School of Chemistry

Aims and Objectives: Session 2017-2018

Module CH4514: Advanced Metal Chemistry

Course Title: Second and Third Row Transition Metals, Lanthanides and Actinides

Duration: 10 hours

Lecturer: Dr E. Zysman-Colman

Aims: This module is intended as an advanced coordination chemistry module and builds upon concepts explored in year 2 modules covering transition metals and coordination chemistry and also bonding and spectroscopy in transition metal complexes. This part of the course explores the lower reaches of the Periodic Table by investigating the chemistry of the 2nd and 3rd row d-block and f-block elements. The coverage of the 'heavier' metals seeks to compare and contrast the properties mentioned above e.g. chemical, spectroscopic and magnetic with those of their lighter counterparts e.g. the first transition series. At the end of the course students should be in a position to fully understand the chemistry of the heavier elements and rationalise the trends in chemical properties both down and across the Periodic Table.

Objectives:

- To explain the concepts behind the chemistry of the 4d and 5d transition elements. The radial and angular expansion in the d-orbitals and the role played by relativistic effects.
- To explain the reasons behind the following:

  The stability of compounds in very high oxidation states and the formation of covalently-bonded compounds having high coordination numbers. The extensive formation of metal-metal bonded compounds.

  The greater d-orbital splitting and exclusive formation of low spin complexes.
- To explain the photophysical properties typical 4d and 5d metal complexes.
- To explain the concepts behind photoredox catalysis using 4d and 5d metal complexes as photocatalysts.
- To explain the physical properties, coordination chemistry and electronic configuration of the lanthanides, including trends observed across the periodic table, term symbols, micro-states and the nature of absorption and emission.
- To explain the physical properties, coordination chemistry and electronic configuration of the actinides, including their radioactive character, their absorption properties and trends observed across the periodic table.
- To describe the use of heavy d-block and f-block metal complexes in medical applications, e.g., cisplatin and auranofin.