

**IGCSE
Science**

Introduction

Welcome to your IGCSE Science 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 examination in the **Edexcel IGCSE Science (Double Award) specification (syllabus) 4SC0**.

The Arrangement of Lessons

The lessons are planned so that the three strands of biology, chemistry and physics are covered fully throughout the course. It is advisable that you do the modules in the order suggested below, as the content has been written to enable you to develop your knowledge and skills as you progress through the lessons.



The Course

The course is designed to develop (1) a broad understanding of scientific facts, concepts and principles, (2) skills in scientific investigation, and (3) an ability to evaluate the benefits and drawbacks of modern scientific developments.

This qualification supports progression to:

- GCE Advanced Subsidiary and Advanced Level in Biology
- GCE Advanced Subsidiary and Advanced Level in Chemistry
- GCE Advanced Subsidiary and Advanced Level in Physics

Students entering for the Edexcel IGCSE in Science (Double Award) (4SC0) may not enter the following specifications in the same exam series:

- Edexcel IGCSE in Biology (4BI0)
- Edexcel IGCSE in Chemistry (4CH0)
- Edexcel IGCSE in Physics (4PH0)

The course is designed to be accessible to students who may have only a limited previous background in science. If you have some background in Science then you should find that some of the lessons build upon things that you have met before in your earlier studies.

The practical work described at various points in this course is to help to develop your skills for the practical-based components of the theory exams. You should try to carry out this work yourself; if you can undertake some of it at home, or have the opportunity to perform supervised laboratory work in the course of your studies, this will be a great help. Three of the lessons are devoted to the development of practical skills, and there is a very useful guide to practical skills in the Appendix at the back of each textbook to help you further.

NB. The exam will include written questions on practical-based study, so you should make sure that you have studied these lessons carefully and have carried out some of the experiments yourself.

Textbooks

The textbooks referred to throughout this course are:

1. **Phil Bradfield and Steve Potter, Edexcel IGCSE Biology (2009; Pearson Education ISBN: 978 0 435966 88 1)**
2. **Jim Clark, Edexcel IGCSE Chemistry (2009; Pearson Education ISBN 978 0 435966 89 8)**
3. **Brian Arnold, Steve Woolley and Penny Johnson, Edexcel IGCSE Physics (2009; Pearson Educational Ltd ISBN 978 0 435966 90 4)**

You will need to use these textbooks throughout the course; you can buy copies through the Oxford Open Learning website. They are referred to in many lessons and provide excellent coverage of the material. By using the textbooks and the course you will have very full coverage of all the material. The books each have an accompanying CD-ROM containing useful extra questions with answers.

Full answers to the Student Book questions are available to teachers and parents by emailing

customersolutions@pearson.com (for UK teachers and parents) or icsorders@pearson.com (for all other teachers and parents).

The *Edexcel IGCSE Science Double Award Student Guide* (Pearson, 2011, ISBN 9780435046774) by Cliff Curtis, Steve Woolley, and Phil Bradfield is also available. This guide offers further revision materials and would also form a useful accompaniment to the course, but it is not an essential requirement for your studies.

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.

Tiering and IGCSE Examination Entry

Science IGCSE examinations are *not* divided into different entry tiers.

Arrangement of Lessons and Textbook References

Biology

Paper 1: Biology		
Module 1: The Nature and Variety of Living Organisms		
<i>Lesson</i>	<i>Title</i>	<i>Book Reference</i>
1	Cells, Organisms, and the Variety of Life	Chapter 1 pages 1–3, 12–13, and Chapter 2 pages 16–21
2	Movement of Substances into and out of Cells TMA A	Chapter 1 pages 9–11 and Chapter 11 pages 122–123, 123–126
3	Investigative Skills A: Design	Appendix A, pages 247, 252–254
4	Respiration and Enzymes TMA B	Chapter 1, pages 3–9.
5	Investigative Skills B: Carrying Out	Appendix A, pages 247–250

Module 2: Plant and Animal Physiology A		
<i>Lesson</i>	<i>Title</i>	<i>Book Reference</i>
6	Human Nutrition TMA C	Chapter 4 pages 37–51
7	Investigative Skills C: Interpreting	Appendix A, pages 249–251
8	Photosynthesis TMA D	Chapter 10 pages 109– 20.
9	Transport in Plants and Animals	Chapter 5 pages 53–63 and Chapter 11 pages 127–133.
10	Gas Exchange in Plants and Animals	Chapter 3 pages 26–35 and Chapter 10 pages 114–115.

Module 3: Plant and Animal Physiology B		
<i>Lesson</i>	<i>Title</i>	<i>Book Reference</i>
11	Homeostasis and Excretion	Chapter 8 pages 83–94.
12	The Human Nervous System TMA E	Chapter 6 pages 65–76.
13	Hormones in Plants and Animals	Chapter 7 pages 78–82 and Chapter 12 pages 135–142.
14	Human Reproduction TMA F	Chapter 9 pages 96–105.
15	Reproduction in Plants	Chapter 13 pages 143–148.

Module 4: Inheritance		
<i>Lesson</i>	<i>Title</i>	<i>Book Reference</i>
16	Chromosomes, Genes and DNA	Chapter 16, pages 181–188
17	Cell Division	Chapter 17, pages 190–195
18	Genes and Inheritance TMA G	Chapter 18, pages 197–206.
19	Natural and Artificial Selection	Chapter 19 pages 208–217 and Chapter 20 pages 218–221
20	Genetic Engineering and Cloning TMA H	Chapter 20 pages 221–224 and Chapter 22 pages 235–244.

Module 5: Ecology and Food Production		
<i>Lesson</i>	<i>Title</i>	<i>Book Reference</i>
21	Ecosystems	Chapter 14 pages 152–162
22	Human Impact on the Environment TMA I	Chapter 15 pages 170–175.
23	Food Production TMA J : Mock Exam	Chapter 15 pages 165–170 and Chapter 21 pages 228–233

Chemistry

Module 1: Introducing Chemistry		
<i>Lesson</i>	<i>Title</i>	<i>Textbook pages</i>
Intro	Using Numbers in Chemistry	
1	Substances and Particles	1-5 and 31
2	Atomic Structure	6-12
3	Chemical Bonds TMA A	13-19
4	Structures and Properties	20-21 and 23-29
5	Formulae and Equations	33-39
6	Rates of Reaction TMA B	41-51

Module 2: Chemistry Investigations		
<i>Lesson</i>	<i>Title</i>	<i>Textbook pages</i>
7	Investigative Skills A: Design	218
8	Investigative Skills B: Carrying out	219-220
9	Investigative Skills C: Interpreting TMA C	220-225

Module 3: Chemical Patterns		
<i>Lesson</i>	<i>Title</i>	<i>Textbook pages</i>
10	Oxygen and Oxides	54-59
11	The Reactivity Series	60-68
12	Acids and Salts	70-79 and 81-88
13	The Periodic Table TMA D	99-110

Module 4: Chemistry in Practice		
<i>Lesson</i>	<i>Title</i>	<i>Textbook pages</i>
14	Separating and Analysing	89-97
15	Electrolysis	112-119
16	Energy Changes during Reactions	120-124
17	Reversible Reactions TMA E	125-130
18	Extracting and Using Metals	139-146
19	Manufacturing Chemicals	133-138

Module 5: Organic Chemistry		
<i>Lesson</i>	<i>Title</i>	<i>Textbook pages</i>
20	Organic Molecules	149-155
21	Alkanes, Alkenes and Alcohols TMA F	156-162
22	Crude Oil and Polymers	163-168 and 169-174

Module 6: Chemistry Calculations		
<i>Lesson</i>	<i>Title</i>	<i>Textbook pages</i>
23	Moles	176-185
24	Equations and Calculations TMA G	187-194
25	Energy Calculations	202-208
26	Titration TMA H	209-215

	Mock Exam Paper 1 (TMA I)	
	Appendix A: The Periodic Table	
	Appendix B: The Reactivity Series and Formulae of Ions	

Physics

Module 1 – Forces and Motion		
<i>Lesson</i>	<i>Title</i>	<i>Textbook pages</i>
	Introductory Lesson: Using Numbers in Physics	
1	Speed, Distance and Time	1 - 10
2	Forces TMA A	12-16, 23-26, 28-29, 39-40
3	Friction	16-18, 26-31, 34-39
4	Investigative Skills A: Experimental Design	234 - 236
5	Turning and Stretching	18-20, 42-58
6	Astronomy TMA B	49-56

Module 2 – Electricity		
<i>Lesson</i>	<i>Title</i>	<i>Textbook pages</i>
7	Electrical Appliances	59 - 65
8	Electrical Circuits 1: Current and Voltage	74 - 80
9	Electrical Circuits 2: Resistance	82 - 88
10	Investigative Skills B: Interpretation TMA C	236 - 241

Module 3 – Waves		
<i>Lesson</i>	<i>Title</i>	<i>Textbook pages</i>
11	Properties of Waves	91 - 98
12	The Electromagnetic Spectrum	99 - 106
13	Light	107 - 116
14	Sound	118 - 125
15	Investigative Skills C: Taking a Reading TMA D	235

Module 4 – Energy Resources and Energy Transfer		
<i>Lesson</i>	<i>Title</i>	<i>Textbook pages</i>
16	Energy Transfers	127 - 132
17	Thermal Energy	133 - 141
18	Work and Power TMA E	142 - 149
19	Energy Resources and Electricity Generation	150 - 159

Module 5 – Solids, Liquids and Gases		
<i>Lesson</i>	<i>Title</i>	<i>Textbook pages</i>
20	Density and Pressure TMA F	162 - 168
21	Solids, Liquids and Gases	169 - 176

Module 6 – Magnetism and Electromagnetism		
<i>Lesson</i>	<i>Title</i>	<i>Textbook pages</i>
22	Magnetism	179 - 186
23	Electric Motors and Electromagnetic Induction	187 - 195

Module 7 – Radioactivity and Particles		
<i>Lesson</i>	<i>Title</i>	<i>Textbook pages</i>
24	Atoms and Radioactivity TMA G	199 - 207
25	Radiation and Half-life	209 - 215
26	Applications of Radioactivity	216 - 224
27	Atomic Theory and Nuclear Fission TMA H TMA I – Mock Exam paper	226 - 231

Appendices		
	A: Electrical circuit symbols	242
	B: Physical Quantities and Units	245
	C: Formulae and Relationships	243 - 244

Twig Resources

We hope that students of this course will also take the opportunity to learn from the wealth of Twig resources to which this course is linked. Twig have produced more than a thousand educational films, particularly for science, maths and geography and these complement the lesson materials here to enhance the learning experience.

To view the films, you will need an e-mail account, internet access and a password, supplied to you on enrolment. As you work through the lessons, you will come across Twig-links quite regularly, looking like this:



Log on to Twig and look at the film titled: **Deforestation**

www.ool.co.uk/1257ud

Discover how the destruction of the rainforest impacts ecosystems, and begins a cycle that contributes to global warming.

To reach the film, you would either type the URL into your web-browser (here www.ool.co.uk/1257ud) or search the Twig site (www.twig-world.co.uk) for 'Deforestation'. Having watched it, you return to the lesson.

Access to these resources is offered on the following terms:

1. OOL is not responsible for the content of the Twig films or for the technology which transmits them.
2. The films may not be accessible at certain times.
3. OOL cannot be responsible for any technical difficulties students may have in viewing the films and cannot advise on any software or hardware issues.
4. Access is limited in any case to the period until the student's expected exam date.
5. Students are responsible for remembering their own usernames and passwords. Please note: once assigned, a username *cannot* be changed. Passwords can be.
6. Passwords are supplied for the use of the named student only and should not be passed on to any third parties under any circumstances – because each password is unique it will be apparent if it is used on numerous machines.
7. The films are of greater or lesser relevance and it is probable that some parts of many of the films will be too “advanced” for your needs, include ideas you have not yet covered, or introduce information that is not required for the Edexcel specification.
8. If you find that a film is not helpful or interesting, stop watching it! It is possible to study the course successfully without watching *any* of the films.

Remember that this is bonus material only, adding depth and context to the course, and this pack forms the spine of the learning material. But each film we have selected should make studying that little bit easier and more enjoyable.

9. Alongside each film, the Twig site offers various additional resources. You can download a transcript of the film, take a quiz or even an advanced quiz. These are optional extras if you have time and inclination.

Other Internet Resources

In most lessons of the course other internet sites are also given which have been carefully selected to provide additional activities. Some of these have been designated as “Extension” activities.

These internet sites are an important tool to help your understanding of your Science course, and you should make every effort to view at least the ones not designated as Extension.

If you do not have an internet connection at home, consider building in regular trips to a library or internet café as part of your study schedule.

The Course Structure: How to use the Course

The course comprises three strands: Biology, Chemistry and Physics. These are arranged separately in three course folders. The course modules correspond to the numbered sections of the Edexcel Science specification. We strongly *recommend* that you follow an **integrated** approach to the course by studying firstly Module 1 of Biology, secondly Module 1 of Chemistry, and thirdly Module 1 of Physics, and then return to Module 2 of Biology, and so forth. This integrated approach will enable you to build on your knowledge in a consistent way across all three sciences.

Make sure you complete the Tutor-marked Assignments (TMAs) for each module before you proceed to the next module of study.

NB. In some instances the lesson content of a large module may be covered by two TMAs. Sometimes the second TMA comes at the end of a lesson in the following module; see for example, TMA B (Biology) which comes at the end of Lesson Six in Module 2. You need to look ahead and make sure you have completed the relevant TMAs before proceeding to a new module in a different subject. If in doubt, please ask your tutor for advice.

The Structure within each Lesson: How to Study

Front Page

The front page of each lesson shows:

- The **Title**.
- **Aims** 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. Paper 2 examines all of these aims, but Paper 1 does not examine the aims picked out in **bold** print.
- **Context**. This shows how the lesson relates to the Specification.
- **Reading**. The individual textbook references for each lesson. This is additional reading to accompany this course.

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 and carry out the activities 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. The textbook and accompanying CD-ROM also contain relevant questions, and at revision time you may want to return to these to further test your knowledge.

At the end of each lesson there is a list of new technical words whose meanings you should know. There is also a summary to which you can add your own comments.

Activities

Activities are placed in the notes at the relevant point. They are indicated as follows:

Activity 7	Find out your own breathing rate per minute. How does this compare to the results shown above.
	

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

Self-Assessment Tests

Most lessons conclude with either a Self-Assessment Test or a Tutor-Marked Assignment. Only tackle these when you feel that you have fully mastered the material in the lesson.

If it is a Self-Assessment Test, first try to check your answers by referring back to the lesson, and then compare your answers with those given right at the end of the lesson.

Tutor-Marked Assignments

After every few lessons there is a Tutor-Marked Assignment (TMA). Many of these are in IGCSE examination style and will thoroughly check your understanding of the previous lessons. You should send your answers to your tutor, who will return your marked script, together with a set of suggested answers.

You should note that each series of TMAs for each science subject includes the name of the science within the TMA name, e.g. TMA A (Biology). When you send your TMA to your tutor, make sure that you include the subject detail in brackets so that your tutor can see at a glance which subject you are currently working on. If you are, for example, sending in TMA B for Chemistry, the TMA should be headed 'TMA B (Chemistry)', not just 'TMA B' as there are three TMA Bs within the course.

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.

The last TMAs in the course are mock exams of one paper, following closely the format of the exam itself. You are recommended to study the online practice exam and mark scheme (see the section Past Papers below) before attempting this TMA and sending it to your tutor. It is also a good idea to restrict yourself to the time specified for the exam, so you have practice writing under time pressure.

Checking the Specification

As you know, this course has been written to cover the contents of the **Edexcel Specification 4SCO** which is available to download at

<http://www.edexcel.com/quals/igcse/int-gcse11/science/Pages/default.aspx>

You will need an Adobe Acrobat® reader on your computer to download it. This can be downloaded freely at:

<http://get.adobe.com/uk/reader>

In the specification, you should look in particular at:

- The Qualification Content on pages 3 -14
- The Assessment Objectives on page 16

NB. Please make sure that you look at the current issue of the specification.

You should check the specification periodically throughout the course, so bookmark the Edexcel IGCSE Science homepage.

The Edexcel International General Certificate of Secondary Education (IGCSE) in Science is designed for use in schools and colleges. It is part of a suite of IGCSEs in Science offered by Edexcel. The course gives students the opportunity to

experience science within the context of their general education.

The Edexcel IGCSE in Science enables students to:

- acquire a systematic body of scientific knowledge and facts, and an understanding of scientific concepts, principles, themes and patterns
- appreciate the practical nature of science, acquiring experimental skills based on correct and safe laboratory techniques
- appreciate the importance of accurate experimental work to scientific method and reporting
- form hypotheses and design experiments to test them
- sustain and develop an enjoyment of, and interest in, the scientific world
- appreciate the significance of science in wider personal, social, environmental, economic and technological contexts, and consider ethical issues
- select, organise and present information clearly and logically, using appropriate scientific terms and conventions
- prepare for more advanced courses in each of the three scientific disciplines which comprise this specification.

Key Features and Benefits of the Edexcel Specification

The IGCSE in Science:

- includes aspects of science appropriate for the 21st century
- has straightforward linear assessment
- assesses investigative skills through examination.
- provides a sound foundation for progression to AS and A2 examinations in scientific disciplines

The IGCSE Science specification can be accessed from the Edexcel IGCSE Science homepage at:

<http://www.edexcel.com/quals/igcse/int-gcse11/science/Pages/default.aspx>

Please make sure that you access the current issue of the specification. NB: Please note the forbidden combinations listed in the specification.

The Examination

The examination you will sit consists of three papers. There is no separate practical exam and no practical coursework component; testing of practical skills is built into all three written papers. You will have to give written answers practical-based questions.

Biology Paper 1

Paper code: 4SC0/1B

This is a two-hour examination paper. The total number of marks is 120, one third of the overall total. The paper examines all of the Specification content and all of the assessment objectives.

Chemistry Paper 1

Paper code: 4SC0/1C

This is a two-hour examination paper. The total number of marks is 120, one third of the overall total. The paper examines all of the Specification content and all of the assessment objectives.

Physics Paper 1

Paper code: 4SC0/1P

This is a two-hour examination paper. The total number of marks is 120, one third of the overall total. The paper examines all of the Specification content and all of the assessment objectives.

In all papers there will be a range of compulsory short-answer, structured questions, which are ramped to ensure accessibility for less able students, as well as to stretch more able students.

In all papers, students may be required to perform calculations, draw graphs and describe, explain and interpret scientific phenomena. Some of the question content will be unfamiliar to students; these questions are designed to assess data-handling skills and the ability to apply scientific principles to unfamiliar information. Questions targeted at grades A* – B will include questions designed to test knowledge, understanding and skills at a higher level, including some questions requiring longer prose answers.

The IGCSE qualification will be graded and certificated on an eight-grade scale from A* to G. Students whose level of achievement is below the minimum standard for Grade G will receive an unclassified U. Where a candidate is unclassified, this will not be recorded on the certificate.

You should read the Specification throughout the course, and more especially when you are revising to check you have covered everything. Keep a copy on your computer or print it out.

If you do not have access to the Internet, it is possible to buy a paper copy from Edexcel. The contact details are:

Edexcel Publications	Tel: 01623 467 467
Adamsway	Tel: 01623 467 467
	Fax: 01623 450 481
Mansfield	Email:
	publication.orders@edexcel.com
Notts NG18 4FN	

Past Papers

At the time of writing, past exam papers for the previous issue of the specification are available for download from the Edexcel website at:

<http://www.edexcel.com/quals/igcse/int-gcse11/science/Pages/default.aspx>

You can also use these as exam practice. You will find the past papers under the link 'Exam paper'. Do not send these to your tutor for marking.

A mock examination that is marked by your tutor is provided as part of this course.

Your Tutor

You have a lot of resources to help you in your studies; your course file, your 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, especially at the start.

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

Philip West, Michael Jones, Marian Green

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