1. KentVision Code and title of the module

CHEM5600 – Physical Chemistry 2 - Quantum Mechanics

## Division and School/Department or partner institution which will be responsible for management of the module

Division of Natural Sciences (Chemistry and Forensic Science)

## The level of the module (Level 4, Level 5, Level 6 or Level 7)

Level 5

## The number of credits and the ECTS value which the module represents

15 credits (7.5 ECTS)

## Which term(s) the module is to be taught in (or other teaching pattern)

Autumn

## Prerequisite and co-requisite modules and/or any module restrictions

None

## The course(s) of study to which the module contributes

Compulsory for the following courses:

BSc(Hons) Chemistry

BSc(Hons) Chemistry with a Professional Placement

BSc(Hons) Chemistry with a Year Abroad

BSc(Hons) Chemistry with a Foundation Year

MChem Chemistry

Not available as an elective module.

## The intended subject specific learning outcomes. On successfully completing the module students will be able to:

8.1 Demonstrate knowledge and critical understanding of key quantum mechanical concepts;

8.2 Demonstrate knowledge and critical understanding of key concepts of molecular symmetry and group theory;

8.3 Understand how to obtain and interpret spectra to calculate molecular parameters from spectroscopic data and apply underlying concepts and principles outside the context in which they were first studied;

8.4 Link quantum mechanical theories to experimental observables;

8.5 Critically interpret spectroscopic data;

8.6 Demonstrate knowledge of basic spectroscopy; microwave, infrared, UV-VIS, Raman;

8.7 Perform calculations on molecular parameters from spectroscopic data outside the context in which they were first studied;

8.8 Understand quantum mechanical concepts underlying bonding and energy transitions experimentally observed in spectroscopy;

8.9 Understand symmetry of molecules to determine spectroscopic data.

## The intended generic learning outcomes. On successfully completing the module students will be able to:

9.1 Demonstrate problem-solving skills, an ability to formulate problems in precise terms and to identify key issues, and the confidence to try different approaches in order to make progress on challenging problems;

9.2 Demonstrate personal skills – the ability to work independently, to use initiative, to organise oneself to meet deadlines and to interact constructively with other people;

9.3 Make use of appropriate texts, or other learning resources as part of managing their own learning.

## A synopsis of the curriculum

This module will deepen your understanding of quantum mechanics and symmetry. We explore how this gives rise to quantisation and selection rules, and go on to apply this to spectroscopic methods to understand structure and bonding including: rotational (microwave) spectroscopy, vibrational (IR and Raman) spectroscopy and electronic transitions (UV-vis).

## Reading list

## The University is committed to ensuring that core reading materials are in accessible electronic format in line with the Kent Inclusive Practices.

## The most up to date reading list for each module can be found on the university's [reading list pages](https://kent.rl.talis.com/index.html).

## Contact Hours

Private Study: 124

Contact Hours: 26

Total: 150

## Assessment methods

13.1 Main assessment methods

* Online Quiz 1 (1 hour) – 5%
* Online Quiz 2 (1 hour) – 5%
* Assessed Worksheet 1 (4 hours) – 15%
* Assessed Worksheet 2 (4 hours) – 15%
* Examination (2 hours) – 60%

13.2 Reassessment methods

* 100% by Examination

## Map of module learning outcomes (sections 8 & 9) to learning and teaching methods (section 12) and methods of assessment (section 13)

**Module learning outcomes against learning and teaching methods:**

| **Module learning outcome** | 8.1 | 8.2 | 8.3 | 8.4 | 8.5 | 8.6 | 8.7 | 8.8 | 8.9 | 9.1 | 9.2 | 9.3 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Private Study | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| Workshop | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |  |
| Lectures | **X** | **X** | **X** |  |  | **X** | **X** | **X** | **X** |  | **X** |  |

**Module learning outcomes against assessment methods:**

| **Module learning outcome** | 8.1 | 8.2 | 8.3 | 8.4 | 8.5 | 8.6 | 8.7 | 8.8 | 8.9 | 9.1 | 9.2 | 9.3 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Online Quizzes | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| Assessed Worksheets | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| Examination | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |

## Inclusive module design

The Division recognises and has embedded the expectations of current equality legislation, by ensuring that the module is as accessible as possible by design. Additional alternative arrangements for students with Inclusive Learning Plans (ILPs)/declared disabilities will be made on an individual basis, in consultation with the relevant policies and support services.

The inclusive practices in the guidance (see Annex B Appendix A) have been considered in order to support all students in the following areas:

a) Accessible resources and curriculum

b) Learning, teaching and assessment methods

## Campus(es) or centre(s) where module will be delivered

Canterbury

## Internationalisation

Science is an international discipline with widely applicable international resonance. This module presents subject-specific knowledge generated, developed, and refined by scientists around the world. Mastery of the learning outcomes will equip students to apply the knowledge in a wide range of international contexts and these will be addressed in making the content relevant to current global issues. The Division of Natural Sciences is an international community of students and staff and group activities and teaching will provide a platform for internationally-focussed discussion.

**DIVISIONAL USE ONLY**

**Module record – all revisions must be recorded in the grid and full details of the change retained in the appropriate committee records.**

| Date approved | New/Major/minor revision | Start date of delivery of (revised) version | Section revised  (if applicable) | Impacts PLOs (Q6&7 cover sheet) |
| --- | --- | --- | --- | --- |
| 9 Dec 2021 | Minor | Sept 2022 | 13 | No |
|  |  |  |  |  |