IGCSE Single Science

# Introduction

Welcome to your IGCSE 'Single' 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 Single Award Science specification** (**4SS0**).

## Contents of the Introduction



Oxford Open Learning

Please note that Edexcel also sets a Double Award (spec 4SD1), worth two (I)GCSEs. The Double Award includes all the content in the Single Award but goes into rather more depth for many of the Biology, Physics and Chemistry topics. Please be sure to refer to the right specification.

## Aims of this Course

The lessons in this course are planned so that all the material and preparation required for the final examination papers is covered.

This course covers Biology, then Physics and finally Chemistry. It is suggested that you do the three subjects in order, one at a time, but this is by no means compulsory.

With your tutor's agreement, you *might* tackle the first Biology module, then the first Physics (or Chemistry) module, and so on. Or you might switch after each tutor-marked assignment.

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.

In combination with other suitable IGCSE entry subjects the course is a useful preparation for those who wish to go on to study scientific subjects at A-level.

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 scientific subjects, 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 places 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.

# Lesson Contents and Textbook References

| **Biology section**<br>**Module 1: Cells and Organisms** | | |
|---|---|---|
| *Lesson* | *Title* | *Textbook pages (see below)* |
| Intro | Using Numbers in Science | |
| 1 | Cells, Organisms, and the Variety of Life | 2-6, 18-21, 25-30 |
| 2 | Movement of Substances into and out of Cells | 16-18 |
| 3 | Investigative Skills A: Design | 303, 305-307 |
| 4 | Respiration and Enzymes<br>**Tutor-marked Assignment A** | 6-14 |
| 5 | Investigative Skills B: Carrying Out | 303-304 |

| **Module 2: Plant and Animal Physiology A** | | |
|---|---|---|
| *Lesson* | *Title* | *Textbook pages* |
| 6 | Human Nutrition | 52-55, 57-58, 62-66 |
| 7 | Investigative Skills C: Interpreting | 304-305 |
| 8 | Photosynthesis<br>**TMA B** | 135-140, 142-144 |
| 9 | Transport in Plants and Animals | 70-74, 76-79 |
| 10 | Gas Exchange in Plants and Animals | 39-43 |

| **Module 3: Plant and Animal Physiology B** | | |
|---|---|---|
| *Lesson* | *Title* | *Textbook pages* |
| 11 | Human Reproduction | 118-124 |
| 12 | Reproduction in Plants<br>**TMA C** | 174-177 |

| **Module 4: Inheritance** | | |
|---|---|---|
| *Lesson* | *Title* | *Textbook Reference: page numbers* |
| 13 | Chromosomes and Genes | 226-237 |
| 14 | Genes and Inheritance | 249-257 |
| 15 | Natural and Artificial Selection | 261-266, 268-272 |
| 16 | Genetic Engineering and Cloning | 272-274, 285-286, 289-298 |

| **Module 5: Ecology and Food Production** | | |
|---|---|---|
| *Lesson* | *Title* | *Textbook pages* |
| 17 | Ecosystems | 187-200 |
| 18 | Food Production<br>**TMA D**<br>**TMA E: Mock Exam (Biology)** | 205-207, 281-284 |

## Physics section

| **Module 6 – Forces and Motion** | | |
|---|---|---|
| *Lesson* | *Title* | *Textbook pages* |
| 19 | Speed, Distance and Time | 2-14 |
| 20 | Forces | 18-20, 28-31, 34 |
| 21 | Friction | 21-22, 32-33 |
| 22 | Investigative Skills A: Experimental Design | 280-281 |
| 23 | The Solar System<br>**TMA F** | 259-263 |

| **Module 7 – Electricity** | | |
|---|---|---|
| *Lesson* | *Title* | *Textbook pages* |
| 24 | Mains Electricity | 63-65 |
| 25 | Current and Voltage | 68-69, 71-73 |
| 26 | Electrical Circuits 2: Resistance | 75-79 |
| 27 | Investigative Skills B: Interpretation | 281-283 |

| **Module 8 – Waves** | | |
|---|---|---|
| *Lesson* | *Title* | *Textbook pages* |
| 28 | Properties of Waves | 97-103 |
| 29 | The Electromagnetic Spectrum | 106-111 |
| 30 | Light<br>**TMA G** | 113-115, 117-121 |
| 31 | Sound | 123-126 |
| 32 | Investigative Skills C: Taking a Reading | 281-282 |

| **Module 9 – Energy** | | |
|---|---|---|
| *Lesson* | *Title* | *Textbook pages* |
| 33 | Energy Transfers | 132-137 |
| 34 | Work and Power | 150-156 |

| **Module 10 – Solids, Liquids and Gases** | | |
|---|---|---|
| *Lesson* | *Title* | *Textbook pages* |
| 35 | Pressure | 175-177 |
| 36 | Gases<br>**TMA H** | 187-191 |

| **Module 11 – Magnetism and Electromagnetism** | | |
|---|---|---|
| *Lesson* | *Title* | *Textbook pages* |
| 37 | Magnetism | 198-201 |
| 38 | Electric Motors and Electromagnetic Induction | 207-209 |

| **Module 12 – Radioactivity, Particles and Astrophysics** | | |
|---|---|---|
| *Lesson* | *Title* | *Textbook pages* |
| 39 | Atoms and Radioactivity | 220-226 |
| 40 | Radiation and Half-life | 234-237 |
| 41 | Applications of Radioactivity | 241-248 |
| 42 | Fission and Fusion | 250-254 |
| 43 | Stellar Evolution<br>**TMA I**<br>**TMA J – Mock Physics Exam Paper** | 266-269 |

| **Chemistry Section**<br>**Module 13: Introducing Chemistry** | | |
|---|---|---|
| *Lesson* | *Title* | *Textbook pages* |
| 44 | Substances and Particles | 3-8 |
| 45 | Atomic Structure | 24-28 |
| 46 | Chemical Bonds | 75-77, 79-80, 85-86 |
| 47 | Structures and Properties | 81-82, 92-94 |
| 48 | Formulae and Equations<br>**TMA K** | 38-41 |
| 49 | Rates of Reaction | 227-235 |

| **Module 14: Chemistry Investigations** | | |
|---|---|---|
| *Lesson* | *Title* | *Textbook pages* |
| 50 | Investigative Skills A: Design | 322-324 |
| 51 | Investigative Skills B: Carrying out | 322-323 |
| 52 | Investigative Skills C: Interpreting<br>**TMA L** | 324-327 |

| **Module 15: Chemical Patterns** | | |
|---|---|---|
| *Lesson* | *Title* | *Textbook pages* |
| 53 | Oxygen and Oxides | 137-143, 191, 270-273, 279 |
| 54 | The Reactivity Series | 150-151, 154-157 |
| 55 | Acids, Bases and Salts | 167-170 |
| 56 | The Periodic Table | 30-31, 123-128, 130-131 |

| **Module 16: Chemistry in Practice** | | |
|---|---|---|
| *Lesson* | *Title* | *Textbook pages* |
| 57 | Separating and Analysing | 15-21, 190-195 |
| 58 | Energy Changes during Reactions | 207-210, 219-220 |

| **Module 17: Organic Chemistry** | | |
|---|---|---|
| *Lesson* | *Title* | *Textbook pages* |
| 59 | Organic Molecules | 254-257 |
| 60 | Alkanes and Alkenes | 258-259, 277-279, 282-283 |
| 61 | Crude Oil and Addition Polymers | 268-272, 302-304 307-308 |

| **Module 18: Chemistry Calculations** | | |
|---|---|---|
| *Lesson* | *Title* | *Textbook pages* |
| 62 | Moles | 25-27, 42-43 |
| 63 | Energy Calculations<br>**TMA M**<br>**TMA N (Mock Chemistry Exam)** | 207-208, 211-219 |
| | Appendix A: The Periodic Table | |
| | Appendix B: The Reactivity Series and Formulae of Ions | |

## Textbooks

You will need three accompanying textbooks. Each of these three texts includes far more detail than you will need for the Single Science specification. It is regrettable that there is no other current, commercially-available textbook for Edexcel Single Science IGCSE (or GCSE). This is the only one!

The textbook that is referred to throughout the Biology section is:

**Philip Bradfield and Steve Potter, *Edexcel International GCSE (9-1) Biology Student Book*** (2017, Pearson Education, ISBN: 978 0 435185 08 4)

The textbook that is referred to throughout the Physics section is:

**Brian Arnold, Steve Woolley and Penny Johnson, *Edexcel Edexcel International GCSE (9-1) Physics Student Book*** (2017, Pearson Education, ISBN: 978-0435185275)

The textbook that is referred to throughout the Chemistry section is:

**Jim Clark, *Edexcel International GCSE (9-1) Chemistry Student Book*** (2017, Pearson Education; ISBN: 978-0435185169

You will need to use a copy of these three textbooks during the course; you can buy copies through the Oxford Open Learning website. There are references to these books in every lesson and they provide excellent supplementary coverage of the material. By using the textbooks and the course you will have very full coverage of all the material. The books have accompanying CD-ROMs which contain useful extra questions with answers.

Please note that reading *not* required for the Combined Science is clearly marked in red as "Biology Only" (or "Chemistry only", etc) in each textbook. But text that is required for Combined Science but not for Single Science is *not* clearly marked. However, each lesson in this course gives clear instructions about what to read and which practice questions to attempt.

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.

## 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.

These internet sites are an important tool to help your understanding of your Single Science course, and you should make every effort to view them.

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.

Please bear in mind that internet addresses change regularly so we cannot guarantee that all addresses listed in the course will remain current. You may have to search for suitable alternatives.

## 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.
- **Context**. This shows how the lesson relates to the 4SS0 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, SATs and TMAs

**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.

Towards the end of each lesson, you will find **Key Words**, a **Summary** and **What You Need to Know** sections. It is vital that you revise these sections before you attempt each assignment and they will form a big part of your revision at the end of the course.

### Self-Assessment Tests

Every lesson is concluded with either a Self-Assessment Question 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 Question, 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 two lessons there is a Tutor-Marked Assignment (TMA). These are in IGCSE examination style and will thoroughly check your understanding of the previous two lessons. You should send your answers to your tutor, who will return your marked script, together with a set of suggested answers.

## Revision and Exam Preparation

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 TMA in each section of the course is a mock exam, following closely the format of the Edexcel 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 4SS0** which is available to download at www.ool/co.uk/0010ssi.

To see this you will need Adobe Acrobat reader on your computer which you can download freely at:

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

In the specification, you should look in particular at:

- The Qualification Content
- The Assessment Objectives

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

The Edexcel International General Certificate of Secondary Education (IGCSE) in Single 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.

### Key Features and Benefits of the Edexcel Specification

The IGCSE in Single 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 A-level science examinations

The Edexcel IGCSE Single Science homepage can be accessed by following the Single Science link from www.ool.co.uk/0012ssi.

## 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 both of the theory papers. It is likely that you will need to give written answers to practical-based questions.

## The Edexcel 4SS0 Specification

### Biology

**Paper code: 4SS0/1B**

This is a one hour ten minutes examination paper. The total number of marks is 60, one third of the overall total. The paper examines all of the Specification Biology content.

### Physics

**Paper code: 4SS0/1P**

This is also a 70-minute examination paper. The total number of marks is 60, one third of the overall total. The paper examines all of the Specification Physics content.

### Chemistry

**Paper code: 4SS0/1C**

This is also a 70-minute examination paper. The total number of marks is again 60, one third of the overall total. The paper examines all of the Specification Chemistry content.

### Grading

The IGCSE qualification is graded on a nine-grade scale from 9-1. 9 is best and 1 is lowest. Students whose level of achievement is below the minimum standard for Grade 1 receive an unclassified U. Where 'unclassified' is awarded, it is not recorded on the certificate.

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 biological 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 biological principles to unfamiliar information. Questions targeted at the highest grades will include elements designed to test knowledge, understanding and skills at a higher level, including some questions requiring longer prose answers.

Calculators can be used in all of these papers.

You will find some sample assessment materials on the Edexcel website. These show you what to expect in your exam, so make sure you look at them and work through the sample questions. You can find this material at www.ool.co.uk/0013ssi.

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
Adamsway
Mansfield
Notts NG18 4FN
Email: publication.orders@edexcel.com

## Past Papers

At the time of writing, past exam papers are available for download from the Edexcel website. You may also use these as exam practice.

## 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