School of Chemistry

Aims and Objectives: Session 2023-2024, Semester 1

Module CH2501: Inorganic Chemistry 2

Course Title: Transition Metal Chemistry

Duration: 12 hours

Lecturer: Dr B. A. Chalmers and Dr A. N. Price

Aims: To provide a description of the chemistry of the transition metals, building on concepts from previous courses.

Objectives:

1. To understand the trends in properties across the d-block, and how these are differences and similarities between the d and p-blocks.

2. To understand and be able to determine the electronic configuration of d-block ions.

3. To know and understand the different types of ligands, coordination methods, coordination numbers, and geometries (including common distortions) exhibited by the 3d, 4d, and 5d metals, and how these can manifest isomerism.

4. To be able to determine the type of isomerism and number of potential isomers in a d-block complex.

5. To be able to determine the Shielding Constant for any atom or ion using Slater's Rules.

6. To understand and apply the rules of nomenclature from the IUPAC Red Book for any d-block metal complex.

7. To understand elementary Crystal Field Theory (CFT), including the shapes of the d-orbitals, for octahedral, tetrahedral, square planar, and linear complexes, and to be able to derive Crystal Field Splitting energy level diagrams, including understanding and deriving Crystal Field Stabilization Energy (CFSE)

8. To know the origins of high and low spin complexes and the factors, which influence the spin state of the metal.

9. To know about the origins of magnetism in d-block complexes and be able to utilise and rationalise data provided by magnetic measurements.

10. To know about colour in transition metal complexes, and to be able to understand and utilise and rationalise data provided by UV-vis spectra.

11. To know about the selection rules governing electronic transitions, explain their origins, and rationalise observations.

12. To understand the concept of hapticity and how π-orbitals can interact with metal d-orbitals and the consequence of this.

13. To be able to apply the 18-electron rule to d-block complexes.

14. To understand and apply Molecular Orbital theory to systems larger than two atoms, including non-linear systems.

15. To understand and explain the origins of the spectrochemical series with respect to Ligand Field Theory (LFT), and to justify the key differences between LFT and CFT

16. To be able to rationalise and show how different ligands influence the splitting of the d-orbitals in octahedral (ML_6, MA_4B_2) and tetrahedral systems.

17. To have an understand of the role of d-block metals in oxygen transport in biological systems, and the importance of metal-containing proteins and cofactors.