CHEM1701 Synopsis

- Course organizer: Dr. Simon T. Banks
- Lecturers: Dr. Simon T. Banks, Dr. Chris Blackman, Prof. Helen. C. Hailes
- Normal Pre-requisites
    - A-level (or equivalent) mathematics
    - One science subject (NOT chemistry) at A-level or equivalent
- Course units: 0.5
- Moodle page: https://moodle.ucl.ac.uk/course/view.php?id=17793

Course structure

- Lectures: 30
- Tutorials/workshops: 10
- E-learning: 30 hours
- Laboratories: 3 experiments

Assessment

- Exam: 70%
- Laboratory: 10%
- Coursework: 20%

Overview

This module is aimed at those students who have A-levels in mathematics and at least one science subject but not A-level chemistry. Students taking CHEM1701 are able to progress to first year core physical (CHEM1301) and inorganic (CHEM1101) chemistry modules.

A variety of teaching methods are used, including lectures, tutorials and laboratories. There is also a significant amount of e-learning based self-study.

Students with A-level chemistry should take CHEM1004 or CHEM1601 rather than CHEM1701.

Objectives

It is intended that students will finish the course with an understanding of the main conceptual underpinnings of chemistry as outlined in the course outline below. They will understand the position of chemistry in relation to the other natural sciences, as well as developing a broad overview of the internal structure of the subject.

Students will obtain knowledge of the fundamentals of physical and inorganic chemistry as well as some basic elements of organic chemistry. They will know and be able to discuss ideas relating to atomic and molecular structure, and the theory of chemical reactions.

Students will develop knowledge of the basic terminology of chemistry.

Recommended Texts

This course does not follow a single text however a good general chemistry text at the right level is "Chemistry" by Blackman, Bottle, Schmid, Mocerino and Wille (2nd edition, Wiley).

Further suggested reading is available on the Moodle page for this module.

Course outline

- the electromagnetic spectrum, classical properties of waves
- atomic structure:
    - from Thomson to Bohr and on to Bohr-Sommerfeld
    - isotopes
    - wave-particle duality
    - introduction to the concept of wave functions and quantum numbers
    - orbitals, nodes and nodal planes
    - orbital energies, Aufbau and Hund's rule of maximum multiplicity
    - electron spin
    - effective nuclear charge
- potential energy curves for diatomics: from hard sphere to Morse
- electron configurations
    - key trends in the periodic table resulting from electronic structure: ionization energies, electron affinities and electronegativity
- bonding in molecules:
    - Lewis structures
    - covalent, ionic, dative bonds. polarity and resonance; the octet rule
- Valence Shell Electron Pair Repulsion theory
- hybridization
- oxidation states
- amounts of substances: Avogadro's number, moles, concentrations, molar mass
- chemical reactions
    - balancing equations
    - charge conservation
    - redox reactions
    - equilibrium
        - factors affecting equilibrium
        - equilibrium constants
    - factors affecting rates of reaction
- basic organic chemistry
    - introduction to the concept of functional groups
    - simple reactions of alkanes, alkenes, alcohols and carboxylic acids; introduction to "curly arrows"
    - π bonding, conjugation and aromaticity
- conformations and isomers
- acids and bases: Lewis / Bronsted; formation of salts
- Valence Bond Theory and simple Molecular Orbital Theory
    - qualitative approach: similar energies, correct orbital geometries
    - bond order, bond length and bond energies

    - ions and free radicals
- the phases of matter: physical properties of solids, liquids and gases:
    - ideal gas equation
    - intermolecular interactions
    - solids:
        - molecular, covalent, ionic, metallic
        - simple band theory: metals, insulators, semi-conductors
        - HCP, BCC, FCC, BCC etc.
        - unit cells and Miller indices