Chemical Science (SFY-S-987)

Unit Leader: Paul Gillard

Unit Aims

- 1 To build upon basic chemical principles and to apply these principles to the areas of life sciences.
- 2 To develop knowledge of theoretical chemical principles in areas key to further study in applied science.
- 3 To emphasise the importance of organic chemistry in applied science.
- 4 To provide students with the skills necessary for effective communication in scientific and technical subjects.

Learning Outcomes

On completion of this unit students should be able to:

- 1 Explain qualitative and quantitative aspects of solution chemistry.
- 2 Apply chemical principles to the study of organic chemistry.
- 3 Apply chemical principles to related disciplines.

PDP & Transferable Skills

During this unit, students will continue to develop skills in the following areas:

- Learning how to study.
- Literacy and numeracy skills.
- Knowledge acquisition. The integration of empirical data with theoretical ideas.
- Observational skills, including note taking and drawing.

Teaching and Learning Pattern

Students will attend lectures and tutorials and where possible learning will be assignment based. The unit will be delivered as a series of lectures and small group tutorials supplemented by handouts.

Indicative Content

Solution and Electrochemistry	(25% of unit)
Organic Chemistry	(50% of unit)
Applied Chemistry	(25% of unit)

Weekly Teaching Programme

Chapters in Lewis & Evans are given for each week of the course to help support the lectures and tutorials, but not all of the material in each chapter will be covered. The 2 other books, the Salters and Nuffield are generally more reliable, and between them provide many questions which will enable you to consolidate your ideas on the content. Guidance will be given in the lectures as to what to study but usually you will be able to find the appropriate sections by looking things up using the Index and Contents within each book. These should be read before and after classes, ie several times, and you should browse in other books that you come across in the library and on the web. You should not be discouraged if you find some of the ideas in classes and/or books to be difficult or puzzling at first. This is a common experience and if you work hard and go over the work repeatedly, these ideas and skills will become clearer.

As with the Scientific Principles unit in Semester 1, the schedule below signposts the topics that will be covered and the probable order in which they will be introduced. The emphasis throughout will be on making students familiar with the absolutely core skills that students can use as a bedrock when building their expertise in later units such as Biological Chemistry. Indeed if the feedback from tutorials and semester 1 assessments indicate that more time needs to be devoted to establishing these core skills, some of the descriptive material listed below will be omitted.

Work Schedule for Semester II

Week 1 Introduction and overview of the unit. Introduction to equilibria. Chemical principles and terminology used in solution chemistry ie solution, solubility, concentration, saturated and super-saturated states.
 [Chapter 11 & 15 in Lewis & Evans]

- Week 2 Energy change and enthalpy. Endothermic and exothermic processes. Le Chatelier's principle. Theory of acids and bases and their strengths.
 [Chapter 16 in Lewis & Evans]
- Week 3 Equilibrium constant and its relation to reaction rate. Empirical and theoretical factors affecting reaction rate. Quantitative aspects of solution chemistry. Solubility product, %m/m, %m/v.
 [Chapters 15 &16 in Lewis & Evans]
- Week 4 Quantitative aspects of solution chemistry continued eg molarity, molality, pH. Buffer solutions, indicators.Introduction to electrochemistry, cells and redox processes.
- Week 5 Review of organic chemistry: empirical, molecular & structural formulae and isomerism. Structural aspects of polarity.
 Hydrogen bonding. Molecular shape.
 [Chapters 17 & 18 in Lewis & Evans]
- Week 6 Classification of organic compounds by functional group.

Aliphatic and aromatic forms. Reactions of organic compounds: addition, substitution, condensation, elimination and polymerisation. [Chapter 17 in Lewis & Evans]

- Week 7 Oxygen containing forms of organic compounds: alcohols, carbonyls, ethers, carboxylic acids and esters.
 [Chapter 18 in Lewis & Evans]
- Week 8 Organic chemistry and nitrogen derivatives. Amines and amides. Amino acids, and their role in physiological processes.[Chapter 18 in Lewis & Evans]
- Week 9 Definitions and illustrations of nucleophilic, electrophilic and free radical reagents.
- Week 10 Worksheet exercise identifying functional groups and reaction types in a range of biochemical forms: proteins, amino acids, lipids, terpenes, heterocyclics and carbohydrates.
- Week 11 Use of analytical methods to determine structure. Energy transitions in atoms and molecules. Spectroscopic techniques: UV/Visible, IR,. Principles of mass spectroscopy.
 [Chapter 20 in Lewis & Evans]

- Week 12 Application of chemical principles to environmental monitoring: atmospheric pollution, land pollution, nuclear emissions and combustion products. [Chapter 22 in Lewis & Evans]
- Week 13 Application of chemical principles to monitoring water quality: pH, COD, BOD, metal and mineral content,. chemical and food wastes.
 [Chapter 22 in Lewis & Evans]
- Week 14/15 Review Examination period

Assessment Method

The unit will be assessed by 2 in-class tests (40%) and by examination (60%).

Indicative Reading

Core Reading

Lewis R & Evans W Chemistry Macmillan Foundations Series (1997)

Background Reading

Ed. Keith Parsons

GCSE Double Science Chemistry The Revision Guide, Higher level CGP ISBN 1 84146 502 X

Nuffield Advanced Chemistry Students' Book ISBN 0-582-32835-7

Salters Advanced Chemistry Chemical Ideas ISBN 0-435-63120--9