

# 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 polymer and surface chemistries. This unit also will strengthen student's problem solving skills in quantitative chemical analysis, develop experimental techniques and advanced data-analysis skills.

**School** Science

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

Check your HECS Band contribution amount 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

**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. Demonstrate enhanced laboratory skills, with a particular emphasis on occupational health and safety, risk assessments and the careful and systematic collection of numerical data.
2. Analyse numerical problems in physical chemistry, including the use of precision estimates.
3. Demonstrate the use of mathematical models for a range of applications in physical chemistry.
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. Principles of colloidal systems including classification, preparation, purification, and characterization, electric double layer, zeta-potential and stabilization.
2. Principles of surface thermodynamics: surface tension, contact angles, capillary condensation and rise, Gibbs surface free energy, and surface excess, micelle formation, thermodynamic behaviour of bubbles, droplets, and crystallites.
3. Interfacial properties: adhesion, and spreading, adsorption (chemisorption and physisorption) models for adsorption.

4. Surface characterization by AFM, STM, nanomanipulation.
5. Applications of surface chemistry in industry and the environment.
6. Theory of polymer nomenclature, three dimensional structure, molecular weight and distributions.
7. Stepwise polymerisation: mechanism, kinetics, control of molecular weight distribution.
8. Chain polymerisation: free radical, ionic and coordination mechanisms and kinetics.
9. Control of molecular weight distributions.
10. Chain copolymerisation: copolymerisation kinetics, production of random, alternating, block and graft copolymers.
11. Polymerisation processes and processing.
12. Polymer characterization: GPC, DSC, FTIR, NMR.
13. Introduction to Quantum Chemistry

## 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.

Item	Length	Percent	Threshold	Individual/ Group Task
Written Assignment - calculations and analysis, take home	Up to 1,000 words	30	N	Individual
Practical - 4 experiments - calculations and brief analysis of data, reports, experiments completed in pairs, individual reports	4 x excel spreadsheets, 2 pages each	30	Y	Individual
Final Exam - short answers, problem solving	3 hours	40	Y	Individual

Teaching Periods

## 2022 Semester 1 Parramatta - Victoria Rd Day

**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/even/timetable/?subject\\_code=CHEM3005\\_22-AUT\\_PS\\_D#subjects](https://classregistration.westernsydney.edu.au/even/timetable/?subject_code=CHEM3005_22-AUT_PS_D#subjects))