}^-(\text{aq}) + \text{ClO}^-(\text{aq}) + \text{H}_2\text{O}(\text{l})$ making bleach

Group 2, the Alkaline Earth Metals

- $\text{Mg}(\text{s}) + \text{H}_2\text{O}(\text{g}) \rightarrow \text{MgO} + \text{H}_2(\text{g})$ magnesium and steam
- $\text{Ca}(\text{s}) + 2\text{H}_2\text{O}(\text{l}) \rightarrow \text{Ca}(\text{OH})_2(\text{s}) + \text{H}_2(\text{g})$ calcium and water
- $\text{Sr}(\text{s}) + 2\text{H}_2\text{O}(\text{l}) \rightarrow \text{Sr}(\text{OH})_2(\text{s}) + \text{H}_2(\text{g})$ strontium and water
- $\text{Ba}(\text{s}) + 2\text{H}_2\text{O}(\text{l}) \rightarrow \text{Ba}(\text{OH})_2(\text{s}) + \text{H}_2(\text{g})$ barium and water
- $\text{Mg}^{2+}(\text{aq}) + 2\text{OH}^-(\text{aq}) \rightarrow \text{Mg}(\text{OH})_2(\text{s})$ solubility of hydroxides
- $\text{Ca}^{2+}(\text{aq}) + 2\text{OH}^-(\text{aq}) \rightarrow \text{Ca}(\text{OH})_2(\text{s})$ solubility of hydroxides

21. $\text{Ca}^{2+}(\text{aq}) + \text{SO}_4^{2-}(\text{aq}) \rightarrow \text{CaSO}_4(\text{s})$ solubility of sulphates
22. $\text{Sr}^{2+}(\text{aq}) + \text{SO}_4^{2-}(\text{aq}) \rightarrow \text{SrSO}_4(\text{s})$ solubility of sulphates
23. $\text{Ba}^{2+}(\text{aq}) + \text{SO}_4^{2-}(\text{aq}) \rightarrow \text{BaSO}_4(\text{s})$ solubility of sulphates

Extraction of Metals

Extraction of iron

24. $\text{C}(\text{s}) + \text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g})$ heat the furnace
25. $\text{C}(\text{s}) + \text{CO}_2(\text{g}) \rightarrow 2\text{CO}(\text{g})$ produce the main reducing agent
26. $\text{Fe}_2\text{O}_3(\text{s}) + 3\text{CO}(\text{g}) \rightarrow 2\text{Fe}(\text{s}) + 3\text{CO}_2(\text{g})$ reduce the iron (III) oxide
27. $\text{Fe}_2\text{O}_3(\text{s}) + 3\text{C}(\text{s}) \rightarrow 2\text{Fe}(\text{s}) + 3\text{CO}(\text{g})$ reduce the iron (III) oxide
28. $\text{CaCO}_3(\text{s}) \rightarrow \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$ removing silicon dioxide
29. $\text{CaO}(\text{s}) + \text{SiO}_2(\text{s}) \rightarrow \text{CaSiO}_3(\text{s})$ removing silicon dioxide
30. $2\text{ZnS}(\text{s}) + 3\text{O}_2(\text{g}) \rightarrow 2\text{ZnO}(\text{s}) + 2\text{SO}_2(\text{g})$ converting sulphides to oxides

Extraction of aluminium

31. $\text{Al}^{3+} + 3\text{e} \rightarrow \text{Al}$ at cathode
32. $2\text{O}^{2-} \rightarrow \text{O}_2 + 4\text{e}$ at anode
33. $\text{C}(\text{s}) + \text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g})$ other reaction at anode

Extraction of titanium

34. $\text{TiO}_2(\text{s}) + 2\text{Cl}_2(\text{g}) + 2\text{C}(\text{s}) \rightarrow \text{TiCl}_4(\text{g}) + 2\text{CO}(\text{g})$ converting oxide to chloride
35. $\text{TiO}_2(\text{s}) + 3\text{C}(\text{s}) \rightarrow \text{TiC}(\text{s}) + 2\text{CO}(\text{g})$ why you can't use carbon
36. $\text{TiCl}_4(\text{g}) + 4\text{Na}(\text{l}) \rightarrow \text{Ti}(\text{s}) + 4\text{NaCl}(\text{s})$ reducing chloride
37. $\text{TiCl}_4(\text{g}) + 2\text{Mg}(\text{l}) \rightarrow \text{Ti}(\text{s}) + 2\text{MgCl}_2(\text{s})$ reducing chloride

Extraction of tungsten

38. $\text{WO}_3(\text{s}) + 3\text{H}_2(\text{g}) \rightarrow \text{W}(\text{s}) + 3\text{H}_2\text{O}(\text{g})$ extracting tungsten

