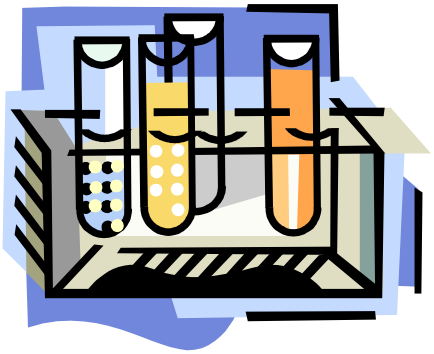
# Transition Elements



**The key areas of study in this topic are:**

- Properties
- Ligands, complex ions and substitution reactions
- Precipitation reactions
- Redox reactions

| **By the end of this topic I should be able to:** | Start | End |
|---|---|---|
| Deduce the electron configuration of atoms and ions of the d-block elements of Period 4 (Sc–Zn), given the atomic number and charge | | |
| Describe the elements Ti–Cu as transition elements i.e. d-block elements that have an ion with an incomplete d-sub-shell | | |
| Illustrate, using at least two transition elements:<br>• the existence of more than one oxidation state for each element in its compounds<br>• the formation of coloured ions<br>• the catalytic behaviour of the elements and their compounds and their importance in the manufacture of chemicals by industry | | |
| Explanation and use the term *ligand* in terms of coordinate (dative covalent) bonding to a metal ion or metal, including bidentate ligands | | |
| State and use the terms *complex ion* and *coordination number* | | |
| Give examples of complexes with:<br>• six-fold coordination with an octahedral shape<br>• four-fold coordination with either a planar or tetrahedral shape | | |
| Describe the types of stereoisomerism shown by complexes, including those associated with bidentate and multidentate ligands:<br>• cis–trans isomerism e.g. $Pt(NH_3)_2Cl_2$<br>• optical isomerism e.g. $[Ni(NH_2CH_2CH_2NH_2)_3]^{2+}$ | | |
| Describe the use of cis-platin as an anti-cancer drug and its action by binding to DNA preventing cell division | | |
| Describe ligand substitution reactions and the accompanying colour changes in the formation of:<br>• $[Cu(NH_3)_4(H_2O)_2]^{2+}$ and $[CuCl_4]^{2-}$ from $[Cu(H_2O)_6]^{2+}$<br>• $[Cr(NH_3)_6]^{3+}$ from $[Cr(H_2O)_6]^{3+}$ | | |

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| | | |
|---|---|---|
| Explain the biochemical importance of iron in haemoglobin, including ligand substitution involving $O_2$ and CO | | |
| Describe reactions, including ionic equations, and the accompanying colour changes of aqueous $Cu^{2+}$, $Fe^{2+}$, $Fe^{3+}$, $Mn^{2+}$ and $Cr^{3+}$ with aqueous sodium hydroxide and aqueous ammonia, including:<br>• precipitation reactions<br>• complex formation with excess aqueous sodium hydroxide and aqueous ammonia | | |
| Describe redox reactions and accompanying colour changes for:<br>• interconversions between $Fe^{2+}$ and $Fe^{3+}$<br>• interconversions between $Cr^{3+}$ and $Cr_2O_7^{2-}$<br>• reduction of $Cu^{2+}$ to $Cu^{+}$ and disproportionation of $Cu^{+}$ to $Cu^{2+}$ and Cu | | |
| Interpret and predict unfamiliar reactions including ligand substitution, precipitation and redox. | | |

**In all topic areas you should be able to demonstrate and apply your knowledge and understanding.**

