UNIT SPECIFICATION FOR EXCHANGE AND STUDY ABROAD

Manchester Metropolitan University

UNIT DETAILS

Unit Code: 6F4Z2107

Unit Name: CHEMISTRY IN SOCIETY 1

Department: School of Science & The Environment

Faculty: Faculty of Science & Engineering

Level: 4 **Credits:** 15 **ECTS:** 7.5

UNIT DESCRIPTION

Brief Summary: This module introduces the role of chemistry in modern materials and product design

Indicative Content:

This module introduces the contribution made by chemistry to society, in the context of the structural materials used in everyday commercial products. Structural materials are prevalent in nature, e.g. pearls, spider silk. Although a limited selection of chemicals are used, the resulting materials are lightweight and show strength and toughness. This is because they comprise hard and soft phases arranged in complex hierarchical architectures, with characteristic dimensions spanning from the nanoscale to the macroscale. The importance of particle scale and properties, when selecting materials, will be illustrated through three study blocks:

Block 1 ¿ Polymers: Production of synthetic and semi- synthetic polymers from petrochemicals and renewables, biopolymers. Chain growth and step growth polymerisation Properties: average molar mass, glass transition temperature, tacticity, amorphous and crystalline phases. Methods of processing, extrusion, injection moulding, film blowing (biaxial orientation)

Block 2 - Nanoparticles and Colloids: Colloids (emulsions, dispersions, aerosols), nanoparticles dispersions. Influence of surface energy on colloid stability; Properties of surfactants and association colloids; Methods of nanoparticles synthesis; Important applications of colloids and nanoparticles.

Block 3 ¿ Structural materials, their properties and selection for product design: Metals, alloys, fibres, composites, ceramics. Foams and elastomers, adhesives and sealants. Selecting materials for given applications: Ashby charts (e.g. Modulus-density, modulus-strength, strength-cost, fracture toughness-strength). Properties on microscopic and macroscopic scales

LEARNING OUTCOMES

On successful completion of this Unit, the student will be able to:

Learning Outcome 1: Discuss the role of chemistry in society and contribution to the economy

Learning Outcome 2: Explain how bulk, interfacial and surface properties relate to the application of a given material and its performance

Learning Outcome 3: Compare and contrast the physical and chemical properties of nanoparticles, colloids, polymers and structural materials

Learning Outcome 4: Apply problem-solving skills to the selection of materials for a given product

Learning Outcome 5:

ASSESSMENT

Element	Type	Weighting	Min Pass Mark	Employability & Sustainability Outcomes
1	Coursework	20		Analyse real world situations critically Demonstrate professionalism and ethical awareness Communicate effectively using a range of media Apply teamwork and leadership skills Manage own professional development reflectively Find, evaluate, synthesise and use information Work within social, environmental and community contexts Use systems and scenario thinking Engage with stakeholder/interdisciplinary perspectives

Method of Assessment

Description

Students will be allocated a potential product from a key industrial sector (e.g. Healthcare sciences, cleaning agents, cosmetics, automotive, aerospace, packaging, coatings, construction electronics). A problem-solving approach will be adopted with students working in groups to select the most appropriate materials for the given application and illustrate how the product and its constituent materials have contributed to society. Group findings will be presented as a poster.

Element	Type	Weighting	Min Pass Mark	Employability & Sustainability Outcomes

	Coursework	80	Communicate effectively using a range of media Find, evaluate, synthesise and use information Work within social, environmental and community contexts

Method of Assessment

2 Report

Description

Students will be allocated a list of materials and a potential product. They will be required to produce a report comparing and contrasting the materials listed and justify why some materials are applicable to the potential product and others not, using the principles outlined in Ashby charts. The report length should not exceed 2000 words.

LEARNING ACTIVITIES

Breakdown of 150 hours of student learning activity

Summative Assessment: 25

Directed Study: 25

Student-centred: 50

Mandatory Requirements:

LEARNING RESOURCES

Special ICTS Requirements:

Additional Requirements:

UNIT SPECIFICATION FOR EXCHANGE AND STUDY ABROAD

Manchester Metropolitan University

UNIT DETAILS

Unit Code: 6F5Z2108

Unit Name: CHEMISTRY IN SOCIETY 2

Department: School of Science & The Environment

Faculty: Faculty of Science & Engineering

Level: 5 **Credits:** 15 **ECTS:** 7.5

UNIT DESCRIPTION

Brief Summary: This module will introduce new, emerging and unusual (NEU) materials and their manufacturing processes.

Indicative Content:

The module introduces the chemistry behind the materials that have had a significant impact on our society in the last few decades. For example, the materials used in electronic devices: Semiconductors and quantum wires are at the heart of microprocessor chips, whilst LEDs and OLEDs (Light emitting diodes) are used in low energy lighting, smart phone displays and curved television screens. The relationships between particle scale and properties that give rise to distinctive modern materials, will be illustrated through three study blocks:

Block 1 ¿ unique properties of nanoscale materials: common nanostructures; effect of nanometre length scale on various optical effects; introduction to quantum wires and dots; nanotubes; nanoparticle scattering effects; combined electron oscillation in metal nanoparticles.

Block 2 ¿ semiconductors, photoconductors and superconductors: principles of semiconductor band structure, charge transport, carrier generation; recombination processes in both equilibrium and non-equilibrium conditions, doping, illustration using appropriate diagrams and equations; optical absorption in semi-conductors (photoconduction); principles of super-conduction and materials used.

Block 3 ¿ coatings technology and additive manufacturing: plasma vapour deposition, chemical vapour deposition; radiation curing chemistry and technology (photovoltaics, solar cells, organic light emitting diodes OLEDs); additive manufacturing and 3D printing, polymers used.

LEARNING OUTCOMES

On successful completion of this Unit, the student will be able to:

Learning Outcome 1: Explain how nanoscale structures give rise to their unique properties

Learning Outcome 2: Explain the functions of semiconductors, photoconductors and superconductors using diagrams and equations

Learning Outcome 3: Critically review how our improved understanding of bulk, interfacial and surface chemistry has influenced current trends in coatings technologies through PVD, CVD, radiation curing and additive manufacturing

Learning Outcome 4:

Learning Outcome 5:

ASSESSMENT

Element	Type	Weighting	Min Pass Mark	Employability & Sustainability Outcomes
1	Coursework	60		Analyse real world situations critically Find, evaluate, synthesise and use information

Method of Assessment

Test

Description

Unseen, closed book, in-class test (1.5h) comprising combination of short multiple-choice and longer descriptive/calculation/problem solving questions: covering key concepts in semiconductor and nanoscale materials.

Element	Type	Weighting	Min Pass Mark	Employability & Sustainability Outcomes
2	Coursework	40		Analyse real world situations critically Demonstrate professionalism and ethical awareness Communicate effectively using a range of media Manage own professional development reflectively Find, evaluate, synthesise and use information Work within social, environmental and community contexts

Method of Assessment

Description

Students will be required to conduct a critical review (up to 1500 words) of a research article from a high-impact journal relating to surface coatings and additive manufacturing

LEARNING ACTIVITIES

Breakdown of 150 hours of student learning activity

Summative Assessment:	25
Directed Study:	25
Student-centred:	50
Mandatory Requirements:	

LEARNING RESOURCES

Special ICTS Requirements:

Additional Requirements:

UNIT SPECIFICATION FOR EXCHANGE AND STUDY ABROAD

Manchester Metropolitan University

UNIT DETAILS

Unit Code:	6F5Z2103				
Unit Name:	CHEMISTRY OF THE CARBONYL GROUP				
Department:	School of Science & The Environment				
Faculty:	Faculty of Science & Engineering				
Level:	5	**Credits:**	15	**ECTS:**	7.5

UNIT DESCRIPTION

Brief Summary:

The use of carbonyl groups as enabling functionality will be illustrated by discussion of a range of chemical transformations of these functional group.

Indicative Content:

Chemistry of the Carbonyl Group:
Formation of carbonyls by oxidation. Reduction of the carbonyl group. Keto-enol equilibria. Alpha deprotonation of carbonyl compounds. Alkylation of 1,3-dicarbonyls using alkoxide bases, kinetic alkylation of ketones using LDA. Homoaldol and mixed aldol additions and condensations. Use of LDA to control products of the aldol reaction. The Claisen condensation.
Conjugate Additions:
Chemistry of conjugated ketones. Conjugate addition of nucleophiles. 1,2 Versus 1,4-addition. The Michael reaction. The Robinson Annulation.
Enamines and Imines:
Formation and reactions of enamines and iminium ions. Application to targeted synthesis. Enolates and iminium species in the synthesis of nitrogen heterocycles.

LEARNING OUTCOMES

On successful completion of this Unit, the student will be able to:

Learning Outcome 1: Apply chemistry of carbonyls to deduce reaction mechanisms for a range of reactions. Predict starting materials/products used in selected transformations.

Learning Outcome 2: Apply chemistry of conjugate additions to deduce reaction mechanisms for a range of reactions and discussion of regioselectivity. Predict starting materials/products used in selected transformations.

Learning Outcome 3: Apply chemistry of enamines/imines to deduce reaction mechanisms for formation of, and a range of reactions of, enamines/iminium species/selected heterocycles. Predict starting materials/products used in selected transformations.

Learning Outcome 4:

Learning Outcome 5:

ASSESSMENT

Element	Type	Weighting	Min Pass Mark	Employability & Sustainability Outcomes
1	Coursework	40		Find, evaluate, synthesise and use information

Method of Assessment

Test

Description

1h unseen, closed-book test. The element of assessment will be supported by formative components and tutorials to provide opportunities for student feedback on interim stages of work. The test will consist of short answer, problem-solving questions testing ability to apply material in indicative content (part 1) to write mechanisms, predict starting materials/products as set out in LO 1.

Element	Type	Weighting	Min Pass Mark	Employability & Sustainability Outcomes
2	Examination	60		Find, evaluate, synthesise and use information

Method of Assessment

Examination

Description

2 hour unseen examination. The element of assessment will be supported by formative components and tutorials to provide opportunities for student feedback on interim stages of work. The exam will consist of a combination of short and long answer, problem-solving questions testing ability to apply material described in indicative content (parts 2 and 3) to write mechanisms, predict starting materials/products as set out in LOs 2/3.

LEARNING ACTIVITIES

Breakdown of 150 hours of student learning activity

Summative Assessment:	25
Directed Study:	25
Student-centred:	50
Mandatory Requirements:	

LEARNING RESOURCES

Special ICTS Requirements:

Additional Requirements:

UNIT SPECIFICATION FOR EXCHANGE AND STUDY ABROAD

Manchester Metropolitan University

UNIT DETAILS

Unit Code:	6F5Z2105				
Unit Name:	INSTRUMENTAL ANALYSIS				
Department:	School of Science & The Environment				
Faculty:	Faculty of Science & Engineering				
Level:	5	**Credits:**	15	**ECTS:**	7.5

UNIT DESCRIPTION

Brief Summary:

This unit is an introduction to key aspects of instrumental analytical chemistry: namely separative methods [chromatography], elemental analysis [atomic spectroscopy] and electrochemistry.
Introduction to Separation Science, Sample preparation for instrumental analysis, especially solvent extraction and solid phase extraction. The basis of chromatographic separations. TLC and column chromatography. Typical stationary and mobile phases. Dead time, Retention time, capacity factor, selectivity, resolution and efficiency. Band spreading in chromatography - the Van Deemter equation. Instrumental Chromatography (GC & HPLC). Isothermal and temperature programmed GC. Isocratic HPLC and solvent programming in HPLC. Order of analyte elution. Chromatographic optimisation. Qualitative and quantitative analysis by GC and HPLC. Internal standardisation and relative response
factors. Ion chromatography. Size exclusion chromatography. Analyte detection in chromatography.

Indicative Content:

Topic 2:
Elemental Analysis. Atomic Spectroscopic techniques: Theory of atomic emission and atomic absorption. Description of the basic instrumentation and instrument components. Techniques covered: flame emission spectroscopy (FES), inductively coupled plasma (ICP), flame atomic absorption spectroscopy (FAAS) and mercury cold vapour and hydride generation variations, electrothermal/graphite furnace AAS (ETAAS or GFAAS). Chemical, physical and spectral interferences. Background correction techniques. Molecular Spectroscopic Techniques: UV/Visible instrumentation. Absorption spectra and the Beer-Lambert Law. Deviations from the Beer-Lambert Law. The analysis of multicomponent mixtures.
Topic 3:
Equilibrium electrochemistry: Electrode potentials, half cell reactions and their role in redox systems. Oxidation state diagrams and their interpretation. Activities and activity coefficients in solution, ion solvent interactions, Debye-Hückel limiting and simplified laws. Reference electrodes; Thermodynamics of cell reactions. Ionic transport and liquid junction potential.

LEARNING OUTCOMES

On successful completion of this Unit, the student will be able to:

Learning Outcome 1:	Critically evaluate common separative methods with particular emphasis on gas chromatography and high performance liquid chromatography.
Learning Outcome 2:	Apply knowledge of the advantages and limitations of a range of standard elemental analysis techniques to select the most appropriate technique to analyse common sample types given the acceptable range of accuracy and precision.
Learning Outcome 3:	Apply electrochemical principles in appropriate analytical case study scenarios
Learning Outcome 4:	
Learning Outcome 5:	

ASSESSMENT

Element	Type	Weighting	Min Pass Mark	Employability & Sustainability Outcomes
1	Coursework	40		Analyse real world situations critically Find, evaluate, synthesise and use information
	Method of Assessment			
	Test			
	Description			
	1h unseen, closed-book test. The test will consist of multiple choice questions relating to topic 3, and will require students to apply the electrochemical principles to a range of appropriate analytical case studies and examples.			

Element	Type	Weighting	Min Pass Mark	Employability & Sustainability Outcomes
2	Examination	60		Find, evaluate, synthesise and use information
	Method of Assessment			

Examination

Description

2 hour unseen examination. The element of assessment will be supported by formative components and tutorials to provide opportunities for student feedback on interim stages of work. The exam will consist of a combination of short and long answer, problem-solving questions testing learning outcomes 1 and 2.

LEARNING ACTIVITIES

Breakdown of 150 hours of student learning activity

Summative Assessment: 25

Directed Study: 25

Student-centred: 50

Mandatory Requirements:

LEARNING RESOURCES

Special ICTS Requirements:

Additional Requirements:

UNIT SPECIFICATION FOR EXCHANGE AND STUDY ABROAD

Manchester Metropolitan University

UNIT DETAILS

Unit Code: 6F4Z2104

Unit Name: INTRODUCTION TO THERMODYNAMICS AND KINETICS

Department: School of Science & The Environment

Faculty: Faculty of Science & Engineering

Level: 4 **Credits:** 15 **ECTS:** 7.5

UNIT DESCRIPTION

Brief Summary: Introduction to the fundamental physicochemical principles of thermodynamics and kinetics along with underpinning mathematical and transferable skills.
This unit will consider the principle mechanisms and concepts of chemical thermodynamics and kinetics.

Indicative Content:
Thermodynamics: First law of thermodynamics, internal energy, enthalpy. Thermochemistry, Hess' law calculations. Standard state functions. Calorimetry. Standard enthalpies of formation. Bond energies. Thermodynamic feasibility, entropy and the second law of thermodynamics. ΔS for phase changes. Gibbs energy, ΔG = ΔH - TΔS. Van't Hoff Isotherm and the determination of equilibrium constants.
Reaction Kinetics: Experimental methods for determining reaction rates, rate profiles, order of reaction, molecularity, rate determining steps. Rate equations for zero, first and second order reactions, evaluation of rate constants by graphical means, half life times. Variation of rate constants with temperature, Arrhenius equation, activation energy, pre-exponential factor. Simple collision theory.
Thermodynamics & Kinetics Mathematics: Basic calculus: Differentiation, tangents, rates of change, and first principles, other functions. The chain rule, maxima and minima, second differentials, product and quotient rules. Integration Introduction to indefinite and definite integrals, separating variables and areas.
Statistical Analysis: statistical analysis of results errors, determinate and indeterminate, treatment and reporting of results. Accuracy and precision, standard deviations, testing for outliers, confidence intervals.
Careers & Employability: Investigate the career roles for chemistry graduates in the chemical industry. Students will be able to identify examples of the following skill areas: communication, team work, as part of a skills portfolio, and begin career planning.

LEARNING OUTCOMES

On successful completion of this Unit, the student will be able to:

Learning Outcome 1: Describe the key thermodynamic and kinetic properties of different species in reactions and apply these concepts to real world problems.

Learning Outcome 2: Conduct independent learning to solve problems related to thermodynamics and kinetics within a set time frame developing time management skills.

Learning Outcome 3: Apply calculus and statistical concepts to solve pure mathematics and applied chemistry system problems.

Learning Outcome 4: Reflect on, and evidence, core employability skills, including beginning career planning.

Learning Outcome 5:

ASSESSMENT

Element	Type	Weighting	Min Pass Mark	Employability & Sustainability Outcomes
	Coursework	40		Analyse real world situations critically Demonstrate professionalism and ethical awareness Communicate effectively using a range of media Manage own professional development reflectively Find, evaluate, synthesise and use information

Method of Assessment

1 Portfolio

Description

The academic skills portfolio will evidence advanced mathematical skills, career planning, along with the online homework system providing students with a range of questions covering the whole syllabus. Homework will be targeted on topics covered in lectures / tutorials and will require students to conduct independent learning using the recommended textbook or similar resources to deepen their understanding. The homework software will give instantaneous feedback specific to each student, as well as hints and tips. Including independent learning, the assessment will take around 1.5 hours per week.

Element	Type	Weighting	Min Pass Mark	Employability & Sustainability Outcomes

2	Examination	60	Find, evaluate, synthesise and use information
	Method of Assessment		
	Examination		
	Description		
	1.5 hour unseen examination covering the whole syllabus. There will be a mix of short answer compulsory questions and long answer problem-solving questions testing topics in more depth. Students will be supported in this element of assessment by formative tests, tutorials and the portfolio described in element 1. These provide opportunities for student feedback on interim stages of work.		

LEARNING ACTIVITIES

Breakdown of 150 hours of student learning activity

Summative Assessment: 25

Directed Study: 25

Student-centred: 50

Mandatory Requirements:

LEARNING RESOURCES

Special ICTS Requirements: Access to SAPLING Homework Tool software http://www2.saplinglearning.com/

Additional Requirements: