UNIVERSITY of BRADFORD

Module Descriptor

Module Details	
Module Title:	Physical Chemistry 1
Module Code:	CFS4024-B
Academic Year:	2019-20
Credit Rating:	20
School:	School of Chemistry and Biosciences
Subject Area:	Chemistry
FHEQ Level:	FHEQ Level 4
Pre-requisites:	
Co-requisites:	

Contact Hours	
Type	**Hours**
Lectures	44
Tutorials	6
Directed Study	150

Availability	
Occurrence	**Location / Period**
BDA	University of Bradford / Academic Year (Sept - May)

Module Aims

This module will introduce students to undergraduate level physical chemistry. By the end of this module students should have developed an understanding of important physical chemistry concepts, and associated mathematical concepts, to enable them to understand states of matter, chemical thermodynamics, kinetics and principles of spectroscopy.

Outline Syllabus

Introductory Concepts: Units, conversions and nomenclature; electro-magnetic spectrum; Newtonian mechanics; equations of state.

Properties of Matter: mathematical descriptions of ideal and real gases; kinetic theory of gases;

Maxwell-Boltzmann distribution of molecular speeds and collisions in ideal and real gases; Introduction to attractive and repulsive forces.

Thermodynamics: Laws of thermodynamics (zeroth, first, second and third laws); state functions; heat capacity; enthalpy; internal energy; entropy; Hess's Law; Kirchoff equation; Gibbs energy; thermodynamic and Boltzmann definitions of entropy.
Chemical Equilibria: Thermodynamic equilibrium constants; relationship between Gibbs energy, chemical changes, thermodynamic activities, reaction quotient and chemical potential; Van't Hoff equation.

Fundamental Kinetics: monitoring reactions and calculating reaction rates; derivation and application of rate equations of elementary reactions; half-lives; Arrhenius equation and activation energy.
Kinetics of Complex Reactions: determination of mechanistic pathways for reversible, parallel and consecutive reactions; chain reactions; steady state and equilibrium approximations; transition-state theory; catalysis (homo- and hetero-geneous); enzyme catalysis and Michaelis-Menten equation.

Principles of Spectroscopy: energy-wavelength relationship; quantisation of rotational, vibrational & electronic energy; absorption & emission processes; population of energy levels; energy transitions and selection rules; examples of spectroscopic methods.
Environmental Chemistry: Environmental pollutants (land, sea and air) and spectroscopic detection.

Library Skills: Introduction to library and bibliographic databases; search and selection of literature; quality assessment of literature sources.

Learning Outcomes	
1	Understand the effect of P, V, T and amount of matter on the idealised behaviour of gases.
2	Use the ideal gas equation, understand the limitations of the ideal gas law and discuss the real behaviour of gases.
3	Determine equilibrium constants and Gibbs free energies of reactions from data provided.
4	Predict the response of equilibria to changes in concentration, temperature and pressure.
5	Explain and be able to express mathematically reaction kinetics and interpret the data from 0, 1st and 2nd order reactions.
6	Determine activation energies and reaction mechanisms from kinetic data.
7	Describe spectroscopic methods used in detection of environmental pollutants and explain the spectroscopic principles of the methods.
8	Use library resources and bibliographic databases to investigate a defined case study and produce an essay on spectroscopic detection of pollutants.
9	Select literature sources to support scientific arguments based on relevance and quality.

Learning, Teaching and Assessment Strategy

Lectures will deliver core content, providing students with the opportunity to acquire the information to enhance their knowledge and understanding of basic undergraduate-level physical chemistry. This will be complemented by tutorials to allow students to apply this learning to specific exemplar problems.

A coursework assignment will provide students with an opportunity to apply the principles covered by this module and explore chosen areas of interest using a range of literature sources. The students will submit an essay discussing the spectroscopic detection of environmental pollutants (land, sea or air). The essays will be assessed for understanding of the environmental impact of the pollutant and the spectroscopic detection and quantification of the pollutant. Essays will also be assessed on the proficiency to which relevant and trustworthy literature sources were selected and evaluated.
Directed study will provide students with the opportunity to undertake guided reading and to develop their own portfolio of learning to enhance transferable skills and knowledge relating to evaluation of their own role and subject provision.

The VLE will be used to provide access to online resources, lecture notes and external links to websites of interest.

Assessment 1: A report will cover LOs 7, 8 and 9
Assessment 2: An examination in January will cover LOs 1 - 4
Assessment 3: Summative examination in May will cover LOs 1 - 7
Assessment 4: Tutorial work sheets will cover LOs 1-7
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Mode of Assessment

Type	Method	Description	Length	Weighting
Summative	Examination - closed book	Summative assessment: closed book examination	2 hours	50%
Summative	Coursework	Scientific Report	-1000 words	20%
Summative	Classroom test	Classroom test	1 hour	20%
Summative	Classroom test	Work Sheets		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.