UNIVERSITY of BRADFORD

Module Descriptor

Module Details	
Module Title	Physical Chemistry 2
Module Code	CFS5018-B
Academic Year	2024/5
Credits	20
School	School of Chemistry and Biosciences
FHEQ Level	FHEQ Level 5

Contact Hours	
Type	Hours
Online Lecture (Asynchronous)	21
Tutorials	8
Directed Study	150
Lectures	21

Availability	
Occurrence	Location / Period
BDA	University of Bradford / Academic Year

Module Aims

This module will build on the material covered by the Physical Chemistry 1 module. By the end of this module, students should have a deeper understanding of thermodynamics, including statistical thermodynamics. This module will also introduce students to electrochemistry, quantum mechanics, colloids and physical chemistry at surfaces and interfaces.

Outline Syllabus

Fundamental Mathematical Concepts: calculus, vectors, matrices, series and determinants. Thermodynamics: Phase behaviour of single component systems, phase diagrams, phase transitions, behaviour at phase boundaries. Inter & Intramolecular Interactions, attractive, repulsive and total.

Phase behaviour of two component systems, phase diagrams, dissolution of solids in liquids, vapour-liquid equilibria, solutions, colligative properties, distillation of liquid mixtures. Electrochemistry: Introduction of electrochemistry terms and concepts; ionic strength and activity; conductivity, molar conductivity and limiting molar conductivity; electrochemical cells and half cells; standard reduction potentials and their use to determine spontaneity and standard cell potentials; thermodynamics and equilibria; electrolysis; Nernst equation.

Quantum Mechanics: Quantum theory, spectra containing discrete energies, photoelectric effect, electron diffraction, wave-particle duality, the Schrodinger equation, the Born interpretation, the uncertainty principle, quantum theory applied to (i) translation (ii) rotation (iii) vibration.

Statistical Thermodynamics: Boltzmann distribution (its general form and origin); partition function and interpretation; molecular partition function; examples of the uses of the partition function (internal energy, heat capacity). Surfaces/Interfaces and Colloids: surfactants; micelles; colloidal stability; surface energy; solid-state kinetics (adsorption, desorption and surface active models); scattering techniques; excluded volume repulsion; electrostatic, van der Waals, entropic and steric/depletion forces.

Learning Outcomes

Outcome Number	Description
01	Interpret the behaviour of both mono- and multicomponent systems & rationalise the inter- and intramolecular forces that give rise to their phase behaviour.
02	Explain how ions interact with one another in solution and that the freedom of movement of the ions impacts on the degree of charge flow and its relation to current.
03	Rationalise why ions may be tabulated according to their standard reduction potential values and the utility of such a table in determining standard cell potentials.
04	Discuss the development of, and ideas contained within, quantum theory and demonstrate the utility in comparing physical and observable quantum effects with the fundamental assumptions of this theory.
05	Understand the significance of the Boltzmann distribution, and its role in determining partition functions.
06	Rationalise the application of statistical mechanics to quantifying a number of thermodynamic properties.
07	Apply mathematical models to explain scientific observations in quantum mechanics and statistical thermodynamics.
08	Manipulate mathematical equations and understand the significance of mathematical formulae and units.
09	Use bibliographic databases to investigate an example from a defined topic area and produce an essay supported by research literature selected on the basis of accuracy and relevance.

Learning, Teaching and Assessment Strategy

The module uses a blended approach to support learning and achievement. Students will engage with a series of weekly online learning packages and accompanying in person sessions.

These will include short videos that address key concepts, a set of structured activities (reading, online discussions etc.) that 'scaffold' the learning, and a range of formative tasks that generate feedback on progress.

Online sessions (tutorials/discussions) will also be used to support learning and monitor progress as student move through the curriculum.

Assessment 1: Podcast presentation on topic of your choosing from the syllabus LO9

Assessment 2: Closed book examination covering LO 1-8

Mode of Assessment

Type	Method	Description	Weighting
Summative	Presentation	Podcast on topic from syllabus	40%
Summative	Examination - Closed Book	Closed book examination (90 minutes)	60%

Reading List

To access the reading list for this module, please visit https://bradford.rl.talis.com/index.html

Please note:
This module descriptor has been published in advance of the academic year to which it applies. Every effort has been made to ensure that the information is accurate at the time of publication, but minor changes may occur given the interval between publishing and commencement of teaching. Upon commencement of the module, students will receive a handbook with further detail about the module and any changes will be discussed and/or communicated at this point.

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