

# CHEM 3005 ADVANCED PHYSICAL CHEMISTRY

**Credit Points** 10

**Legacy Code** 300926

**Coordinator** Allan Torres ([https://directory.westernsydney.edu.au/search/name/Allan Torres/](https://directory.westernsydney.edu.au/search/name/Allan%20Torres/))

**Description** Advanced Physical Chemistry builds on the fundamental principals of energy changes in systems (thermodynamics), and the rates and mechanisms of reactions (kinetics) learnt in Physical Chemistry and extends this so that students gain an understanding of more advanced topics in this field of chemistry such as polymers, colloids, surfaces, quantum principles and spectroscopy. This subject also will strengthen student's problem solving skills in quantitative chemical analysis, develop experimental techniques and advanced data-analysis skills.

**School** Science

**Discipline** Chemical Sciences, Not Elsewhere Classified.

**Student Contribution Band** HECS Band 2 10cp

Check your fees via the Fees ([https://www.westernsydney.edu.au/currentstudents/current\\_students/fees/](https://www.westernsydney.edu.au/currentstudents/current_students/fees/)) page.

**Level** Undergraduate Level 3 subject

**Pre-requisite(s)** CHEM 2010

**Equivalent Subjects** CHEM 3015 - Physical Chemistry 3

## Restrictions

Successful completion of 120 credit points

## Assumed Knowledge

An understanding of and competence with the basic principles of physical chemistry including states and properties of matter, thermodynamics, chemical equilibria, kinetics and electrochemistry.

## Learning Outcomes

On successful completion of this subject, students should be able to:

1. Analyse numerical problems in physical chemistry and explain various physical chemistry principles.
2. Demonstrate the use of mathematical models for a range of applications in physical chemistry.
3. Demonstrate enhanced laboratory skills, with a particular emphasis on occupational health and safety, risk assessments and the careful and systematic collection of numerical data.
4. Apply the theory of synthetic, mechanistic, thermodynamic, kinetic and material properties to polymer and surface chemistries in research and industry.
5. Apply the theory of physical chemistry to practical applications in other disciplines or subdisciplines; for example, analytical, industrial and environmental chemistry, geochemistry, nanotechnology, biochemistry.

## Subject Content

1. Polymer chemistry: three dimensional structure, molecular weight and distributions, polymerisation processes and polymer characterisation.

2. Colloidal systems: classification, preparation, purification, and characterization, electric double layer, zeta-potential and stabilization.
3. Surface chemistry: surface tension, contact angles, capillary condensation and rise, Gibbs surface free energy, and surface excess, micelle formation, thermodynamic behaviour of bubbles, droplets, and crystallites. Applications of surface chemistry in industry and the environment.
4. Interfacial properties: adhesion, and spreading, adsorption (chemisorption and physisorption) models for adsorption.
5. Quantum Principles: Wave nature of matter and Schrodinger model of atoms, atomic and molecular orbitals.
6. Spectroscopy: Connection to quantum principles, interactions of electromagnetic waves and matter and various analytical methods for probing structure such as uv/vis, infrared and nuclear magnetic resonance (NMR) and magnetic resonance imaging (MRI),

## Special Requirements

Essential equipment

Students are required to have laboratory coat, appropriate shoes and eye protection.

## Assessment

The following table summarises the standard assessment tasks for this subject. Please note this is a guide only. Assessment tasks are regularly updated, where there is a difference your Learning Guide takes precedence.

| Type       | Length                                         | Percent | Threshold | Individual/<br>Group Task | Mandatory |
|------------|------------------------------------------------|---------|-----------|---------------------------|-----------|
| Report     | Up to 1,000 words                              | 30      | N         | Individual                | N         |
| Practical  | 5 x excel spreadsheet or MS word, 2 pages each | 30      | N         | Individual                | Y         |
| Final Exam | 3 hours                                        | 40      | N         | Individual                | N         |

Teaching Periods

## Autumn (2025)

### Parramatta - Victoria Rd

#### On-site

**Subject Contact** Allan Torres ([https://directory.westernsydney.edu.au/search/name/Allan Torres/](https://directory.westernsydney.edu.au/search/name/Allan%20Torres/))

View timetable ([https://classregistration.westernsydney.edu.au/odd/timetable/?subject\\_code=CHEM3005\\_25-AUT\\_PS\\_1#subjects](https://classregistration.westernsydney.edu.au/odd/timetable/?subject_code=CHEM3005_25-AUT_PS_1#subjects))