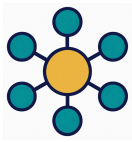
Ions in Solution Map

AQA A-level Chemistry · 3.2.6 Reactions of ions in aqueous solution

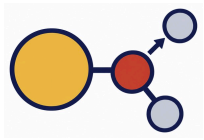
1 Aqua ions 3.2.6

- $[Fe(H_2O)_6]^{2+}$, $[Cu(H_2O)_6]^{2+}$
- $[Al(H_2O)_6]^{3+}$, $[Fe(H_2O)_6]^{3+}$
- Octahedral
- Water ligands can lose H^+



2 Acidity 3.2.6

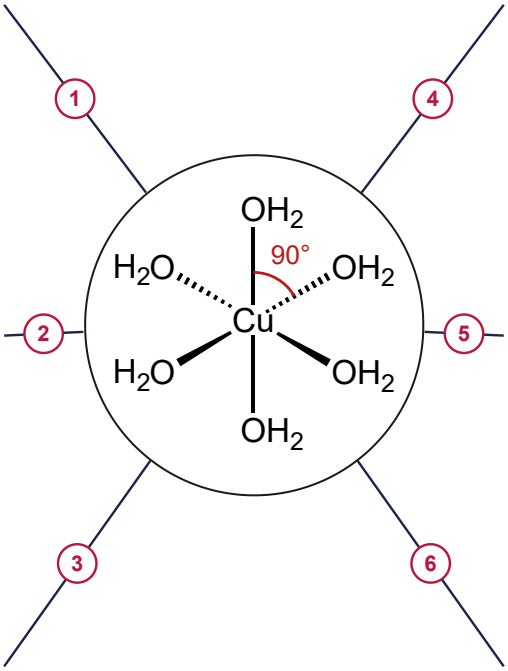
- Metal ion **polarises** O−H
- 3+: higher **charge/size ratio**
- So 3+ ions are more acidic
- H_3O^+ forms



3 OH^- and NH_3 3.2.6

- Base removes H^+
- Neutral complex: a **precipitate**
- 2+ loses two H^+; 3+ loses three
- $Fe(OH)_2$ darkens in air





4 Excess reagents 3.2.6

- Al hydroxide: **amphoteric**
- Excess OH^-: $[Al(H_2O)_2(OH)_4]^-$
- Excess NH_3: ligand exchange
- $[Cu(NH_3)_4(H_2O)_2]^{2+}$ deep blue



5 Carbonates 3.2.6

- 2+: **MCO_3** precipitate, no gas
- 3+: hydroxide and **CO_2**
- Effervescence: a 3+ ion
- No $Fe_2(CO_3)_3$ forms



6 Identifying ions 3.2.6

- NaOH: colour of the solid
- Excess NaOH: Al^{3+} dissolves
- Excess NH_3: Cu^{2+} dissolves
- Na_2CO_3: a gas means 3+



Reactions of the four ions observations

Ion	OH^- or a little NH_3	Excess	CO_3^{2-}
Fe^{2+}	dirty green	stays	green $FeCO_3$
Cu^{2+}	pale blue	NH_3: deep blue solution	blue-green $CuCO_3$
Fe^{3+}	orange-brown	stays	brown solid, CO_2
Al^{3+}	white	OH^-: colourless solution	white solid, CO_2

Worked examples

Acidity

- $[Fe(H_2O)_6]^{3+} + H_2O$
- $\rightleftharpoons [Fe(H_2O)_5(OH)]^{2+}$
- **$+ H_3O^+$**

Hydroxide

- $[Al(H_2O)_6]^{3+} + 3OH^-$
- $\rightarrow [Al(H_2O)_3(OH)_3]$
- **$+ 3H_2O$**

Carbonate

- $2[Fe(H_2O)_6]^{3+} + 3CO_3^{2-}$
- $\rightarrow 2[Fe(H_2O)_3(OH)_3]$
- **$+ 3CO_2 + 3H_2O$**

Required Practical 11 uses these tests to identify ions in solution.

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