London South Bank University

Module Guide

Chemistry for Biosciences

EAA_4_430

School of Applied Sciences

2014-2015

Level 4, Year 1

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1. MODULE DETAILS

Module Title:	Chemistry for Biosciences
Module Level:	Level 4, Year 1
Module Reference Number:	EAA-4-430
Credit Value:	15 Credits
Student Study Hours:	150 hours
Contact Hours:	48 Hours
Private Study Hours:	102 Hours
Pre-requisite Learning (If applicable):	None
Co-requisite Modules (If applicable):	Scientific Skills (practical skills)
Course(s):	Bioscience, Food and Nutrition all options, HND, Chem. Eng.
Year and Semester	Year 1, semesters 1 Year 2, semesters 1 (Chem & Pet Engineering)
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Teaching Team & Contact Details	
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Tutors:	Dr Chris Brock Room BR 143 Tel: 7815-7970 Email: Brockc@lsbu.ac.uk Dr Subhas Rambocus Room E 246 Tel: 7815-7093 Email: Rambocus@lsbu.ac.uk Mr Misbahu Mohammed Room E 134 Tel: 7815-8139 Email: mohamm74@lsbu.ac.uk
Subject Area:	Biosciences ,Food, Nutrition and Pet & Chem Engineering.
Summary of Assessment Method:	MCQ tests online & Class tests (40%), end of semester examination (60%).

2. SHORT DESCRIPTION

An introduction that prepares the student with a base understanding of the chemistry required to underpin science and engineering degree courses. Starting from a basic description of the atom, the course leads progressively to cover key aspects of fundamental physical, inorganic and organic chemistry.

3. AIMS OF THE MODULE

The aims of this unit are:
• To equip students with the appropriate scientific background for the study of applied science and engineering.
• To encourage a confident, reasoning, disciplined, inquiring and investigative approach to the study of science.
• To provide a body of knowledge of chemical science necessary for the study of biological science-based courses.

• To illustrate some investigative and interdisciplinary approaches that explains biochemical structures and processes.

4. LEARNING OUTCOMES

4.1 Knowledge and Understanding

• Describe in qualitative terms the nature of the interactions between molecules in solids, liquids and gases,
• Carry out simple calculations using the relationships between molarity, relative molecular mass, %w/v, ppm, w/w,
• Describe the electronic structure of elements in the Periodic Table, particularly of those that are biologically important, and explain the structure of the Table,
• Describe the different types of bonding found between atoms and predict the type of bonding to be expected in particular compounds,
• Predict the approximate equilibrium position of a reaction given the value of the Gibbs free energy change,
• Explain the difference between strong and weak acids and the significance and mechanism of buffering in biological systems and differentiate between oxygen addition and oxidation.
• Explain the differences between S_N^1 and S_N^2 mechanisms of reaction, how this may affect the stereo-chemical outcome of a molecule.

4.2 Intellectual Skills

• Learn how to interpret structural or molecular formulae to predict the approximate shapes of simple organic molecules from their formulae.
• Describe the biologically relevant reactions that might be expected of organic substances of given molecular formulae.
• Learning how to learn - there are a wide range of aspects to this skill which will be developed e.g. time management, finding and using information.
• Use of information and communication technology - the use of the textbooks and the internet to retrieve information.

4.3 Practical Skills

• Core laboratory skills come from the Scientific Skills module, which this module is designed to augment.

4.4 Transferable Skills

• Reasoning skills – through the knowledge of scientific concepts and reasoning.
• Communication skills - written and oral communication will be required during preparation for tutorials especially those involving presentations.
• Numeracy skills - analysis and interpretation of numerical information along with simple algebra.

5. ASSESSMENT OF THE MODULE

There will be a 2 hour examination containing up to fifty multiple choice questions along with some descriptive questions at the end of each semester. The coursework component will be a series of online MCQ and in-class tests throughout each of the semesters containing between 10 to 20 questions per test depending on duration. **The assessment will be based on the end-of-semester examination, 60%, and 40% from course work.**

6. FEEDBACK

Class test results will normally be returned to students the week after the test was set. MCQ results will be provided immediately after submission.

7. INTRODUCTION TO STUDYING THE MODULE

7.1 Overview of the Main Content

The nature of matter. This examines the concepts of atoms and molecules, their structure, mass and chemical and physical properties: Electrons in pairs, orbitals and shells. Isotopes (stable and unstable). The formation of ions. The Periodic Table. Bonding; covalent and ionic. The structure of water and hydrogen bonding. Water as a solvent; hydrophobic and hydrophilic effects. ***Reactions.*** This examines chemical reactions, their direction, stoichiometry, catalysis, and energetics: Balancing equations and stoichiometry. Activation energy and the effect of temperature and reactant concentrations on the rates of reaction. Enthalpy, entropy and free energy. Equilibrium, Le Chatelier and the role of 'free energy'. Ionisation, water, strong and weak acids, bases, salts, pH, pK, titrations, buffers, indicators and the Henderson-Hasselbalch equation. ***Organic chemistry.*** This describes simple organic molecules and their reactions: The tetrahedral carbon atoms, double bonds and p electrons. Resonance and conjugation, delocalisation of electrons and aromatic compounds. Electrophilic and nucleophilic groups and reactions. Functional groups: - biologically relevant properties and reactions of alkyl, alkenyl, alcohols, aldehydes, ketones, carboxylic acids, anhydrides, amines, amides and esters. Conformational isomerism, stereoisomerism, optical isomerism and cis/trans isomerism. D-/L- and S-/R- nomenclature.

7.2 Overview of Types of Classes

This double credit (15 CATS points) credit unit contains lectures, tutorials and directed student-centred learning. It consists of over 150 hours made up of class contact time (48 hrs) and directed learning (102 hrs). Related practical classes form part of the Core Skills unit. The course will be presented in a series of 36 lectures with 12 one-hour tutorials in support. Some reinforcement/revision lectures may also be given. A number of one hour periods will be timetabled during the semester for the completion of multiple-choice tests, a reasonable notification period for these will be provided to the students via lectures and Moodle. Examples from the assessment may be reviewed post-testing in tutorials.

Practical work (about 18 hours) will support and reinforce the material in the theory sections and develop laboratory skills, safe practice and group participation in the associated module Scientific Skills (SFB_4_100).

For the tutorials you will be divided into groups. Your tutor will concentrate on the needs of students who have done the least chemistry in the past. A program of guided student-centred activities is provided which includes guided reading, audio-visual aids, computer simulations, molecular modelling and problem solving. These times are NOT optional. You must invest your time if you are to benefit from University. If you do not use your opportunity then you let us and yourself down.

All lectures, tutorials and multiple-choice test classes must be attended unless you have an excuse acceptable to your course director. All sessions will have attendance monitored. Attendance is important and absence may cause you to fail. If multiple-choice test sessions are unavoidably missed, it will not be possible to do them at an alternative time. The course has essential textbooks associated with it. One must be purchased to complete the background reading satisfactorily. The university library also provides a range of suitable supporting texts.

7.3 Importance of Student Self-Managed Learning Time

Each one-hour lecture has associated with it two hours for reading your notes and the directed essential reading matter. This should be done on the same day as the lecture. The rest of the unit time is taken up with the problems. For maximum benefit these should also be done as close to their associated lectures as possible and before the following week. For these reasons you should set aside at least two hours each week on the same day as the Chemistry for Biosciences module for this work. A further six hours should be set aside during the week for the problems and to prepare for the following week. Recognise that this is one of the more demanding Units and invest the time. This investment pays dividends.

7.4 Employability

The unit will develop written and verbal skills (including presentation skills) that are useful in future careers. These include: numeracy, literacy and the ability to reason, along with the ability to retrieve and process information

8. THE PROGRAMME OF TEACHING, LEARNING AND ASSESSMENT

The module comprises 3 hours of formal lectures per week along with a number of 1-hour long tutorials which students are assigned to take. An indicative weekly programme is given (in the next section) with the following headings:

Tutorials

Tutorial problem sheets will be provided weekly via Moodle. Being able to answer these, or similar problems will help in meeting many of the learning outcomes for the module. The competence to answer theses, or similar, will be tested in the weekly tutorial session as well as the final examination, so practise these problems regularly.

An indicative guide of week to week program.

Semester 1

Week 1 a) Atomic structure, protons, electrons and neutrons; relative atomic mass; amu, (NP). **b**) Stoichiometry of reactions, balancing reaction equations. (SK)

Week 2 c) Electronic structure of the atom. **d**) The Periodic Table, metals and non-metals, groups and periods; atomic orbitals, shielding and electronegativity **e**) Molecular mass, Avogadro's number, the mole and molarity (SK)

Week 3 f) Ionic and covalent bonding; properties of ionic and covalent compounds; Molecular orbitals, shapes of molecules. (NP) **g**).Molarity, calculation of molecular composition, reactions. (SK)

Week 4 h) States of matter, solids, liquids and gases, the gas laws, polar and non-polar molecules; solutions. (NP) **i**) Water, structure, properties and importance; surface energy and entropy; hydrogen bonding. (SK) **Related learning aids; The gas laws** & **Water**, see http://www.lsbu.ac.uk/water.

Week 5 j) Equilibrium; Le Chatelier's principle, effect of temperature and pressure on equilibria. (NP) **k**) Water and other solvents, gas solubility; osmosis and other colligative properties; the hydrophobic effect; detergents. (SK)

Week 6 l) Introduction to transition metals, ions, electronic configuration of the different valence states, colour, simple redox reactions. (NP) **m**) Water, ionisation, acids (strong and weak), bases, salts and pH. (SK)

Week 7 n) The tetrahedral carbon atom and the projection of three-dimensional structures; alkanes and alkenes; double bonds, pi electrons, aromaticity and resonance; conjugated structures and the optical absorption of dyes (NP) **o**) Weak acids, pKa, the Henderson-Hasselbalch equation and buffers; acid-base titrations and indicators (SK).

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Week 8 p) Isomers, stereo, cis/trans, optical and conformational; chirality (NP) **q**) Reactions, rates of reaction, zero, first and second order rate equations (SK)

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Week 9 r) Organic reactions; introduction to nucleophilic groups; nucleophilic substitution reactions, addition and polymerization of alkenes (NP) **s**) Activation energy, effect of temperature, heat of reaction, catalysis (SK).

Week 10 t) Alcohols, dehydration; ethers; phenols, carboxylic acids, pKa's; anhydrides and esters, formation and hydrolysis (NP) **u)** Laws of thermodynamics, Free energy, relationship to equilibrium

constant, enthalpy, entropy, spontaneity (SK).

Week 11 v) Aldehydes and ketones, oxidation and reduction, reaction with amines and alcohols (NP) **w**) Electrochemistry, half reactions, redox potential (SK)

Week 12 x) Amines, primary, secondary, tertiary and quaternary, imidazole, pKa's, redox properties; amides, formation and hydrolysis, (NP) **y**) Revision lecture (NP) **z**) Revision lecture (SK).

ASSESSMENT

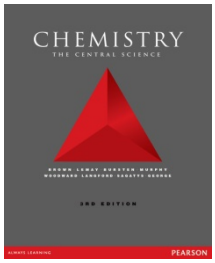
The assessment will be based on end-of-semester multiple-choice and/or descriptive examinations (60%), and in-course multiple-choice tests and online MCQ's (40%). A selection of the highest scoring marks may be weighted in forming the in-course continous assessment. This may allow for, and encourage, students to improve throughout the unit and should not be used as an excuse for not trying to pass all tests. These tests will be addressed to the learning outcomes of current aspects of the course, as presented in the lectures, guided reading, and tutorial problems. To encourage note-taking, you *may be* allowed to bring your hand-written notes to the first class test, but not to the end-of-module examination. You will need a simple calculator for these tests. They will concentrate on the specified lectures but may contain material tested previously. The overall pass mark for this Unit is 40% with a minimum mark in the end of semester examination and coursework of 30%.

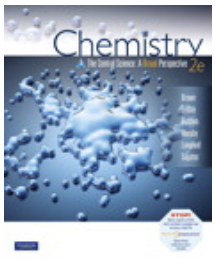
9. LEARNING RESOURCES

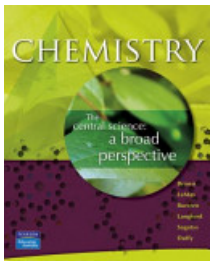
9.1 Recommended Core Materials

- **Chemistry: The Central Science, 3rd Ed.** Brown, Lemay, Bursten, Langford, Sagatys, George. Pearson Education Australia, 2014, ISBN 9781442559462, ISBN10: 1442559462. http://www.pearson.com.au *This link is for the ebook!*

- **Chemistry: the central science: with Mastering Chemistry**, Brown, Lemay, Bursten, Langford, Sagatys, Duffy. Pearson Education Australia, 2009, ISBN13: 9781442511477, ISBN10: 1442511478. http://www.pearsonhighered.co.uk *Check Amazon and Ebay.*







Note: The purchase of a chemistry book should be considered essential for this module. They contain all of the directed reading and you will also find them to be useful for other modules in your course and as a reference book in your future careers.

9.2 Optional Materials

- Chemistry; Human Activity, Chemical Reactivity. Mahaffy, Bucat, Tasker, Kotz, Treichel, Weaver, McMurry. Nelson Education Ltd. 2014, ISBN 13: 978-0-17-668408-2. http://www.Nelson.com
- Chemistry, Molecules, Matter, and Change, Loretta Jones and Peter Atkins, 4th edition, W. H. Freeman, 1999, ISBN 0-7167-3254-8. It includes two excellent and useful CD-ROMs for PCs and links to its Web site, http://www.whfreeman.com/chemistry/.
- Chemistry, 2nd edition, by Catherine E. Housecroft and Edwin C. Constable, Prentice Hall, 2002, ISBN 0-130-86924-4. This is a comprehensive and more advanced textbook. Students with an 'A' or 'AS' level chemistry background are recommended this. It includes a useful Web site, http://www.booksites.net/housecroft.
- A non-chemistry text well worth reading: The Drunkard's Walk, Leonard Mlodinow. Penguin Books, ISBN: 9780141026473.