

Module Details	
Module Title	Inorganic Chemistry 2
Module Code	CFS5016-B
Academic Year	2024/5
Credits	20
School	School of Chemistry and Biosciences
FHEQ Level	FHEQ Level 5

Contact Hours	
Type	Hours
Online Lecture (Asynchronous)	24
Lectures	16
Practical Classes or Workshops	3
Tutorials	8

Availability	
Occurrence	Location / Period
BDA	University of Bradford / Academic Year

Module Aims
<p>The module aims to build on stage 1 theory and develop an understanding of the structures and reactivity of the main group elements and transition metals, including the principles of coordination chemistry and organometallic chemistry. -</p> <p>This will allow for further understanding of periodic trends and reactivity, with a more in depth understanding of applicable spectroscopic techniques. The chemistry of organometallic complexes will be discussed in terms of metal to ligand bonding, with introduction to Molecular Orbital theory of the d-block metals. Importantly, the chemistry of metal-carbon bonds, s-bonding and p-bonding and their importance in the chemistry of carbenes and catalytic reactions will be discussed. The students transferrable skills will be developed by working in groups to describe and communicate a variety of topics relating to coordination and organometallic chemistry.</p>

Outline Syllabus

Chemistry of transition metals and f-block metals: Group trends and series trends for transition metals and f-block metals; Coordination number and isomerism; Different ligand types; Nomenclature of coordination compounds. Bonding models for metal ion coordination compounds: Crystal Field Theory and Ligand Field Theory (LFT); Calculation of crystal field stabilisation energy (CFSE); Consequences of CFSE; Jahn-Teller distortion; Electronic spectra, colour (UV-Vis) and magnetic properties of coordination complexes; Correlation diagrams, Stability and reaction mechanisms in coordination complexes.

Organometallic chemistry: main group chemistry, their methods of preparation and reactivity; the 18 electron rule; s and p-ligands and their relation to LFT; isolobal relationships; synergic bonding in metal carbonyls and olefins; bonding of multi-electron donor systems; Molecular Orbital Theory of metal-ligand bonding; metal-metal bonding; cluster compounds; electron counting conventions for structure prediction in clusters using Wade's rules.

Selected catalytic applications of organometallic chemistry: Chemistry at the surface; Langmuir, adsorption, absorption and desorption of gases; homogeneous catalysis; heterogeneous catalysis; catalytic cycles

Learning Outcomes

Outcome Number	Description
01	Determine and explain nomenclature, coordination numbers, chemical composition and chemical structures of coordination and organometallic compounds.
02	Apply Crystal Field and Ligand Field Theories to understand and predict electronic and magnetic properties of compounds.
03	Predict and discuss the stability and reaction mechanisms of coordination compounds.
04	Determine the electron counts, oxidation states and metal-ligand bonding in coordination and organometallic compounds.
05	Describe the bonding of metals to s and p ligands and demonstrate this with use of atomic and molecular orbital theory.
06	Identify and rationalise metal-metal bonding and metal-carbonyls in clusters chemistry, and predict the shapes using Wade's rules.
07	Construct catalytic cycles to illustrate the applications of inorganic and organometallic compounds in catalysis.
08	Use scientific literature databases, appraise primary literature and prepare a scientific presentation.
09	Use effective teamwork skills to analyse and evaluate key coordination and organometallic theory and concepts.

Learning, Teaching and Assessment Strategy

The module uses a blended approach to support learning and achievement. Students will engage with a series of weekly online learning packages.

These will include short videos that address key concepts, a set of structured activities (reading, online discussions etc.) that 'scaffold' the learning, and a range of formative tasks that generate feedback on progress.

Synchronous sessions (tutorials/discussions) will also be used to support learning and monitor progress as students move through the curriculum. This will help in peer-learning activities. Formative feedback will be given at the end of these activities. In semester 2, students will be assigned to different groups to design and present a presentation to the cohort in a seminar style. Each group will be given a different core topic which covers different key concepts from the module content.

The discussion forum in the VLE will be used to encourage peer learning activities with regular monitoring of the discussion threads by the module instructor. The participation in discussions will be assessed with respect to quality of contribution (questions, discussions, and answer).

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Assessment 1: A seminar-style presentation and forum discussion based on the questions and answers will cover LO's: 8-9.

Mode of Assessment

Type	Method	Description	Weighting
Summative	Presentation	Individual presentation (15+2 minutes)	40%
Summative	Examination - Closed Book	Summative assessment: closed book examination (90 minutes)	60%

Reading List

To access the reading list for this module, please visit <https://bradford.rl.talis.com/index.html>

Please note:

This module descriptor has been published in advance of the academic year to which it applies. Every effort has been made to ensure that the information is accurate at the time of publication, but minor changes may occur given the interval between publishing and commencement of teaching. Upon commencement of the module, students will receive a handbook with further detail about the module and any changes will be discussed and/or communicated at this point.

