

# Introduction

Your Combined Science GCSE course has been designed to be a comprehensive, clear and usable practical course which develops the necessary skills for GCSE, as well as ensuring that you learn and retain the information for your examination. Accordingly, each lesson has a summary diagram or a list of key terms, and clear statements of aims and context.

These features will ensure you know exactly how what you are learning fits into the overall plan of the course; what the main learning features of the lesson are; and what you need to revise most! Moreover, almost every lesson includes a self-assessment test, which will help you to monitor your progress, as well as tutor-marked tests; and activity sections which will help you to put your knowledge into practice in the way required by GCSE. In short, the course has been designed to help you learn how to exercise the scientist's skills demanded by GCSE, in a way which is clear, and suited to correspondence or distance learning.

In this Introduction we will make clear the other requirements of GCSE, and the ways that your Oxford Open Learning Course meets these. We discuss the textbooks which the course uses; the organisation of lessons and test material; and suggestions as to the best study methods for using your GCSE course.

## Textbooks

It is essential that you acquire the following textbook.

*Double Award Science for GCSE* by Graham Hill (Hodder and Stoughton, ISBN 0-340-80044-5)

The textbook is written in a friendly and approachable way. It is this book that we recommend that students purchase to accompany the course. Try to get the latest (second) edition – if you get an out of date edition the reading references in the course may be inaccurate.

## Note

There are some topics on the syllabus which are not covered fully in the textbook. In such cases all the information needed will be contained within the course. Reading references are given at the beginning of each lesson and it is expected that the student will read the relevant sections alongside the course. In some cases the textbook goes into a lot more detail than is required by the GCSE course which is aimed at the Single Award rather than the Double Award.

Students should look on extra detail as a supplement to their course but should not learn the extra material as it will not be needed in the exam. All the material needed to be learnt is contained within the course, except when the student is referred to a specific section of the textbook.

If you wish to purchase some additional textbooks we also recommend the 'Key Science' series published by Stanley Thornes.

- *Key Science: Biology*, David Applin (0-7487-6241-8)
- *Key Science: Chemistry*, Eileen Ramsden (0-7487-6242-6)
- *Key Science: Physics*, Jim Breithaupt (0-7487-3008-7)

## The Arrangement of Lessons

All reading references are to Hill. There are more specific and detailed instructions at the beginning of each lesson and in the lessons themselves. References in brackets indicate reading that should have already been covered in an earlier lesson.

<b>Module One</b>	<b>Biology</b>	
<b>Lesson</b>	<b>Subject</b>	<b>Reading</b>
1	Key Skills	-
2	Living Things and Cells	Chapter 1
3	Human Diet, Digestion and Enzymes	Chapter 2
4	Homeostasis	Chapter 8
	<b>Tutor-marked Assignment A</b>	
5	Respiration	Chapter 3
6	The Circulatory System and Blood	Chapter 4
7	The Nervous System and Hormones	Chapters 7 and 8
8	Dealing with Infection; Drugs	(Chapter 8)
	<b>Tutor-marked Assignment B</b>	
9	Reproduction	Chapter 10
10	Variation and Inheritance	Chapter 11
11	Food Chains, Cycles and Energy Flow	Chapter 9
12	Human Impact on the Environment	Chapter 12
	<b>Tutor-marked Assignment C</b>	
<b>Module Two</b>	<b>Chemistry</b>	
13	Classifying Substances	Chapter 13
14	Atomic Structure	Chapter 17
15	Formulae	Chapter 14
	<b>Tutor-marked Assignment D</b>	

16	The Periodic Table	Chapters (17) and 18
17	Metals	Chapters 15 and 16
1	Air and Water	Chapters (12) and 21
19	Acids, Bases and Salts	(Chapter 15)
	<b>Tutor-marked Assignment E</b>	
20	Chemical Reactions	Chapter 20
21	Fuels and Polymers	Chapter 22
	<b>Tutor-marked Assignment F</b>	
<b>Module Three</b>	<b>Physics</b>	
22	Measurement and Motion	Chapter 25
23	Forces and Motion	Chapters 24 and 25
24	Energy	Chapters (25) and 26
	<b>Tutor-marked Assignment G</b>	
25	Electricity	Chapters 27, 28 and 29
26	Heat	(Chapters 14, 25 and 26)
27	Circuits and Appliances	None
	<b>Tutor-marked Assignment H</b>	
28	Waves	Chapters 30 and 31
29	Radiation	Chapter 32
30	The Solar System	Chapter 33
31	Movement in Space	(Chapter 33)
	<b>Tutor-marked Assignment I</b>	
	<b>Practice Examination J</b>	

## Assessment

At the end of each lesson you will find a self-assessment test. You should answer these questions but you should *not* send the answers to your tutor. Suggested answers are provided at the end of the module against which you can check your answers.

You should answer tests A-I as you encounter them. These tests should be sent to your tutor who will mark them and comment on them. Suggested answers will be sent to you after you have attempted the tests.

At the end of the course you should attempt the practice examination J, and send this to your tutor for assessment.

## The GCSE Syllabus

The GCSE syllabus (or specification) which we are following is set and examined by Assessment and Qualifications Alliance (AQA). The syllabus code for Combined Science is 3463. The full name of the specification is Science: Single Award Specification B (Co-ordinated). This meets the National Curriculum requirements in full and the main areas of science (Biology, Chemistry and Physics) are clearly separated.

The easiest way to check the details of the syllabus is to download it from the website:

[www.aqa.org.uk](http://www.aqa.org.uk) or more specifically  
[www.aqa.org.uk/qual/pdf/AQA3463WSP.pdf](http://www.aqa.org.uk/qual/pdf/AQA3463WSP.pdf)

### Aims

The aims of the AQA syllabus are to encourage you to:

- (a) acquire a systematic body of scientific knowledge, and the skills needed to apply this in new and changing situations in a range of domestic, industrial and environmental contexts;
- (b) acquire an understanding of scientific ideas, how they develop, the factors which may affect their development and their power and limitations;
- (c) plan and carry out a range of investigations, considering and evaluating critically their own data and that obtained from other sources, and using ICT where appropriate;
- (d) evaluate in terms of their scientific knowledge and understanding, the benefits and drawbacks of scientific and technological developments, including those related to the environment, personal health and quality of life, and considering ethical issues;
- (e) select, organise and present information clearly and logically, using appropriate scientific terms and conventions, and using ICT where appropriate.

## Assessment Objectives

You will need to be able to demonstrate your abilities in four areas:

- A** Knowledge and understanding (AO1)
- B** Application of knowledge and understanding, analysis and evaluation (AO2)
- C** Investigative skills (AO3)
- D** Quality of written communication.

## Scheme of Assessment (AQA 3463)

The subject code for entry to the GCSE award is **3463**. Do not confuse this with the classification code for this specification (1310).

### Paper 1 (Biology)      45 mins      26.66% of the marks

This paper will assess the content specified in Section 10: Life Processes and Living Things, including ideas and evidence. It will comprise compulsory structured questions of different lengths, incorporating calculations and data-response, and will provide the opportunity for answers written in continuous prose. The marking of candidates' continuous prose answers will take into account the quality of written communication. Candidates may use a calculator.

### Paper 2 (Chemistry) 45 mins      26.66% of the marks

This paper will assess the content specified in Section 11: Materials and their Properties, including ideas and evidence. It will comprise compulsory structured questions of different lengths, incorporating calculations and data-response, and will provide the opportunity for answers written in continuous prose. The marking of candidates' continuous prose answers will take into account the quality of written communication. A Data Sheet will be provided. Candidates may use a calculator.

## Paper 3 (Physics)    45 mins    26.66% of the marks

This paper will assess the content specified in Section 12: Physical Processes, including ideas and evidence. It will comprise compulsory structured questions of different lengths, incorporating calculations and data-response, and will provide the opportunity for answers written in continuous prose. The marking of candidates' continuous prose answers will take into account the quality of written communication. Candidates may use a calculator.

## Coursework    20% of the marks

Assessments will be submitted in each of four skill areas from assessments made during normal coursework. The four skill areas are:

- P.** Planning
- O.** Obtaining evidence
- A.** Analysing and considering evidence
- E.** Evaluating.

Detailed instructions are provided later in this introduction.

## Tiers and Grade Descriptions

This GCSE has two tiers of assessment: **Foundation** (grades G-C) and **Higher** (grades D- A\*). Each of the three written papers has Foundation and Higher Tier alternatives although the papers are of the same duration. As you would expect, the Higher Tier papers ask harder questions! You do not need to decide at this stage which tier you are aiming at. As you proceed through the course, your tutor should be able to advise you which tier is most appropriate for you.

There are eight possible grades at GCSE: A\* ("A starred"), A, B, C, D, E, F and G. The bottom two grades indicate a very poor performance and you should expect to aim much higher than that. This course is designed for students aiming for grades A\*-D.

## Prohibited Combinations

You cannot take GCSE Science: Double Award in the same examination series or even the single award specification for Chemistry, Physics, Biology or Human Biology.

## Private Candidates

This specification is available for private candidates. Private candidates should write to AQA for a copy of the latest guidance for private candidates. You will also need the latest information on the procedures for assessing the coursework of private candidates. Private candidates should also be aware of the necessity for locating an examination centre which is prepared to take them.

## Mathematical Requirements

**Calculators** may be used in all parts of the examination.

Candidates should be able to:

1. add, subtract, multiply and divide;
2. use averages, decimals, fractions, percentages, ratios and reciprocals;
3. recognise and use standard notation;
4. use direct and inverse proportion;
5. use positive, whole number indices;
6. draw charts and graphs from given data;
7. interpret charts and graphs;
8. select suitable scales and axes for graphs;
9. make approximate evaluations of numerical expressions;
10. recognise and use the relationship between length, surface area and volume and their units on metric scales;
11. use usual mathematical instruments (ruler, compasses, protractor, set square);

12. understand the meaning of angle, curve, circle, radius, diameter, square, parallelogram, rectangle, diagonal;
13. solve equations of the form  $x = yz$  for any one term when the other two are known;
14. recognise and use points of the compass (N, S, E, W).

These skills are, for the most part, *not* taught within this OOL course and it is assumed that the student will already have such skills. If the student does not have these skills, it may be necessary to take a Maths course as well (e.g. GCSE or GCSE).

## Method of Study

Each set of lesson notes normally contains a number of activities, and a summary or a set of key terms. You should use these notes as follows.

1. Read the lesson notes thoroughly until you feel you have a clear idea of what they have to say. Sometimes information will be given which is not in the text-books, sometimes the lesson notes will tell you how to use the text-book.
2. When you come to an activity, try to carry it out, or make a note to carry it out as soon as you can. The GCSE syllabus expects you to take an active interest in the subject.
3. Read the recommended chapters or pages in your text-book(s). If necessary, re-read until you are confident you understand the material. In most cases there will be some exercises or practice exam questions in the text-book. Have a try at these, especially numerical questions — you cannot have too much practice.
4. When you have mastered the material in the notes and text-book(s), look at the key terms given. Check that you can write a brief, clear explanation or definition of each one.
4. Answer the self-assessment test without reference to the notes or text-books. When you have finished check your answer against the specimen answers.

6. If you cannot understand any part of the study, it should be possible to discuss it with your tutor. Give a brief and specific statement of your problem. If it is a question in a text-book, write the questions out for your tutor (it has been known for students to have a different edition!)
7. At the end of a section, when a lettered test is due, do it under strict examination conditions. There is no point in referring to your notes or a text-book. Let your tutor see what you have understood and they will be better able to help you.
8. When your lettered test is returned, check any comments and corrections. If you are not absolutely certain of your tutor's comments, don't be afraid to ask for clarification.

## Practical Work

Science is an observational discipline. The GCSE syllabus assumes a large amount of experimental work. The type of experiments a student studying in a school or college would undertake are described in the text-books. Even if you have only limited access to a laboratory, you must try to complete as many experiments as possible. If you are unable to undertake all the experiments prescribed by the syllabus, you must be able to describe the experiments at least. It would be a disadvantage to start this course unless you have some access to a laboratory.

To help students without automatic access to a laboratory, a number of activities are described which should be possible with the help of domestic equipment or easily obtained objects. Don't ignore these activities. You must give the examiner the impression that your knowledge is based on practical *and* theoretical study.

This course concentrates on the theoretical rather than the practical side of the subject because it is not possible for a textbook to act as a substitute for real practical experience.

## Coursework

There is no need to be alarmed by the prospect of coursework; it will form a natural part of your studies. Coursework is not

supposed to be a *special* requirement; the exam boards say it should be a *normal* part of your work. During your study, you will work on your coursework in much the same way as you would approach one of the tutor-marked assignments.

To do well in coursework you will need almost exactly the same skills as you will require for success in the examination and the same qualities that you will require to get you through this course of study. All three require an ability to work and think independently, to hunt out information and make notes, to make good use of resources (e.g. laboratories) and to organise and express your ideas effectively.

It is expected that your tutor will give you a certain amount of help with your coursework even though he/she is also going to mark the finished work. Your tutor should help you select an appropriate topic or topics, according to your interests and aptitudes, and suggest possible avenues of investigation that might prove fruitful. You may be advised on the methods you adopt in an experimental situation, and *some* help may be given with preparatory drafts. But after that you are on your own.

## Planning Coursework

So you will need to plan your time carefully. Discuss a possible timetable for producing coursework with your tutor and work out your own private calendar to meet that deadline. It is perhaps advisable that you should have completed most of your basic studies before embarking on your coursework in order to create a good impression. But right from the beginning you can be looking out for topics which are of special interest to you and keeping a file of any useful items (e.g. records of your diet or fitness levels) which might contribute to your investigations.

Because coursework is a very individual thing, this course can only give you a limited amount of guidance with this aspect of your studies. About half way through the course, you will be asked to start thinking about the coursework requirement and, in due course, a few tentative topics will be suggested that might tie in with what you have learnt so far and the assignments that you have already done.

A little later you will be expected (with your tutor's help) to hit on a specific topic or topics and you will be given some assistance with the planning of your investigations. Finally, there will be some guidance on how to present your findings and ideas objectively and persuasively.

With luck, the coursework should be the most enjoyable and rewarding part of your studies!

## How many Pieces of Work will be assessed as Coursework?

This is up to you and your tutor. It is not laid down by the exam board. You should submit at least two pieces of work, but it is more likely that you will produce three or four pieces of investigational work which demonstrate *different* practical skills. But they do not necessarily need to represent all the different modules.

## What Skills will you need to show in your Coursework?

There are four skill areas: planning experimental procedures; obtaining evidence; analysing evidence and drawing conclusions; and evaluating evidence. Your tutor will eventually give you a mark for each of these categories.

Ways of achieving the highest marks are closely defined by the syllabus, so you should study your copy of the syllabus carefully.

From the selection of investigations you do, your tutor will take the best mark that you achieve in each different skill area. You will need to give your tutor a great deal of information about how you set up the investigation, the theories that were testing, the equipment you used, the results you gained, the conclusions that you wish to draw, the help that you got from other people or from books, etc., and an assurance that it is all your own work.

## Marking and Authentication

Most students following this course will have enrolled “direct” with Oxford Open Learning and therefore qualify as “external” candidates from AQA’s perspective. External candidates follow the same syllabus as “internal” (ordinary school- or college-based) students but their coursework is marked by a representative of AQA *not* by their tutor. AQA will arrange all this (via your adopted exam centre) once you find an examination venue.

You will need to tell your tutor about any practical work that they do not supervise. You also need to verify that all the work is your own, except for any specific areas where you have had help from someone other than your tutor. Here you will need to state the

nature of the help that you received on forms provided for this purpose.

If you are studying this course on your local college's open learning programme, it is probable that you will be classified as an "internal" candidate. The difference is that internal candidates have their coursework marked by their tutor, i.e. they are centre-assessed. Your tutor will be expected to keep records of your coursework performance and submit the marks to the exam board.

Work by some students will eventually be checked by moderators from the exam board to make sure that your tutor's marking system and standards are much the same as everyone else's. The student and the tutor must both sign documents to say that it is all the student's own work. Samples of these documents are given at the end of the Introduction.

## AQA Coursework

With any science coursework, there are four skills you need to demonstrate: planning, obtaining evidence, analysing evidence and evaluating evidence.

For those who are unable to obtain access to laboratory facilities at a school or college, AQA made the following suggestions for simple investigations in each of the three sciences:

### AQA's Suggestions for Investigations: Biology GCSE

Title	Equipment that may be used	Notes
The effect of exercise on pulse rate	Stop watch, if you are a member of a fitness club or gym you may have access to suitable equipment	May only be suitable for a low level of demand
Factors affecting the growth of plants, e.g. soil acidity	Soil testing kits may be purchased from many garden centres	
Human reaction times	Stop watch (incorporated into many wrist watches), ruler	Take care – there are many variables which it is difficult to control
Effect of light on the rate of photosynthesis	Pondweed, table lamp, ruler, jars, funnel	If a photographic lightmeter is available it could be made more sophisticated

An ecological survey in the local park – how does the number of species growing depend upon tree shading?	Home-made quadrat	Ecological studies often difficult because of the number of variables
The effect of temperature on the respiration of yeast	Home brewing kits often contain bubble traps which may be utilised; thermometer	May be difficult to quantify

Here are some investigations you could try if you have access to laboratory equipment:

- Photosynthesis
- Osmosis
- Amylase on starch
- Yeast and  $H_2O_2$
- Liver and  $H_2O_2$
- Exercise and heart rate
- Rate of cooling
- Burning food
- Leaf decay
- Protease/gelatine on plates
- Water loss in plants

Most of these investigations are covered in the OOL course and there are many other alternatives. Help will also be given with planning, recording results, drawing conclusions and evaluating your own work.

## AQA's Suggestions for Investigations: Chemistry

If you are unable to obtain access to laboratory facilities at a school or college, AQA make the following suggestions for simple investigations:

Title	Equipment that may be used	Notes
The effect of temperature on sugar dissolving	Thermometer	May be only a low level of demand
Investigating the colouring in Smarties using chromatography	Blotting paper may suffice, or filter paper may be obtained from home brew suppliers	Low level of demand

Here are some investigations you could try if you have access to laboratory equipment:

- Rates – thiosulphate
- Rates – magnesium/acid
- Rates – marble chips/acid
- Rates – H<sub>2</sub>O<sub>2</sub>
- Energy mixing acids and alkalis
- Dissolving sugar cubes
- Burning alcohols
- Rusting of iron
- Making soluble salts
- Melting ice
- Loss of mass of a copper during electrolysis

## AQA's Suggestions for Investigations: Physics

If you are unable to obtain access to laboratory facilities at a school or college, AQA make the following suggestions for simple investigations:

Title	Equipment that may be used	Notes
Factors affecting the time period of a pendulum	A simple pendulum may be made by tying a mass onto the end of a piece of string; stopwatch (wristwatch)	Initial amplitude, mass and length may all be tried

Does a rubber band obey Hooke's Law?	Rubber bands, ruler, masses whose weight is known	Can be expanded to bands in series and parallel
How does distance affect the height of lettering that we can read?	Tape measure; graph paper is ideal for putting the letters on	Can also investigate the effect of using different colours
The bending of a cantilever	Metre rule or long lath; string; weights; C-clamp	Investigate the amount of deflection for various loads
What is the best material for thermal insulation?	Empty, clean pet-food cans to contain hot water; thermometer; bubble-wrap, newspaper, etc	Difficult to make "fair test", as materials vary greatly in thickness

Here are some investigations you could try if you have access to laboratory equipment:

- Resistance of a wire
- Extension of a spring
- Electromagnets
- Pendulums
- Bouncing balls
- Inclined planes
- Parachutes
- Radioactive emissions from a wristwatch
- Ball bearings running down a slope

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