



Fettes College

CHEMISTRY AT FETTES

WHY STUDY CHEMISTRY?

Certainly, anyone contemplating a scientific career should study Chemistry. It is a central scientific discipline that will equip you with an understanding of natural phenomena and enable you to follow debates relating to scientific issues in later life.

The government is rightly concerned at the level of ignorance concerning science by the adult population. Do you want to have to believe the newspapers or civil servants when they argue about safety or health issues, blinded by science, or do you want to be in a position to make up your own mind based on an understanding of the facts?

THIRD FORM

In the Third Form students embark on the introductory topics of the [Edexcel IGCSE](#) course. These include an introduction to laboratory safety before studying a variety of topics that form the basis of studying chemistry in the future.

Pupils have three single periods per week of Chemistry. Practical work forms an essential part of the course culminating in a full investigation towards the latter part of the Third Form.

The main topics are;

1. Hazards in chemistry
2. States of matter
3. Chemical & physical change
4. The Periodic Table of elements
5. Atomic structure
6. The Reactivity Series of Metals
7. The Reactions of Acids
8. Rates of Reaction

IGCSE

The Fourth Form Curriculum is initially concerned with atomic structure and how atoms bond together to form compounds. Students then study how the structure of materials can explain their properties before considering how metals can be extracted from their naturally occurring ores. Numerous experiments are then carried out to study the range of valuable materials that can be made from crude oil, including fuels and plastics.

1. Atomic structure
2. Ionic and covalent bonding
3. The structures of elements and their compounds
4. The extraction of metals from their ores
5. An introduction to moles and empirical formulae
6. The separation and refining of crude oil
7. Addition polymers

The Fifth Form Curriculum is initially concerned with the chemistry of the alcohols and energy changes during chemical reactions. We then use the reactions of acids and alkalis to develop quantitative chemistry further, using gases and solutions. Various industrial processes are then considered including the Haber Process and the use of electrolysis to produce aluminium, chlorine and to purify copper.

1. Alcohol chemistry and Energetics
2. Quantitative chemistry: Moles and equations
3. Further reactions of acids
4. Further quantitative chemistry
5. Equilibria
6. Redox reactions
7. Electrochemistry
8. Qualitative chemistry
9. The transition metals

How will I be examined?

At the end of the Fifth Form you will sit two theory papers, which are made up of short structured questions covering the whole of the material you have studied since the start of the third year.

Paper 1 lasts 2 hours and is worth 67% of your total mark, whilst Paper 2 is only 1 hour long and makes up the remaining 33%.

AS

The AS Chemistry course is quite accessible, and would be suitable for those with a good GCSE grade in Chemistry. At the end of the AS course you will have the option to take the more challenging (but even more exciting and stimulating) A2 course.

We recommend those taking Chemistry to A2 level take at least one other science. Mathematics is useful, but not essential. Chemistry is difficult for those with weak language skills and often becomes a struggle for those trying to take more than the standard number of subjects at A level.

To get a certificate for Advanced Subsidiary (AS), you will need to have been assessed on your performance in the three AS units below.

The department has adopted the [OCR Salters Chemistry A level course \(H035 and H435\)](#).

Unit F331 Chemistry for Life

The first module tells the story of the elements of life - what they are, how they originated and how they can be detected and measured. It shows how studying the composition of stars can throw light on the formation of the elements that make up our own bodies and considers how these elements combine to form the 'molecules of life'.

The second module tells the story of petrol and diesel: what they are and how they are made. It also describes the work of chemists on improving fuels for motor vehicles, and in searching for and developing alternative fuels and sustainable energy sources for the future. Important ideas about vehicle pollutants and their control are also covered.

At first sight it would seem that you have met all this before. Whilst you will be covering some very familiar material, this module builds on what you learnt at GCSE but is obviously dealt with in much more detail.

In June of the lower sixth, a 75 minute written examination will test your understanding of this module.

Unit F332 The Chemistry of natural resources

The first module of the course - Elements of Life - told the story of how the elements were formed. The theme is taken further in this module, which tells how we have learned to win back some elements from the natural resources that contain them and turn them into useful substances. The halogens and their compounds, some of which are present in sea water, have been chosen.

The focus of the second module is change - change in the atmosphere brought about by human activities, and the potential effects on life. Two major areas are explored - the depletion of the ozone layer in the upper atmosphere and the link between increased concentrations of greenhouse gases in the lower atmosphere and global warming.

The third module has three themes. First, it tells the story of the polymer revolution - the many beneficial changes that polymers have brought to our lives. Many of the discoveries that led to important advances were made by chance; the experiments did not always go according to plan or give the expected result! This is the second theme of the module. The polymers which are produced in the largest quantities are addition polymers. The historical development of addition polymers is the third theme.

In June of the lower sixth, a 1 hour 45 minute written examination will test your understanding of this unit.

Unit F333 Chemistry in Practice

There is no formal written examination for this unit. You will be assessed by your teacher in five different skill areas during practical work as a normal and integral part of your study of chemistry. The five skill areas are:

Competence, measurement, analysis and evaluation, observation and interpretation.

All activities are carried out individually under controlled conditions.

What will the written examinations be like?

The written papers will consist mainly of short answer questions or calculations; similar to the format of the papers you met at GCSE. A minority of questions will ask you to be more descriptive, although examiners will still be looking for specific points. Prior to the examination, lessons will be set aside for revision, using past paper questions and you will hopefully feel well prepared on the day.

Will I be able to retake any of these modules?

You can retake modules in order to improve your mark. Your best mark will count toward your final grade. However, you should aim to gain your target grade first time round, as this will prevent you having to take a large number of units in an examination period. Strictly speaking, if you sit the module thinking about the insurance of a retake, then you will more than likely be retaking it next time round.

A2 CHEMISTRY

How do I get a full A level in Chemistry?

The A2 Chemistry course is accessible to those students who have already coped very well on the AS course.

To get a certificate for Advanced Level (A2), you will need to have been assessed on the three AS units from the lower sixth and three further A2 units in the upper sixth.

This means that your AS grade, at the end of the lower sixth, will represent 50% of your full A level grade.

In the upper sixth the following three modules are taken:

Unit F334 : The Chemistry of Materials

The first module introduces the pharmaceutical industry, which not only produces new and more effective medicines but is a net exporter of medicinal products and so contributes to the financial health of the UK. Through a study of aspirin, the module illustrates many of the principal activities involved in the development of a medicine and considers the problems of safety testing.

The second module considers the development of materials with specific properties to meet particular needs. The module follows on from the Polymer Revolution and continues the story of polymerisation – concentrating on condensation polymers. Possible alternatives to the disposal of plastics in landfill sites such as recycling, incineration and the use of biodegradable polymers are also considered.

In the third module you will learn about the structures of proteins, their importance as enzymes and their synthesis in cells from DNA, the thread of life. The study of proteins as enzymes also extends your chemical knowledge of reaction rates.

The fourth module tells the story of the production of steel, with emphasis on the redox reactions involved and the huge scale of the process. You will learn how the composition of steel is related to the job it has to do. Rusting is introduced as an electrochemical process and various methods of rust prevention are considered. This leads to a detailed study of the unique properties of the transition metals – variable oxidation state, catalytic activity, complex ion formation and the formation of coloured compounds.

Unit F335 : Chemistry by Design

The first module looks at the processes that occur as plants grow and decay. It then looks at the ways in which a knowledge of these processes can be used to optimise crop yields and to ensure our food supply, in the context of both organic and non-organic (conventional) farming. Finally, chemical and organic methods of pest control are studied. In particular the development of pesticides that do not persist in the environment.

The second module describes how some coloured pigments were discovered by accident and how chemists at the National Gallery use a variety of analytical techniques to investigate pigments and paint media. This provides an ideal setting to learn about UV and visible spectroscopy, atomic emission spectroscopy and gas-liquid chromatography. The third part of the module traces the development of synthetic dyes for fabrics and how they can be made to dissolve and adhere strongly to different fabrics.

The third module attempts to raise awareness of the importance of the oceans to life on Earth, and to bring out some of the fundamental chemistry which lies behind some ocean processes. Major chemical ideas are developed and linked to familiar objects such as seashells and to the behaviour of water itself.

The final module begins with a look at ethanol, how it interacts with the human body and how spectroscopy is used to measure alcohol concentrations in the breath. It then looks at a group of medicines called 'statins' which are used to reduce the risk of heart disease and strokes by reducing the level of cholesterol in the body. The mechanism for statin action is examined before a final study of how penicillin inhibits a bacterial enzyme.

Unit F336 : Chemistry Individual Investigation

Students carry out a single individual investigation on a topic taken from any aspect of chemistry. They are expected to spend about 18 hours in the laboratory carrying out practical work as part of their investigation, and an appropriate amount of time both before and after this period preparing for and using the results of their investigation.

Students are assessed by their teachers in eight skill areas (A–H).

Teachers assess the ability of candidates to:

Skill Area A (Chemical ideas) – apply scientific knowledge and processes to unfamiliar situations (6 marks);

Skill Area B (Methods) – select and describe appropriate qualitative and quantitative methods (6 marks);

Skill Area C (Communication) – select, organise and communicate relevant information with due regard to spelling, punctuation and grammar and the accurate use of specialist vocabulary (5 marks);

Skill Area D (Observations and measurements) – make, record and communicate reliable and valid observations and measurements with appropriate precision and accuracy (6 marks); Skill Area E (Analysis and interpretation) – analyse and interpret the results of investigative activities (6 marks);

Skill Area F (Evaluation) – explain and evaluate the methodology and results of investigative activities (6 marks);

Skill Area G (Manipulation) – demonstrate safe and skilful practical techniques and processes (5 marks);

Skill Area H (Demand) – develop and apply familiar and new chemical knowledge and processes in demanding situations (5 marks).

The marks for the eight skill areas are added together to provide a total mark out of 45 for this unit.

Will I be able to retake any of these modules?

You will be able to retake module F334 in June of your upper sixth to improve your mark. Your best mark will count toward your final grade.

How do I gain an A* grade overall?

To gain an A* grade overall you will need to average at least 90% in the three A2 units and gain more than 80% overall across all of your AS and A2 units.

IB

The Diploma Programme chemistry course includes the essential principles of the subject but also, through selection of options, allows some flexibility.

The course is available at both higher level and standard level, and therefore accommodates students who may wish to study science in higher education and those who do not.

The Course Content

The syllabus for the IB chemistry course is divided into three parts, the core, the additional higher level (AHL) material and the options.

The following units are studied by both higher and standard level students. Within each unit the higher level students cover additional material that is conceptually more demanding and which contains a higher degree of mathematical analysis.

1. Quantitative chemistry
2. Atomic structure
3. Periodicity
4. Bonding and structure
5. Energetics
6. Kinetics
7. Equilibrium
8. Acids and bases
9. Oxidation and reduction
10. Organic chemistry

Options for higher and standard level

A Modern analytical chemistry

B Human biochemistry

C Chemistry in industry and technology

D Medicines and drugs

E Environmental chemistry

F Food chemistry

G Further organic chemistry

All candidates are required to study any two options from A to G.

What will the written examinations be like?

Assessment is by means of written examinations (76%) and practical work (24%) for both higher and standard level chemistry courses.

For each level there are three written examination papers:

Paper 1 (20%): consists of multiple choice questions. Calculators are not allowed but a periodic table is provided.

Paper 2 (36%): consists of several structured questions and a choice from a number of extended response questions. Calculators are allowed and a data booklet is provided.

Paper 3 (20%): consists of several short answer questions from each of the two selected options. Calculators are allowed and data booklets are provided.

Will I be assessed on my practical work?

The simple answer is yes. This is assessed by means of a practical course consisting of a series of experiments which you will carry out and write reports on in a separate laboratory exercise book. The reports are assessed according to the following eight criteria. These are:

1. Design (D)
2. Data collection and data processing (DCP)
3. Concluding and evaluating (CE)
4. Manipulative skills (MS)
5. Personal skills (PS)

You will be assessed at least twice on each of the first three criteria.

Manipulative skills will be assessed summatively by your teacher throughout the course.

Your personal skills will be assessed only once during the Group 4 project.

The marks for each of the criteria are added together to determine the final mark out of 48 for the internal assessment component. This will then be scaled by the board to give a total out of 24%.

Each of the assessment criteria can be separated into two or three aspects.

Descriptions are provided to indicate what is expected in order to meet the requirements of a given aspect completely [c] and partially [p].

A description is also given for circumstances in which the requirements are not satisfied, not at all [n].

How much practical work will there be in the course?

Higher level students are required to spend a minimum of 60 hours, and standard level students a minimum of 40 hours, on practical activities (excluding time spent writing up work). These times include 10 for the Group 4 project.

The Group 4 Project

The Group 4 project allows you to appreciate the environmental, social and ethical implications of science. The emphasis is on interdisciplinary cooperation and the processes involved in scientific investigation, rather than the products of such an investigation.

The exercise is a collaborative experience where concepts and perceptions from across the group 4 disciplines are shared. The intention is that you will analyse a topic or problem which can be investigated in each of the science subjects. The topic can be set in a local, national or international context.

Project Stages

The 10-15 hours allocated to the group 4 project can be divided into four stages:

Planning

This crucial stage should last about 2-4 hours and should consist of a single session, or two or three shorter ones. All science students will meet to 'brainstorm' and discuss the central topic, sharing ideas and information. After selecting a topic or issue, the activities to be carried out must be clearly defined before moving from the planning stage to the action and evaluation stages.

Definition of Activities

A possible strategy is that you define specific tasks for yourselves, either individually or as members of a group, and investigate various aspects of the chosen topic.

Action

This stage should take 6-8 hours in total and may be carried out over one or two weeks in normal scheduled class time. Alternatively a whole day could be set aside if, for example, the project involves fieldwork.

You will investigate your chosen topic from the perspective of the individual science disciplines. The emphasis during this stage is on collaboration; findings of investigations should be shared with others working on the project.

Evaluation

The emphasis during this stage, for which 2-4 hours is probably necessary, is on you sharing your findings, both successes and failures, with other students. The exact nature of this will be decided later in the year, although possible solutions involve:

- devoting a morning or evening (such as a science society) to a symposium where all of the students, as individuals or groups, give brief presentations.
- alternatively the presentation could be more informal and take the form of a science fair where all students circulate around displays summarizing the activities of each student or group.

Each student must show evidence of their participation in the project.

When will the project take place?

The project will take place towards the latter end of the lower sixth in the summer term.

The Final IB grades

The final grade awarded for chemistry is on a numbered scale from 1 to 7.

OUTSIDE FETTES

We make use of the facilities available to us in and around Edinburgh, and have a number of useful links. Pupils attend lectures and visits and we participate in competitions such as the National RSC Top of the Bench Competition and the East of Scotland Analytical Chemistry competition. Fourth form pupils attend the Salter's Chemistry camps in the summer whilst the sixth form students take part in the Spectroscopy workshops around Edinburgh and St Andrews.

FETTES STAFF

Dr Lynden Whyte studied chemistry at the University of East Anglia in Norwich, where he obtained a first class degree. He then spent a further three years completing a PhD, researching the photochemical reactions of the atmosphere. After two years as a Chemistry teacher at Stafford Grammar School he gained promotion to Head of Science at Abbotsholme School in Derbyshire. He so enjoyed his time at this rural boarding school that he stayed for nine years gradually working his way onto the Senior Management Team as Director of Studies. Before moving to Fettes, Lynden spent two years as Head of Science at Scarborough College. He has a keen interest in football, following his beloved Liverpool and though raised in Lincolnshire, is an ardent Scotland supporter, having been bribed throughout his early years by his Scottish father.

Mr David Goude graduated in Chemistry from Nottingham University in 1974. After spending a further three years at Nottingham researching into the reactions of liquid alkali metals he moved to Leeds University where he gained his PGCE. He came to Fettes College in 1978 with the intention of spending a couple of years experiencing teaching in Scotland. Somehow he keeps forgetting to leave. In addition to his teaching commitments he is the school's Examinations Officer.

He devotes much of his limited spare time to refurbishing his cottage (a partially converted farm granary) but when he is released from this he enjoys sailing and yomping the Yorkshire moors (provided there is a good pub at the end of the trail). He has an extensive video and DVD collection and is very proud of the fact that it contains nothing made by Disney!

Mrs Eva Young studied Applied Chemistry at the Heriot Watt University in Edinburgh where she graduated with a first-class degree in 1969. For the next few years she worked for Shell Research in Manchester, developing new uses for plastics. On getting married, she moved back to Scotland where she completed her Teaching Certificate for Secondary Education at Moray House, Edinburgh. She began her teaching career at Kirkcaldy High School, then took a rather prolonged career break to bring up her two children. In the late 1980s she began part-time teaching again and in 1993, she took up her teaching post at Fettes College. Apart from teaching Chemistry and Science, Eva helps out with Careers. She enjoys cooking, gardening and creative crafts.

Dr Kate Fairbairn started teaching at Fettes in September 2006. She is originally from Lichfield in Staffordshire, but arrived in Edinburgh in 1996 to study chemistry at the University of Edinburgh. After finishing her BSc Kate went on to complete a PhD in inorganic chemistry, researching the extraction of metal salts. During her PhD Kate enjoyed working along side various industrial chemists. Following her PhD she then completed her PGCE and has since worked at Bannockburn High School, where she helped introduce the Eco Schools Scheme and an after school science club for younger students. Apart from teaching Chemistry and Science, Kate is a tutor in College East and helps out with UI4 girls hockey. Kate enjoys spending her free time hill walking, camping, skiing, playing tennis and travelling.

Mrs Val Murray worked for 13 years as an Analytical Chemist in the QA Department of Macfarlan Smith Ltd, Pharmaceutical Manufacturers. During this time Val studied at Napier University, graduating in Chemistry in 1984. Later she gained Membership of the Royal Society of Chemistry and Chartered Chemist status. After a career break, Val joined Fettes in 1994 as Chemistry Laboratory Technician. She is responsible for the day to day running of the Prep Room and is involved in the setting up of practicals for new courses. Val's hobbies include gardening, D.I.Y. and watching her son playing football. The latter has certainly helped Val in the College Fantasy Football League.