CH164-15 Atoms and Molecules

23/24

Department
Chemistry
Level
Undergraduate Level 1
Module leader
Scott Habershon
Credit value
15
Module duration
5 weeks
Assessment
100% exam
Study location
University of Warwick main campus, Coventry

Description

Introductory description

This module is a self-contained and integrated introduction to bonding models in chemistry. Here, five core topics will be covered, namely:

- Origins and history of chemistry
- The shapes of molecules
- Atoms, orbitals and periodic trends
- From atomic orbitals to molecular orbitals
- Understanding structure and bonding using molecular orbitals

Together, these topics will enable students to discuss molecular structure and bonding across a wider variety of molecules.

Module web page

Module aims

The overall module aim is to build up knowledge of the different models used to describe chemical bonding and structure across the chemical sciences.

Students will learn about the different fundamental models used to describe the structure and bonding of molecules, ranging from rigorous mathematical models based on quantum mechanics

to more qualitative models such as VSEPR. The strengths and weaknesses of these different models will be presented and demonstrated by applications to understand structure, bonding and spectroscopy in a range of different technologically and biologically relevant molecules.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

Week 1: Origins and history of chemistry
History of Chemistry, Fundamental particles: Protons, neutrons and electrons, The Elements and where they came from, Bonding types

Week 2: The shapes of molecules
Lewis structures, VSEPR, Symmetry elements in molecules, Assigning point groups as a labelling system of molecules, Applications of point groups

Week 3: Atoms, orbitals and periodic trends
Why do we need quantum mechanics, quantisation, light, Atomic orbitals and quantum numbers, Aufbau and atomic configuration, Trends across periodic table

Week 4: From atomic orbitals to molecular orbitals
MOs as linear combinations of atomic orbitals, Potential energy curves for H2, H2+, Homo-diatomics, Hetero-diatomics, MOs for polyatomics.

Week 5: Understanding structure and bonding using molecular orbitals
Hybridisation as a general concept, Single bonds and multiple bonds across the periodic table, Conjugation and Aromaticity, Electrophiles and Nucleophiles, Curly arrows.

Learning outcomes

By the end of the module, students should be able to:

- Gain an understanding of the models used to describe the structure, bonding and properties of molecules and matter.
- Understand how quantum mechanics leads to key chemical concepts such as atomic orbitals, molecular orbitals, and quantization of energy.
- Appreciate the limitations of different bonding models and be able to choose the most appropriate model for a given chemical problem.

Indicative reading list

Atkins''s Physical Chemistry
McQuarrie's Physical Chemistry: A molecular approach

Subject specific skills

Numeracy
Problem solving

Time management and organization
Critical thinking

Transferable skills

Numeracy
Problem solving
Time management and organization
Critical thinking

Study

Study time

Type	Required
Lectures	30 sessions of 1 hour (20%)
Tutorials	3 sessions of 1 hour (2%)
Practical classes	3 sessions of 1 hour (2%)
Other activity	4 hours (3%)
Private study	108 hours 30 minutes (72%)
Assessment	1 hour 30 minutes (1%)
Total	150 hours

Private study description

N/A

Other activity description

Revision workshops

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group B

	Weighting	Study time
Examination Written examination	100%	1 hour 30 minutes

- Answers provided on Question Paper. No Answerbook required
- Students may use a calculator
- Graph paper
- Periodic Tables
- Thermodynamics tables

Feedback on assessment

Cohort level examination feedback provided via Moodle following the Exam Board.

Past exam papers for CH164

Availability

Courses

This module is Core for:

- UCHA-4 Undergraduate Chemistry (with Intercalated Year) Variants
  - Year 1 of F101 Chemistry (with Intercalated Year)
  - Year 1 of F122 Chemistry with Medicinal Chemistry (with Intercalated Year)
- UCHA-3 Undergraduate Chemistry 3 Year Variants
  - Year 1 of F100 Chemistry
  - Year 1 of F100 Chemistry
  - Year 1 of F121 Chemistry with Medicinal Chemistry
- UCHA-F110 Undergraduate Master of Chemistry (with Industrial Placement)
  - Year 1 of F100 Chemistry
  - Year 1 of F110 MChem Chemistry (with Industrial Placement)
  - Year 1 of F112 MChem Chemistry with Medicinal Chemistry with Industrial Placement
- Year 1 of UCHA-F107 Undergraduate Master of Chemistry (with Intercalated Year)
- UCHA-F109 Undergraduate Master of Chemistry (with International Placement)
  - Year 1 of F109 MChem Chemistry (with International Placement)
  - Year 1 of F111 MChem Chemistry with Medicinal Chemistry (with International Placement)
- UCHA-4M Undergraduate Master of Chemistry Variants
  - Year 1 of F100 Chemistry
  - Year 1 of F105 Chemistry
  - Year 1 of F110 MChem Chemistry (with Industrial Placement)
  - Year 1 of F109 MChem Chemistry (with International Placement)

    - Year 1 of F125 MChem Chemistry with Medicinal Chemistry
- Year 1 of UCHA-F127 Undergraduate Master of Chemistry with Medicinal Chemistry(with Intercalated Year)