A Level Science Applications Support Booklet: Chemistry

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APPLICATIONS OF CHEMISTRY

INTRODUCTION

Too often the study of chemistry at A-level can seem like a disorganised collection of facts. The problem is that to understand many of the ways in which chemistry is used to enhance our lives, we need to understand the basic principles of chemistry, and this can take time. Now that you are approaching the end of your A level studies you have a better understanding of the way chemistry works.

This section of the syllabus examines some of the important areas in which chemistry is being used in biological systems and medicine, in analysing and designing new materials, and in monitoring and helping protect the environment.

The first topic deals with the chemistry of proteins and the mechanism of enzyme catalysis. A knowledge of these is critical to understanding the way in which living organisms function. Next the chemistry of DNA is examined, both in terms of its structure, and the way in which genetic information is encoded and passed on. The provision of energy within cells using ATP is explained, and finally the importance of metals both in trace amounts, and in terms of their toxicity is examined.

The second topic looks at the various analytical techniques that chemists use to help them determine the structure of compounds and to follow the course of chemical reactions. These include electrophoresis and DNA 'fingerprinting', NMR and mass spectroscopy, X-ray crystallography and chromatographic techniques. The emphasis in this topic is on understanding the techniques and interpreting data rather than the recall of particular examples or the detailed theory behind the different techniques.

The final topic looks at ways in which chemical techniques are used to design new materials for specific purposes. These include the targeting and delivery of modern drugs to fight disease, the development of new polymers with properties similar to traditional structural materials, the use of nanotechnology to assemble chemical structures, and finally using chemistry to extend the life of known resources and to protect the environment. Once again the emphasis is on understanding the principles involved rather than acquiring a detailed knowledge of particular examples.

The book is designed so that it can be used by teachers, alongside the Applications of Chemistry syllabus and the Scheme of Work that can be found on the CIE Teacher Support Website (contact international@cie.org.uk to find out how to gain access to this learning resource). The book should help teachers to design effective learning programmes to teach this material, which makes up 16% of the total assessment at A level and should thus make up just over 30% of the total teaching time available during the A2 part of the course.

This booklet is also designed so that it can be used by students, to promote their own learning, and for this purpose contains self-assessment questions for students to use in helping to determine how effective their learning has been. At the end of each section there is also a glossary to help you remember any new terms introduced. Finally, at the end of the booklet there are some specimen questions to give an idea of what you might expect to see in the examination.

Website addresses are given for many topics in this book, particularly those in the final chapter. All of these have been tested and are working at the time of writing, but such sites are notoriously quick to change their url addresses, so by the time that you get to try and use them, they may well be found not to work. The author strongly recommends that a good search engine be used to seek up-to-date and reliable websites for information on each of the topics on the syllabus.

Finally, this section of the syllabus aims to help students develop the skill of applying their chemical knowledge to novel situations. For this reason, the contexts and case studies given in this booklet are not for rote learning, unless specified in the syllabus. Rather, the contexts given are to illustrate the concepts in the syllabus and it is hoped that this will stimulate students to investigate further examples that are of interest to them. Students may be asked in the exam to give examples of contexts that they have studied, but exam questions on this part of the syllabus will primarily be testing core knowledge applied to novel situations, rather than rote learning of examples.