IGCSE Combined Science

Introduction

Welcome to your IGCSE Combined 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 Combined Science specification**. This specification and the exams attached to it are changing:

- The old specification (**4SC0**), was examined first in June 2013 and will be offered for the last time in January 2019.
- The new specification (**4SD0**) will be examined for the first time in June 2019

Because you may not be sure when you will sit your exam, this course covers both specifications.

There are three possibilities:

1. You are sure that you will *not* sit your exams before June 2019. In this case, you can miss out the sections marked "up to January 2019 only" in the course notes. The Aims and Context statements on page 1 of each lesson apply to the new specification, and therefore to you, and the Mock Exams will have the same length and division of material as the exams you will sit.

2. You decide to sit your exams *by* January 2019. In this case, you can miss out the sections marked "June 2019 onwards" in the course notes. Because the Aims and Context sections on page 1 of each lesson apply to the

new specification, those in your (older) specification will be slightly different, with slightly different numbering.

3. You are unsure when you will sit your exams. In this case, study all of the material in the file to cover all possibilities.

The Arrangement of Lessons

The lessons in this Biology section are planned so that all the material and preparation required for the final examination papers is in the following five course modules:

Module 1: Cells and Organisms
Module 2: Plant and Animal Physiology A
Module 3: Plant and Animal Physiology B
Module 4: Inheritance
Module 5: Ecology and Food Production

Physics and Chemistry are arranged in similar fashion. It is advisable that you do the modules in order, 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.

In combination with other suitable IGCSE entry subjects the course is an ideal 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. Three of the lessons in each subject-pack are devoted to the development of practical skills, and there is a very useful Appendix at the back of the Biology textbook (pages 247 - 254) 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.

Lesson Contents and Textbook References

Biology Section **Module 1: Cells and Organisms**		
Lesson	*Title*	*Book Reference*
1	Cells, Organisms, and the Variety of Life	Chapter 1 pages 1–3, 11–13, 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, pp. 247, 252–4
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		
Lesson	*Title*	*Book Reference*
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 Humans	Chapter 3 pages 26–35.

Module 3: Plant and Animal Physiology B		
Lesson	*Title*	*Book Reference*
11	Homeostasis and Excretion	Chapter 8 pages 83-85 and 90-94.
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		
Lesson	*Title*	*Book Reference*
16	Chromosomes, Genes and DNA	Chapter 16, pages 181 and 184–187.
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 218–221 and Chapter 22 pages 235–241.

Module 5: Ecology and Food Production		
Lesson	*Title*	*Book Reference*
21	Ecosystems	Chapter 14 pages 152–159
22	Human Impact on the Environment **TMA I**	Chapter 15 pages 170–175.
23	Food Production **TMA J: Mock Exam**	Chapter 15 pages 165–169 and Chapter 21 pages 228–233

Chemistry Section **Module 1: Introducing Chemistry**		
Lesson	*Title*	*Textbook pages*
Intro	Using Numbers in Chemistry	
1	Substances, Particles and Solutions	1-5 and 30-31
2	Atomic Structure	6-12
3	Chemical Bonds	13-19

	TMA A	
4	Structures and Properties	21, 23 and 25-29
5	Formulae and Equations	33-39
6	Rates of Reaction **TMA B**	41-51

Module 2: Chemistry Investigations		
Lesson	*Title*	*Textbook pages*
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		
Lesson	*Title*	*Textbook pages*
10	Oxygen and Oxides	54-59
11	The Reactivity Series	60-68
12	Acids, Bases and Salts	70-79 and 81-88
13	The Periodic Table **TMA D**	99-110

Module 4: Chemistry in Practice		
Lesson	*Title*	*Textbook pages*
14	Separating and Analysing	89-97
15	Energy Changes during Reactions	120-124
16	Reversible Reactions	125 and 127
17	Manufacturing Chemicals (2018 only)	133-134

Module 5: Organic Chemistry		
Lesson	*Title*	*Textbook pages*
18	Organic Molecules	149-155
19	Alkanes and Alkenes **TMA E**	156-159
20	Crude Oil and Addition Polymers	163-168 and 169-171

Module 6: Chemistry Calculations		
Lesson	*Title*	*Textbook pages*
21	Moles	176-185
22	Equations and Calculations **TMA F**	187-189 and 193
23	Energy Calculations	204-207

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

Physics section **Module 1 – Forces and Motion**		
Lesson	*Title*	*Textbook pages*
1	Speed, Distance and Time	1 -10
2	Forces **TMA A**	12-16, 23-26, 28-29, 39
3	Friction	16-18, 26-31
4	Investigative Skills A: Experimental Design	234 - 236
5	Stretching	18-20
6	The Solar System **TMA B**	49-56

Module 2 – Electricity		
Lesson	*Title*	*Textbook pages*
7	Mains Electricity	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		
Lesson	*Title*	*Textbook pages*
11	Properties of Waves	91 - 98
12	The Electromagnetic Spectrum	99 –106
13	Light	107 - 116
14	Sound	118, 120 - 121
15	Investigative Skills C: Taking a Reading **TMA D**	235

Module 4 – Energy		
Lesson	*Title*	*Textbook pages*
16	Energy Transfers	127 - 132
17	Thermal Energy	133 - 141
18	Work and Power **TMA E**	142 - 149

Module 5 – Solids, Liquids and Gases		
Lesson	*Title*	*Textbook pages*
19	Density and Pressure	162 - 168
20	Gases **TMA F**	171 - 175

Module 6 – Magnetism and Electromagnetism		
Lesson	*Title*	*Textbook pages*
21	Magnetism	179 - 181
22	Electric Motors and Electromagnetic Induction	187 - 192

Module 7 – Radioactivity, Particles and Astrophysics		
Lesson	*Title*	*Textbook pages*
23	Atoms and Radioactivity **TMA G**	199 - 207
24	Radiation and Half-life	209 - 215
25	Applications of Radioactivity	216 - 224
26	Fission and Fusion **TMA H**	226 - 231
27	Stellar Evolution **TMA I – Mock Exam paper Physics**	55
Appendices		
	A: Electrical circuit symbols	242
	B: Physical Quantities and Units	245
	C: Formulae and Relationships	243 - 244

Textbook

You will need three accompanying textbooks. The textbook that is referred to throughout the Biology section is:

Phil Bradfield and Steve Potter, *Edexcel IGCSE Biology* (2009, Pearson Education, ISBN: 978 0 435966 88 1)

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

Jim Clark, *Edexcel IGCSE Chemistry: Student Book* (2009, Pearson Education; ISBN: 978 0 435966 89 8)

The textbook that is referred to throughout the Physics section is

Brian Arnold, Steve Woolley and Penny Johnson, *Edexcel IGCSE Physics Student Book* (2009, Pearson Educational Ltd, ISBN 978 0 435966 90 4)

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.

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. Some of these have been designated as "Extension" activities.

These internet sites are an important tool to help your understanding of your Combined 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.

Please bear in mind that internet addresses change regularly so we cannot guarantee that all addresses listed in the course will remain current.

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 Specification. Again, the numbering refers to the new specification (4SD0), which differs slightly from the old (4SC0) numbering.
- **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

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

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 the course is a mock exam of two papers, 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 4SD0** which is available to download at www.ool/co.uk/0010sci.

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

However, if you are sitting your exams *before* June 2019 (i.e. up to January 2019 at the latest) the relevant specification is **4SC0**, available for download at www.ool.co.uk/0010sci2.

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

The Edexcel International General Certificate of Secondary Education (IGCSE) in Combined 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 Combined 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 Combined Science homepage can be accessed by following the Combined Science link from www.ool.co.uk/0010sci.

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 details are different depending upon when you sit your exams:

Up to and including January 2019 (spec 4SC0)

Biology **Paper code: 4BI0/1B**

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 *except* those items printed in **bold**, and all of the assessment objectives.

Chemistry **Paper code: 4CH0/1C**

This is a two-hour examination paper. The total number of marks is again 120, one third of the overall total.

Physics **Paper code: 4PH0/1P (and 4SD0/1P**

This is also a two-hour examination paper. The total number of marks is 120, two thirds of the overall total.

From June 2019 onwards (4SD0)

Biology **Paper code: 4BI1/1B**

This is a two-hour examination paper. The total number of marks is 110, one third of the overall total. The paper examines all of the Specification content *except* those items printed in **bold**, and all of the assessment objectives.

Chemistry **Paper code: 4CH1/1C**

This is a two-hour examination paper. The total number of marks is again 110, one third of the overall total.

Physics **Paper code: 4PH1/1P (and 4SD0/1P**

This is also a two-hour examination paper. The total number of marks is 110, two thirds of the overall total.

New Grading

Up until January 2019, 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 unclassified is received it will not be recorded on the certificate.

From June 2019, the IGCSE qualification will be 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 will receive an unclassified U. Where 'unclassified' is awarded, it will not be recorded on the certificate.

The following points apply whichever set of exams you are taking:

In both 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 both 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 grades highest grades will include questions 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/0013sci.

(Click on the link "Combined Science", and then follow the link to your specification and the materials associated with it.)

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 for the old 4SC0 specification are available for download from the Edexcel website.

You can also use these as exam practice. You may send up to two past papers to your tutor for marking, but only after

you have successfully completed all the other assignments in your course.

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