UNIVERSITY of BRADFORD

Module Descriptor

Module Details	
Module Title	Physical Chemistry 2 (at Distance)
Module Code	CFS5023-B
Academic Year	2022/3
Credits	20
School	School of Chemistry and Biosciences
FHEQ Level	FHEQ Level 5

Contact Hours	
Type	Hours
Online Tutorials (Synchronous)	8
Online Lecture (Synchronous)	21
Directed Study	150
Interactive Learning Objects	21

Availability	
Occurrence	Location / Period
DLA	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 Schr?dinger 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- & multicomponent systems and rationalise the inter- and intramolecular forces that give rise to their phase behaviour.
02	Explain how ions interact with one another in solution and how 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

As outlined for Physical Chemistry 1 (at distance) this module will be delivered using a 'flipped' learning and teaching strategy. The material for Physical Chemistry 2 (at distance) may also be presented in a range of media of which includes podcasts, vodcasts and directed reading all of which will be delivered through the University's virtual learning environment or VLE.

The use of on-line activities such as quizzes, discussions and wiki's will support the taught material. The majority of classes will be hosted and facilitated online using collaborative software. These sessions will require the student to use the knowledge they have gained through completion of the pre-work and apply it to real world problems that one might meet within the discipline of physical chemistry. Furthermore, the problems presented will require the student to take a collaborative approach in achieving their solution, helping in the development of key employability skills whilst contributing within a peer-learning environment.

Interaction with the course tutor and other group members on a regular, timetabled basis will be supported via the use of teleconferencing facilities. In these sessions, groups will be encouraged to both explore the core content and reflect on their approach to problem solving. Active engagement with online discussions and activities will be crucial to the success achieved in this module and evaluation of engagement will inform the support that is required from the Supervisory Team.

Assessment 1: Summative examination in May to cover the whole module. Los 1-9

Assessment 2: Summative coursework (1500 word essay): Los 1-9

Assessment 3: Summative 'at distance' online test to cover material taught in semester 1. This will test your ability to solve problems. Los 1-3, 9.

Assessment 4: Summative online quiz during delivery of GM/ST content: Los 4-9

Mode of Assessment

Type	Method	Description	Weighting
Summative	Examination - Closed Book	Summative assessment: Closed book exam (2 Hrs)	50%
Summative	Coursework - Written	Essay (1500 words)	20%
Summative	Online MCQ Examination	Online assessment (1 Hr)	20%
Summative	Online MCQ Examination	VLE Quiz	10%

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.
