



GCSE

Chemistry

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Chemistry

Introduction

Welcome to your GCSE Chemistry course. This introduction will serve as a guide to what you can expect from the course, and it will show you how to plan your study of this course effectively. Take your time to read this Introduction thoroughly before you start the lessons.

The course is designed to prepare students for the **AQA GCSE Chemistry specification (syllabus)**.

The AQA subject code is **4421 GCSE Chemistry**.

Please note that this course has four examined components:

Examination paper Chemistry 1
Examination paper Chemistry 2
Examination paper Chemistry 3 plus

An ISA (see below), which consists of

- An item of practical coursework, *and*
- An examination paper based on the practical work

Full details of these components are given below and during the course.

Please note that a full set of data, including a Periodic Table, will be provided in the examinations for the papers Chemistry 2 and Chemistry 3, **but not Chemistry 1**.



The Course

The course is different from GCSE Chemistry courses of the past in that it attempts to look at the way Chemistry affects your everyday life and how you can evaluate the scientific material that you come across in newspapers, magazines and on television. The course is ideal preparation for those who wish to go on to study Chemistry at AS and A2 level.

If you have some background in Chemistry then you will find some of the lessons touch upon things that you have encountered before, but the course is designed to be fully understandable by those who have little or no previous background in science.

Arrangement of Lessons

The lessons are planned so that material for the four examination papers is covered by the four modules of the course:

1. Chemistry 1
2. Chemistry 2
3. Chemistry 3
4. Science Skills

You should note that the fourth module is common to examinations for GCSE Biology and GCSE Physics. If you are doing more than one of these courses with Oxford Open Learning then you will find that this material is found in all three courses, with the exception of TMA J, which is different, so you will need to send separate TMAs to each of your tutors for science subjects.

You should do the three main Chemistry modules in order but the Science Skills module can be completed whenever you like; this *must* be before you start on your practical assessment (see below).

Textbook

The textbook that is referred to throughout this course is

AQA GCSE Chemistry
Patrick Fullick – Nelson Thornes – ISBN 978-0748796441.

You will need a copy of *AQA GCSE Chemistry* throughout the course; you can buy a copy through the Oxford Open

Learning website. It is referred to in almost every lesson and provides excellent coverage of the material. By using the textbook and the course you will have very full coverage of all the material.

You should not need other books throughout the course but you may like to look in other science books from time to time. If you feel that you would like to use a revision guide before the examination you should ask your tutor which one they recommend.

Lesson Contents and Textbook References

Chemistry Module 1		
<i>Lesson</i>	<i>Title</i>	<i>Fullick Reference</i>
1	What the World is made of	C1.1
2	Using Metals	C1.2
3	Obtaining Metals / TMA A	C1.2
4	Oils and Fuels	C1.3
5	Making Things from Oil	C.1.4
6	Making Things from Plants/ TMA B	C.1.5
7	Changes in the Earth/ TMA C	C1.6

Chemistry Module 2		
<i>Lesson</i>	<i>Title</i>	<i>Fullick Reference</i>
8	Bonding	C2.1
9	Structures / TMA D	C2.2
10	Chemical Calculations 1	C2.3
11	Chemical Calculations 2	C2.3
12	Rate of Reactions/ TMA E	C2.4

13	Energy and Reactions 1	C2.5
14	Ions and Solutions / TMA F	C2.6 – C2.7

Chemistry Module 3

<i>Lesson</i>	<i>Title</i>	<i>Fullick Reference</i>
15	The Periodic Table	C3.1
16	Trends and Patterns	C3.1
17	Acids and Alkalis / TMA G	C3.2
18	Water	C3.3
19	Energy and Reactions 2	C3.4
20	Analysis TMA H	C3.5

Science Skills

<i>Lesson</i>	<i>Title</i>	<i>Fullick Reference</i>
21	What is Science All About?	H1
22	Can we Believe Scientists? / TMA I	H8 and H9
23	Investigating and Observing	H3 and H4
24	Gathering Data	H5, H6 and H7
25	Coursework / TMA J	-
26	Your Practice ISA Test	-
Appendices	Chemistry Data/Glossary/More on ISAs	-

Internet Resources

In each lesson of the course, internet sites are given which have been carefully selected to illustrate points in the course and to provide additional activities. These are an important tool in your understanding of your Chemistry course and you should make every effort to view them and carry out the activities that they contain. If you do not have an internet

connection at home, consider making regular trips to a library or internet café as part of your study schedule.

The Structure within each Lesson: how to study

Front Page

The front page of each lesson shows:


- The title.
- **Aim(s)** for the lesson. These set out the position that you should reach after working through the lesson; keep these in mind while reading the lesson material.
- **Context.** This gives a very brief summary and shows how the lesson fits in with the rest of the course.
- **Reading.** The individual references for each lesson.

Lesson Notes

There then follow the notes; these are an outline of the subject material to be studied in the lesson. Read the notes carefully several times until you feel that you have understood the broad outline of the theory involved, and then tackle the reading references. The textbook may deal with the subjects in greater detail, and, as with the notes, you will probably need to read the passages several times.

Activities

Most activities in the course are placed in the notes at the relevant point. Activities are indicated as follows:

Activity 7	Investigate how a nucleus is held together, particularly how the binding energy of the nucleus relates to Einstein's equation $E = mc^2$.
	

The pencil symbol indicates that you should make your own notes in the space provided.

Self-Assessment Tests

When you feel that you have mastered the topics and completed the activities, tackle the practice tests, which are at the end of every lesson that does not contain a tutor-marked assessment.

Tutor-marked Assignments

After every two or three lessons there is a tutor-marked assignment. Most of these are in GCSE examination style. Some students may opt to tackle them under timed conditions as examination practice. These tests will thoroughly check your understanding of the previous few topics. You should send your answers to these tests to your tutor, who will return your marked script, together with a set of suggested answers.

Revision

Do **not** leave all your revision until the end of the course. You will need to revise thoroughly for your examination, but frequent revision throughout the course is **essential**. Plan your revision sensibly, and re-read as you feel necessary, if your knowledge is beginning to fade.

Coursework

You will need to discuss the coursework with your tutor once you have made a start on the course. AQA will specify the topic that you will be working on. Do not start the coursework before discussing it with your tutor.

You should not need too much in the way of specialist equipment for your coursework; it requires mainly items that you can find in the kitchen.

Checking the Syllabus

As you know, this course has been written to cover the contents of the **AQA syllabus 4421** which is available to download (you will need an Adobe Acrobat reader on your computer) at:

www.aqa.org.uk

You should read the syllabus throughout the course, so either keep a copy on your computer or print it out. If you do not have access to the internet, it is available from:

AQA Logistics Centre (Manchester)
Unit 2, Wheel Forge Way,
Ashburton Park, Trafford Park,
Manchester, M17 1EH

Past Papers

AQA now makes all (but the very last set) of past papers available online for free download at:

www.aqa.org.uk

Discuss with your tutor how to approach these.

A Choice of AQA Exams

Within the individual **Biology**, **Chemistry** and **Physics** specifications, AQA offers an **alternative Paper 1**. Candidates can take a 45 minute short-answer paper *or* they can tackle *two* (30 minute) objective (multiple choice) tests instead. These are Papers 1a and 1b. If so, candidates can *either* do the new objective tests on paper *or* on screen. They can do (or re-do) them in November, March *and* June. Nonetheless, OOL recommends sticking to the 45 minute short-answer paper (but please note that this can only be taken in January or June).

When you enter for the 4421 exam, you will need to ensure that the correct Entry Codes are inserted on the entry form. These are:

CHY1 tiers F or H (a written paper) **or** **CHY1AP** and **CHY1BP** (a paper-based objective test) **or** **CH1AS** and **CH1BS** (an on-screen objective test), tiers F or H

plus **CHY2** tiers F or H, **plus** **CHY3** tiers F or H (these are written papers), **plus** **CHYC** (not tiered, comprising PSA and ISA)

Tiering and Assessment

In each of the main Science GCSEs, there is a choice between Foundation Level and Higher Level examinations

papers. These are called “tiers”. You do not need to make a choice at the start of your studies. This course is designed to give you a full preparation for the *Higher Level* examinations. Foundation Level exams cover the same topics but not quite to the same depth and the questions are designed to be a lot easier.

As time goes by, your tutor should be in a position to advise which level of examination it would be best to take. Our advice is to aim for the Higher Tier at the outset and then, if you find it hard, set your sights lower.

The ISA is not tiered. In the other assessments for this specification, the papers are tiered with Foundation Tier being aimed at grades C–G, and Higher Tier being aimed at grades A*–D. Questions for the Higher Tier will be more demanding requiring higher level skills allowing candidates to access the higher grades. See Section 9.4 of the specification for information about tiering and subject content. Different tiers can be taken for different papers.

In Chemistry 1a and Chemistry 1b, the questions for both tiers are contained within the same question paper. Candidates choose at the time of the examination which tier to take.

The last normal exam sitting for the main science specifications is **2012** (there is a theoretical possibility of re-taking in January 2013 but it may be hard to find an exam centre holding such exams). Changes to the GCSE Science specifications (i.e. the introduction of controlled assessment) mean that it is unlikely to be possible to take GCSE Science exams after 2012 as a distance learner. If you wish to take exams in 2013 (or later years), you will need to take (or transfer to) an IGCSE course. Please see our website for the latest details.

Your Tutor

You have a lot of resources to help you in your studies; your course file, textbook, internet resources and your tutor. You should make good use of your tutor to help you with any difficulties that you may have during the course.

And finally... very good luck with your studies.

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Chemistry
GCSE ISA

Your Coursework Practical (ISA)

Aims

By the end of this lesson you should be able to:

- understand how to work effectively on the coursework component for your GCSE qualification

Context

This section is designed to give you a preliminary understanding of how the coursework element of your GCSE course is carried out and marked. It is important that you read through it carefully, as many of the procedures for the ISA are different for Private Candidates. More detailed information is given in an Appendix at the back of the pack but this does not need to be studied at the outset.



To prepare for your ISA, carefully read through the appropriate part of the syllabus. You can view or download this at www.aqa.org.uk.



Oxford Open Learning

Introduction

Your coursework instructions are included in the following pages. Please read them carefully and talk to your tutor about what you intend to do.

What is an ISA?

An 'ISA' ('Investigative Skills Assessment') is the practical element of your GCSE Science course. It is made-up of two parts;

Part 1: A Practical Experiment

This is carried out by you, the student. Because you are a private candidate, you should do this practical part of the ISA at home. You should then record the results of your experiment in a table and use them to produce a graph or a chart.

Part 2: A 45-minute written test

You must take this at an exam centre of your choice. You will need to contact your chosen centre well in advance to arrange a time when you can take Part 2 of your ISA (the written test) under exam conditions.

This test will be based on the experiment you did in Part 1 (see above). It will contain a section with questions related to your own experiment and results and a second section related to a similar experiment which you will not have seen before. The data obtained from Part 1 (the practical experiment) will be taken into the related written examination with you. You will need to use your data to answer questions (more about the written examination later).

You must *not* take any written explanations, write-ups or methodology into the written test part of your ISA. This is not allowed.

When you have completed both parts of the ISA, your test paper, along with the results from your experiment and any graphs or charts you might have produced, will be sent off to a moderator to be marked.

Risk Assessment

All experiments are undertaken at the student's own risk, so it is essential that you should be aware of (and minimise) the risks associated with your chosen experiment(s). You should therefore read and consider the Risk Assessment sections that precede each experiment.

Drawing up a Table of Results

Before you carry out your practical investigation, you should draw up a table you can use to record your results. You should design your table based on the requirements of the investigation. Guidelines on drawing up a table can be found in Lesson 24 'Gathering and Using Data'.

Labelling your tables, graphs and charts

There are strict rules about what you can and cannot take into the written exam for your ISA. You should label the axes on your graph with the appropriate titles, but the only other writing you may have on your graphs or charts is that of the ISA title (e.g. 'Chemistry ISA 1.6: Investigating the Properties of Oils'). N.b. The wording must be **exactly the same** as the title you have chosen to investigate. There must be **no other writing** on tables, graphs or charts, including that which identifies dependent or independent variables.

Writing up your Practical (Optional)

For both the practice ISA and the final ISA, we would advise you to write up your chosen experiment(s) using the lessons on practical work (in particular Lessons 23 onwards, plus the Appendices) to help you. Your tutor will talk to you about what they expect from a write-up.

You *cannot* take your write-up into the written exam part of the ISA. It is to help you understand your experiment, but does not form part of the final assessment.

Practice ISAs (Part 1: Practical Experiment)

You should complete the practice ISA on 'Viscosity of Oils' before you attempt your final ISA.

The instructions for practice ISAs are outlined in the pages that follow. It is very important that you carry out a practice ISA in order to familiarise yourself with the processes involved

in carrying out a practical scientific experiment. Doing a practice ISA should mean you are better equipped with the skills of planning, observation and evaluation which you will be tested on in the actual ISA.

Practice ISAs (Part 2: Written Test)

A past paper relating to your practice ISA on 'Viscosity of Oils' is included at the end of this course. Once you have completed your practical experiment and written it up (Part 1), you should complete the past paper under test conditions, as if it were the real thing. You should refer only to your table of results and the graph(s) or chart(s) you produced when you take the practice written test. Look carefully at the mark scheme for the written test (see lesson 26) to see how marks are allocated for each question.

Which ISA should I take?

AQA releases a number of ISA options at regular intervals during the course of the year, which are valid for a certain period only. It is important that you understand which ISAs you can choose from, so that you do not end up submitting an ISA which is no longer accepted.

The tables below show the ISA options for the years 2010 and 2011.

If you are taking your exams in June **2011**, you should choose **one** ISA from **Table 1** to carry out for your coursework.

If you are taking your exams in June **2012**, you should choose the ISA from **Table 2** to carry out for your coursework. A further set of options will be released by AQA in due course, and OOL will update you of any developments. You should also make sure that your student advisor at OOL knows which year you have decided to sit your exams.

Final ISA (Part 1: Practical Experiment)

Table 1 (2011)

Option	June 2011 GCSE Chemistry Final ISA Options
Option 1	Chemistry 1.6 Investigating the properties of oils, Set 4

Where there is a choice, you should discuss which ISA you will choose with your tutor. The instructions for these options are outlined in the pages that follow, and each is labelled as a 'Final ISA'.

Experiments should be all your own work and AQA ask schools not to announce the experiments until they are actually to be attempted (to prevent students from accessing model answers on the internet). Your tutor and the exam board will be on the look out for work that has been copied from elsewhere.

Final ISA (Part 2: Written Test)

This will be sat at an Exam Centre of your choice. It is the student's responsibility to find a centre. For more information, see the 'Oxford Open Learning Guide to finding a Centre'.

Not sure about anything?

You should find further useful information about ISAs in an Appendix at the back of this course. But that is as much as you need to know at the outset.

Practice ISA and Final ISAs

Please note that the following section includes 1 practice ISA and 1 final ISA. You should carry out the practice ISA first and then the final ISA that you are going to submit for assessment. Please ask your tutor if you are not sure how to proceed. N.b. The practice ISA and the active ISA have different titles. Please make sure the ISA you are going to submit for assessment includes the exact wording of the title as given on p.10.

PRACTICE ISA

Chemistry ISA C1 - Viscosity of Oils

Risk Assessment



The risks involved with this practical are minimal, but as with all practical work you should be careful.

- Do not use nut oil in this experiment if you or any member of your household has a nut allergy.
- Oil spilt on surfaces can be slippery – take care.
- Oil is flammable so do not do the experiment in any place where this presents a danger.
- Oil will stain carpets, upholstery and clothing if spilt.
- Tiles have sharp edges if dropped – dispose of them safely.
- Do not dispose of oil by putting it down the drain.
- Keep small children out of the way when performing this experiment.

Area of investigation

This work relates to the section of your course which investigates:

How do we get fuels from Crude Oil?

Related Lessons

You should re-visit **Lesson 4: 'Getting Fuel from Oil'** in your course pack before you carry out this ISA, to refresh your memory of the topic. Viscosity is a measure of how 'thick' a liquid is. In this experiment you will be testing the viscosity of three oils at three different temperatures.

Equipment

You can use three of the following oils; all are readily available and you may be able to find them in your kitchen or your local supermarket.

- Groundnut oil
- Corn oil
- Rape oil
- Olive oil
- Almond oil
- Walnut oil
- Grape seed oil
- Baby oil

It is best not to use oils marked as 'cooking oil' or 'vegetable oil' as they often are blended and may give confusing results.

You can obtain bathroom tiles from any DIY store.

You can use the stopwatch facility on your wristwatch.

A free stopwatch that works on your computer screen can be downloaded (at the time of going to press) from:

www.download.com/XNote-Stopwatch/3000-2350_4-10332723.html

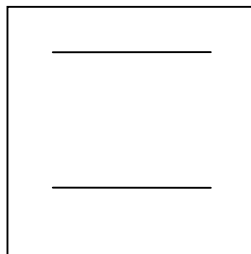
You can buy a very cheap sports stopwatch at:

www.astopwatch.co.uk/products/fastimerange.asp

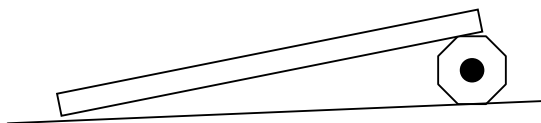
Part 1: The Practical Work

You should aim to carry out an investigation concerning the viscosity of oils.

1. Using a flat glazed bathroom tile, mark two lines at least 10 cm apart (if your tile is large then you can use a greater distance) with a permanent felt tip pen.



2. On a newspaper-covered surface, place one end of the tile on a pencil so that one edge is slightly raised.



3. With a dropper put one drop of oil on your tile at the top line and time how long it takes to reach the bottom line.
4. Each time you need to clean the tile with a dry paper towel - do not use detergent (this may affect your experiment)
5. Repeat the experiment with two other oils; it is a good idea to take repeat readings.
6. Repeat the experiment at a lower temperature by keeping the oil, the tile and the dropper in the refrigerator for one hour.

Part 2: The Data Processing

You should draw up a table of results and process the data in an appropriate way, e.g. charts, graphs, diagrams, and line of best fit if appropriate.

You need to have collected sufficient data to display in such a format. For more information on this, see the *GCSE Sciences Coursework (ISA) Guide for Students* in your course-pack.

Candidates' work must **not** be annotated with additional information, by either the teacher or the candidate, which would give them an unfair advantage during the ISA, e.g. the use of the terms independent/dependent variable.

Remember:

You must decide:

1. How you will make this investigation a 'fair test'.
2. Which variable will be your independent variable.
3. The number of tests. (Each test with a different value for the independent variable.)
4. How many repeats of each test you should carry out so that you can calculate the average value of the dependent variable for each test.
5. The type of graph/chart to plot.

Before you start the practical work you must draw up a table ready to record your results.

When you have finished your investigation:

1. Make sure that you have produced a clear table of results as close to the standard table layout as possible.
2. Process your results to produce what you think is the most appropriate **graph** or **chart**.

The written ISA Test which matches this Practice ISA can be found in Lesson 26.

FINAL ISA

Option 1 (Valid for June 2011)

Chemistry 1, ISA 1.6: Investigating the Properties of Oils

(N.B. You must use this exact wording as the title of your ISA.)

This ISA relates to Unit C1: Science A (4461), Science B (4462) Section 12.3,

Chemistry (4421) Section 11.3.



Risk Assessment

It is the responsibility of the candidate (and any relevant parent or guardian) to ensure that a risk assessment is carried out. This ISA has been chosen, in part, because the risks are small.

Your attention is drawn in particular to the dangers associated with the following:

Do not use a nut oil in this experiment if you or any member of your household has a nut allergy.

Oil spilt on surfaces can be slippery – take care.

Oil is flammable so do not do the experiment in any place where this presents a danger.

Oil will stain carpets, upholstery and clothing if spilt.

Do not dispose of oil by putting it down the drain.

Area of investigation

This work relates to the section of your course which investigates:

How do we get fuels from Crude Oil?

Related Lessons

You should re-visit Lesson 4: '**Getting Fuel from Oil**' in your course pack before you carry out this ISA, to refresh your memory of the topic. Viscosity is a measure of how 'thick' a liquid is. In this experiment you will be testing the viscosity of 3 different oils at different temperatures using a **Cup Viscometer**. A Cup Viscometer is a cup with a hole in the base. Oil flows out of the cup through the hole at a rate determined by the oil's viscosity.

Equipment

Choose three of the following oils; all are readily available and you may be able to find them in your kitchen or local supermarket.

Corn oil	Groundnut oil
Rapeseed oil	Walnut oil
Olive oil	Almond oil
Grape seed oil	Baby oil

It is best not to use oils marked as 'cooking oil' or 'vegetable oil' as they are often blended and may give confusing results.

Alternatively you could investigate the viscosity of washing up liquid or shower gel at different dilutions, to see how the viscosity changes.

You will also need,

Disposable plastic drinks cups
A compass point or skewer to make a hole in the cup
A measuring cylinder or measuring jug

You will need a stopwatch facility, which could be on your wristwatch. You can buy cheap stopwatches at

www.astopwatch.co.uk/products/fastimerange.asp

The Practical Work

A suggested method is described below, but you may adapt this method to suit your own situation.

You should aim to carry out an investigation concerning the properties of oils.

Candidates can investigate how the viscosity of different oils varies. The investigation can also include how the viscosity of different oils varies when the oils have been subjected to a lower temperature.

Candidates can make a cup viscometer using a plastic drinks cup. A compass point or skewer can be used to punch a hole in the centre of the bottom of the cup. This should be about 1mm in diameter. (Heating the compass point in a gas flame for a few seconds will make the job easier, but take care if you use this method).

Candidates need to suspend the cup so that oil can drain out of the hole into another container. In the absence of a clamp, a piece of card can be used with a hole cut out big enough to hold the cup without it falling through. The card can then be positioned across two supports. Another cup may be placed underneath to catch the oil.

Candidates should be aware of the need accurately to measure suitable quantities of oil and accurately to time the flow of oil through the cup viscometer. Place one finger underneath the cup blocking the hole. Then pour the oil into the cup. Start the stopwatch and remove your finger. Time how long it takes for the oil to run out of the cup. You need to think carefully about the exact point when you are going to stop timing. You should carry out a preliminary investigation to determine the quantity of oil you want to use, and the point at which you will stop timing.

It is a good idea to take repeat readings. Clean the cup thoroughly before testing the next oil.

Repeat the experiment at a lower temperature by keeping the oils, the cup and the measuring jug in the refrigerator for one hour.

Candidates need to produce a table for the results and draw a graph or bar chart to show their results.

You need to have collected sufficient data to display in such a format. For more information on this, see the *GCSE Sciences Coursework (ISA) Guide for Students* in your course-pack.

The Data Processing

Each candidate must draw up his or her own table for the results and should process the data in an appropriate way, e.g. charts, graphs, diagrams, line of best fit.

Candidates' work must **not** be annotated with additional information, by either the tutor or the candidate, which would give them an unfair advantage during the ISA, e.g. the use of the terms independent/dependent variable.

Remember:

You must decide:

1. How you will make this investigation a 'fair test'.
2. Which variable will be your independent variable.
3. The number of tests. (Each test with a different value for the independent variable.)
4. How many repeats of each test you should carry out so that you can calculate the average value of the dependent variable for each test.
5. The type of graph/chart to plot.

Before you start the practical work you must draw up a table ready to record your results.

When you have finished your investigation:

1. Make sure that you have produced a clear table of results as close to the standard table layout as possible.
2. Process your results to produce what you think is the most appropriate **graph** or **chart**.