Transition Element Reactions Map

OCR A Level Chemistry A · 5.3.1 Reactions of transition elements · 5.3.2 Qualitative analysis

1 Ligand substitution

5.3.1(h)

- $[Cu(H_2O)_6]^{2+}$ + excess NH_3
- Deep blue $[Cu(NH_3)_4(H_2O)_2]^{2+}$
- Conc HCl: yellow $[CuCl_4]^{2-}$
- $[Cr(H_2O)_6]^{3+}$ to $[Cr(NH_3)_6]^{3+}$



2 Precipitation

5.3.1(j)

- Cu^{2+} pale blue
- Fe^{2+} green; Fe^{3+} orange-brown
- Mn^{2+} pale brown
- Cr^{3+} grey-green

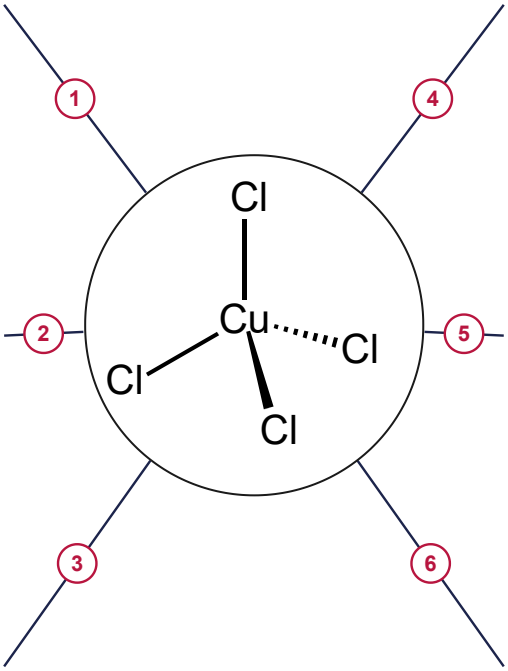


3 Excess reagents

5.3.1(j)

- Excess OH^-: $[Cr(OH)_6]^{3-}$ dark green
- Excess NH_3: Cu deep blue
- Excess NH_3: Cr purple
- Fe and Mn solids stay





4 Iron and chromium redox

5.3.1(k)

- Fe^{2+} to Fe^{3+}: H^+/MnO_4^-
- Fe^{3+} to Fe^{2+}: I^-
- Cr^{3+} to $Cr_2O_7^{2-}$: H_2O_2 / OH^-
- $Cr_2O_7^{2-}$ to Cr^{3+}: Zn / H^+



5 Copper redox

5.3.1(k)

- Cu^{2+} + I^-: CuI and I_2
- White solid, brown solution
- Cu^+ disproportionates
- $2Cu^+ \rightarrow Cu + Cu^{2+}$



6 Testing for ions

5.3.2

- CO_3^{2-}, then SO_4^{2-}, then halides
- NH_4^+: warm with NaOH
- Cations: NaOH and NH_3
- Note every colour



Metal ions with aqueous hydroxide and ammonia

precipitate, then in excess

Ion	Precipitate	Excess OH^-	Excess NH_3
Cu^{2+}	pale blue	stays	deep blue solution
Fe^{2+}	green	stays	stays
Fe^{3+}	orange-brown	stays	stays
Mn^{2+}	pale brown	stays	stays
Cr^{3+}	grey-green	dark green solution	purple solution

Worked examples

Substitution

- $[Cu(H_2O)_6]^{2+}$ + $4Cl^-$
- $\rightleftharpoons [CuCl_4]^{2-}$
- **+ $6H_2O$**

Copper(II) and iodide

- $2Cu^{2+}$ + $4I^-$
- $\rightarrow 2CuI + I_2$
- **White solid, brown solution**

Disproportionation

- $Cu_2O + 2H^+$
- $\rightarrow Cu + Cu^{2+} + H_2O$
- **Cu +1 to 0 and +2**

Each test follows the sequence: carbonate, sulfate, halide.

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