2020-21

A Complete Survival Guide for A-level Biology

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The Course

Specification at a glance

Specification

The A-level Specification can be found on the AQA website, link below.

https://www.aqa.org.uk/subjects/science/as-and-a-level/biology-7401-7402

Subject content

Core content

1 Biological molecules

2 Cells

3 Organisms exchange substances with their environment

4 Genetic information, variation and relationships between organisms

5 Energy transfers in and between organisms (A-level only)

6 Organisms respond to changes in their internal and external environments (A-level only)

7 Genetics, populations, evolution and ecosystems (A-level only)

8 The control of gene expression (A-level only)

A-level Assessments

Paper 1	Paper 2	Paper 3
What's assessed • Any content from topics 1–4, including relevant practical skills	**What's assessed** • Any content from topics 5–8, including relevant practical skills	**What's assessed** • Any content from topics 1–8, including relevant practical skills
Assessed • written exam: 2 hours • 91 marks • 35% of A-level	**Assessed** • written exam: 2 hours • 91 marks • 35% of A-level	**Assessed** • written exam: 2 hours • 78 marks • 30% of A-level
Questions • 76 marks: a mixture of short and long answer questions • 15 marks: extended response questions	**Questions** • 76 marks: a mixture of short and long answer questions • 15 marks: comprehension question	**Questions** • 38 marks: structured questions, including practical techniques • 15 marks: critical analysis of given experimental data • 25 marks: one essay from a choice of two titles

Assessment objectives

The exams will measure how students have achieved the following assessment objectives.

- AO1: Demonstrate knowledge and understanding of scientific ideas, processes, techniques and procedures
- AO2: Apply knowledge and understanding of scientific ideas, processes, techniques and procedures:
  - in a theoretical context
  - in a practical context
  - when handling qualitative data
  - when handling quantitative data
- AO3: Analyse, interpret and evaluate scientific information, ideas and evidence, including in relation to issues, to:
  - make judgements and reach conclusions
  - develop and refine practical design and procedures.

Weighting of assessment objectives for A-level Biology

Assessment objectives (AOs)	Component weightings (approx %)			Overall weighting (approx %)
	Paper 1	Paper 2	Paper 3	
AO1	44–48	23–27	28–32	30–35
AO2	30–34	52–56	35–39	40–45
AO3	20–24	19–23	31–35	25–30
Overall weighting of components	35	35	30	100

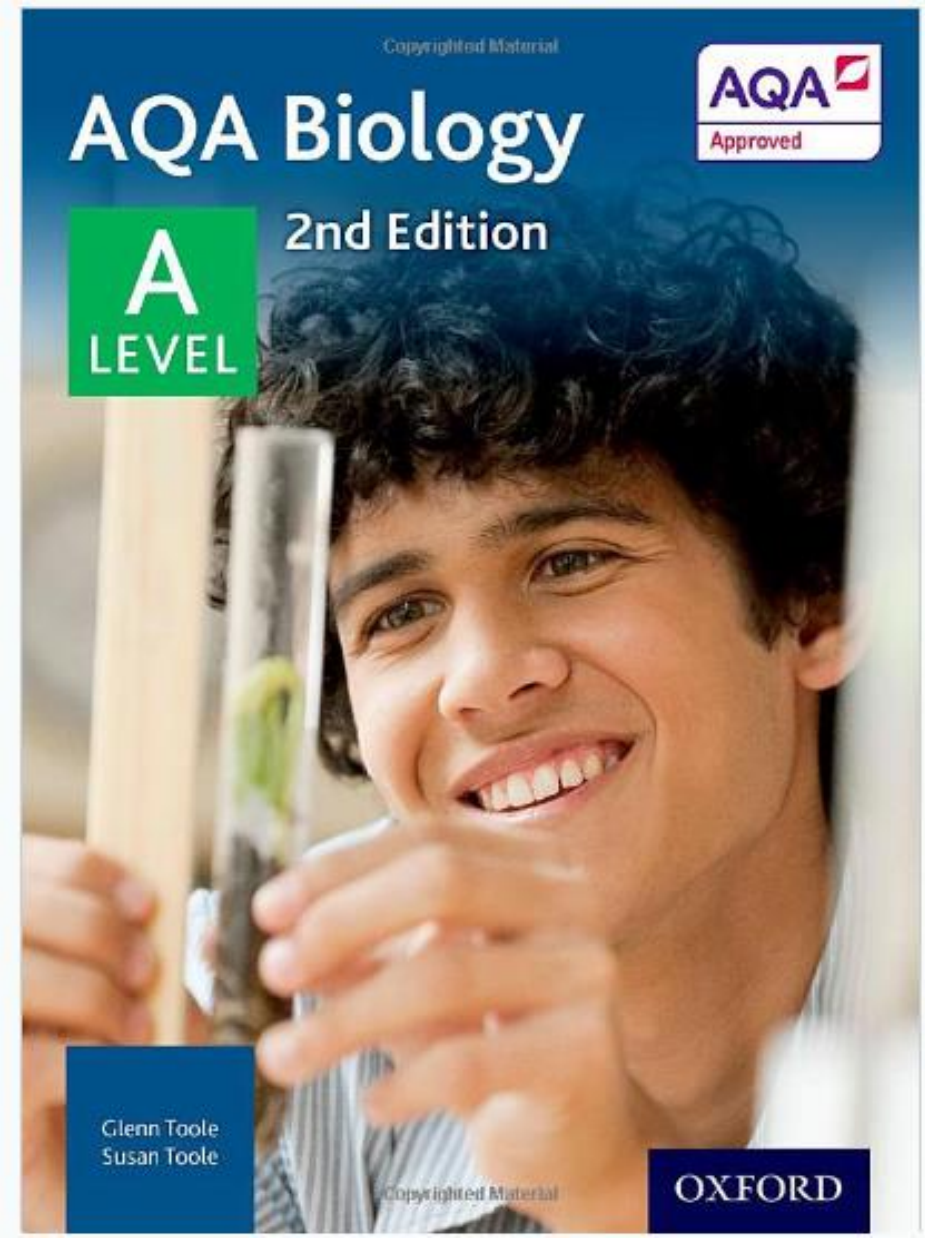
10% of the overall assessment of A-level Biology will contain mathematical skills equivalent to Level 2 or above.

At least 15% of the overall assessment of A-level Biology will assess knowledge, skills and understanding in relation to practical work.

Textbook

Below is a picture of the recommended textbook. We ask that all students purchase their own copy to support your A-level studies. Link below.

https://www.amazon.co.uk/AQA-Biology-Level-Student-Book/dp/0198351771/ref=sr_1_3?dchild=1&keywords=aqa+biology+textbook&qid=1594573616&sr=8-3



Resources.

All lesson resources will be uploaded to the **Biology Teams page** weekly.

If you miss a lesson, head to the Teams page in order to access the materials used. It is vital that you contact your teacher is you have any questions following this.

Practical work

The assessment of practical skills is a compulsory requirement of the course of study for A-level qualifications in Biology. It will appear on all students' certificates as a separately reported result, alongside the overall grade for the qualification. 15% of the marks in the written papers will relate to practical work. There are 12 required practical investigations over the A-level course. You will be required to demonstrate a range of practical skills and written reports in your lab books.

The Required Practicals are:

1. Investigation into the effect of a named variable on the rate of an enzyme-controlled reaction
2. Preparation of stained squashes of cells from plant root tips; setup and use of an optical microscope to identify the stages of mitosis in these stained squashes and calculation of a mitotic index
3. Production of a dilution series of a solute to produce a calibration curve with which to identify the water potential of plant tissue
4. Investigation into the effect of a named variable on the permeability of cell-surface membranes
5. Dissection of animal or plant gas exchange or mass transport system or of an organ within such a system
6. Use of aseptic techniques to investigate the effect of antimicrobial substances on microbial growth
7. Use of chromatography to investigate the pigments isolated from leaves of different plants, eg leaves from shade-tolerant and shade-intolerant plants or leaves of different colours
8. Investigation into the effect of a named factor on the rate of dehydrogenase activity in extracts of chloroplasts
9. Investigation into the effect of a named variable on the rate of respiration of cultures of single-celled organisms
10. Investigation into the effect of an environmental variable on the movement of an animal using either a choice chamber or a maze
11. Production of a dilution series of a glucose solution and use of colorimetric techniques to produce a calibration curve with which to identify the concentration of glucose in an unknown 'urine' sample
12. Investigation into the effect of a named environmental factor on the distribution of a given species

By carrying out all of these practicals, you will be exposed to the following apparatus and techniques:

	Apparatus and techniques
AT a	use appropriate apparatus to record a range of quantitative measurements (to include mass, time, volume, temperature, length and pH)
AT b	use appropriate instrumentation to record quantitative measurements, such as a colorimeter or potometer
AT c	use laboratory glassware apparatus for a variety of experimental techniques to include serial dilutions
AT d	use of light microscope at high power and low power, including use of a graticule
AT e	produce scientific drawing from observation with annotations
AT f	use qualitative reagents to identify biological molecules
AT g	separate biological compounds using thin layer/paper chromatography or electrophoresis
AT h	safely and ethically use organisms to measure: • plant or animal responses • physiological functions
AT i	use microbiological aseptic techniques, including the use of agar plates and broth
AT j	safely use instruments for dissection of an animal organ, or plant organ
AT k	use sampling techniques in fieldwork
AT l	use ICT such as computer modelling, or data logger to collect data, or use software to process data

<u>Practicals will be assessed in the following areas:</u>
Use of apparatus and techniques
Independent thinking
Use and application of scientific methods and practices
Numeracy and the application of mathematical concepts in a practical context
Instruments and equipment.

Competency	
	In order to achieve a **pass**, students will need to have met the following expectations. Students will be expected to develop these competencies through the acquisition of the technical skills specified for each science subject. Students can demonstrate these competencies in any practical activity undertaken throughout the course of study. The 12 practical activities prescribed in the subject specification, which cover the requirements of the DfE content for sciences, will provide opportunities for demonstrating competence in all the skills identified together with the use of apparatus and practical techniques for each subject. Students may work in groups but must be able to demonstrate and record independent evidence of their competency. This must include evidence of independent application of investigative approaches and methods to practical work. Teachers who award a pass to their students need to be confident that the student consistently and routinely exhibits the competencies listed below before completion of the A-level course.
1. Follows written procedures	Correctly follows instructions to carry out the experimental techniques or procedures.
2. Applies investigative approaches and methods when using instruments and equipment	Correctly uses appropriate instrumentation, apparatus and materials (including ICT) to carry out investigative activities, experimental techniques and procedures with minimal assistance or prompting. Carries out techniques or procedures methodically, in sequence and in combination, identifying practical issues and making adjustments when necessary. Identifies and controls significant quantitative variables where applicable, and plans approaches to take account of variables that cannot readily be controlled. Selects appropriate equipment and measurement strategies in order to ensure suitably accurate results.
3. Safely uses a range of practical	Identifies hazards and assesses risks associated with these hazards when carrying

Competency	
equipment and materials	out experimental techniques and procedures in the lab or field. Uses appropriate safety equipment and approaches to minimise risks with minimal prompting. Identifies safety issues and makes adjustments when necessary.
4. Makes and records observations	Makes accurate observations relevant to the experimental or investigative procedure. Obtains accurate, precise and sufficient data for experimental and investigative procedures and records this methodically using appropriate units and conventions.
5. Researches, references and reports	Uses appropriate software and/or tools to process data, carry out research and report findings. Sources of information are cited demonstrating that research has taken place, supporting planning and conclusions.

Folder expectations – what should it look like?

Before you start the course, **you must**;

1. Get an A4 ring binder folder, paper and dividers

2. Get some post-it notes and/or highlighters

3. Get a scientific calculator and bring to every lesson

4. Get an academic diary to organise your homework and deadlines

You must bring all of the above with you to **ALL** Biology lessons. Your teachers are constantly looking for a positive **attitude, motivation to complete work to the best of your ability and your organisation**. As such, random checks of your equipment and 'readiness to learn' will be undertaken and reflected upon in your reports and at parent's evenings. In the front of your folders you should have the folder check list, use this as a guide to help you maintain your folders.

Your Biology folder should be –

- **Split up (using dividers) based on each of the 8 specification areas.**
- **The subject content (from the Specification) should be printed and stuck on the appropriate divider.**
- **This should be used as a half termly checklist to ensure your notes are complete.**
- **All classwork, homework, assessments and independent work should be stored in the relevant section.**

At the front of your folder, you should have –

- **Assessment tracking sheet**
- **Independent Learning Log (updated regularly)**
- **Green folder-check proformas**

You should transfer work from your two-weekly folder into your main Biology folder once a topic is **complete** (as we may need to revisit relevant notes within a topic).

Note taking – How do we do it?

You are not expected to simply reproduce the textbook. If you are asked to take notes, on a three page article for example, then follow this step-by-step guide to help you along.

Please note that the art of note taking may take some practise before you get used to the skills involved.

1. Do not panic at the volume of reading

2. Take the reading a piece at a time (even cover up the sections you don't want to concentrate on)

3. Do not write down anything that you already know – perhaps make yourself a brief reminder in the margin

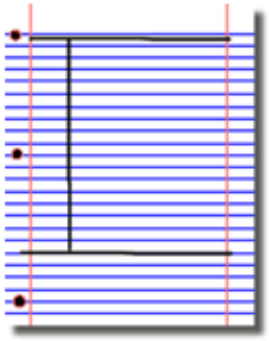
4. Highlight keywords and words you need to look up

5. Aim to write clear and concise bullet points, **in your own words**

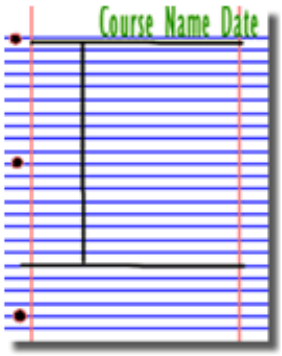
Remember, note taking is different for everyone, you may condense a passage into 5 bullet points whereas I may put it into 8 points – as long as it works for you and aids your understanding and revision.

The Cornell note taking method –

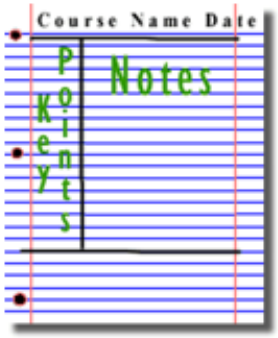
1. Divide your page into three sections like this



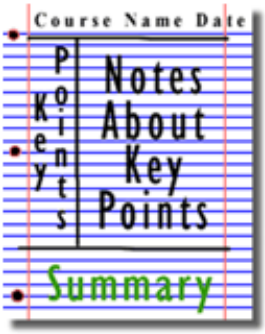
2. Write the name, date and topic at the top of the page



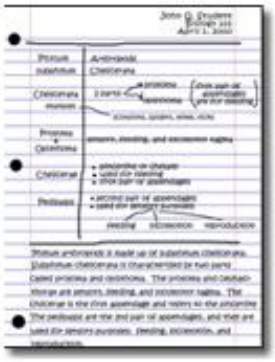
3. Use the large box to make notes. Leave a space between separate ideas. Abbreviate where possible.



4. Review and identify the key points in the left hand box



5. Write a summary of the main ideas in the bottom space



Images taken from http://coe.jmu.edu/learningtoolbox/cornellnotes.html

Independent work – What should you be doing?

*During lessons, you will be given a basic cover of the topics – it is up to **YOU** to expand on your notes and read in more detail to ensure you understand how and why. Dive in and see what google has to say. YouTube has lots of AQA specific videos that will help too. This should be added to your Independent learning log and evidence filed in your notes. This should take at least one hour a week.*

Once you have completed your extended notes, the following should be used to develop your wider knowledge and skill.

Additional exam question practice

Exam question packs will be uploaded to Teams at the end of each topic (as well as being available on Physics & Maths Tutor – useful website). These should be completed and marked independently (alongside questions set in lessons), to develop exam technique and understanding.

Podcasts

'In Our Time' has podcasts and resources on a huge number of topics.
Check out 'Geek Wrapped' for 20 of the best scientific (and witty) podcasts.

https://www.geekwrapped.com/posts/the-20-best-science-podcasts

Ted Talks

Check out ted.com/talks, there are hundreds of videos to choose from! You could either choose a video based on your current topic(s), or choose a totally different video that will extend your general knowledge.

Suggested reading list

Magazines, Newspapers and journals
New Scientist – weekly magazine available in newsagents
Scientific American – monthly magazine available in bigger newsagents.
BBC Focus Science and Technology – Copies can be found in the school library as well as newsagents.
Biological Sciences Review (From the Society of Biology – Biology Library shelves)
Any scientific articles in newspapers (e.g. the Guardian on Wednesday)
Many of the above can be followed on Facebook or Twitter to get links to topical articles.

Useful Websites

- http://learn.genetics.utah.edu/ For all things genetic, DNA and cells. A fantastic resource.
- http://www.dnalc.org/resources/3d/ Animations on all things DNA related
- http://www.nature.com/scitable Free to register for access to comprehensive on-line textbooks on genetics, cell biology and ecology.
- http://www.accessexcellence.org/RC/VL/GG – A web site showing illustrations of many processes of biotechnology
- http://www.uq.oz.au/nanoworld – Visit the world of electron-microscopy
- http://www.dnai.org/a/index.html – Explore the genetic code
- http://nature.com – The site of the scientific journal
- http://royalsociety.org – Podcasts, news and interviews with scientists about recent scientific developments
- http://www.nhm.ac.uk – The London Natural History Museum's website with lots of interesting educational material
- http://www.bbc.co.uk/news/science_and_environment - The BBC news page for Science and the Environment
- **S-cool** - quick tutorials to support core topic areas in AS and A2 biology.
- **mRothery –** AS/A2 revision materials – notes set up for the old AQA course but still useful for new specification.
- **Biozone links –** provides links to other biological sites.
- **BioEthics Education Project (BEEP)** - Learn about the difficult ethical dilemmas that arise out of modern applications of Biology. Topics include: genetic technology, reproductive issues, cloning, environmental issues and much more. All content is cross linked to exam syllabus specifications.
- https://www.futurelearn.com/ - Enhance your knowledge on a variety of topics with free online short courses provided by universities from around the world.

Books

Choose at least a couple of the following books from different categories to read. Some are available to sign out of the Biology Library. Essential reading shown by *

Evolutionary Biology

Charles Darwin: The Origin of Species

***Richard Dawkins:** Every A-level Biology student should read **at least one** of Dawkins' books. Readable and provocative, you can accuse Dawkins of many things, but he is never dull.

The Selfish Gene

The Blind Watchmaker.

River Out of Eden

Steve Jones:

Almost Like a Whale: The 'Origin of Species' Updated

The Language of the genes

Edward O Wilson: The Diversity of Life

Matt Ridley

Genome: The Autobiography of a Species in 23 Chapters

(Definitely the BEST popular introduction to modern genetics. Ridley's structure is wonderfully simple – 23 chapters to cover the 23 human chromosomes – but he uses it brilliantly. We start with Chromosome number 1 and a gene that we share with every other life form, including, probably, the very first living organism.)

DNA and Genetics

James Watson:

DNA: The Secret of Life

The Double Helix: Personal Account of the Discovery of the Structure of DNA

Susan Aldridge: The Thread of Life – The story of genes and genetics engineering

Energy, Life and cell biology

***Guy Brown:** The Energy of Life

(An enthralling account of the electricity that keeps you alive and one of the best popular science books ever written. It complements the A2 Respiration topic perfectly and makes all kinds of complex issues immediately accessible. **If you read nothing else, read this**)

Nick Lane - Power, Sex, Suicide: Mitochondria and the meaning of life

(Not an easy read, but awesome in scope and mind-boggling in its implications. From the very origins of mitochondria in the murky bacterial soup, to the dangers of keeping DNA next to this bubbling furnace of free radicals, and the role of mitochondria in apoptosis. Includes all the latest research and ideas in the field, and is essential reading for anyone who's serious about Oxbridge)

Microbiology
John Postgate: Microbes and Man
Biochemistry
Steven Rose: The Chemistry of Life

Neurobiology
Barry Gibb: The Rough Guide to the Brain (Rough Guides Reference Titles)
Ecology
Rachel Carson: Silent Spring (Now recognized as one of the most influential books of the twentieth century, *Silent Spring* exposed the destruction of wildlife through the widespread use of pesticides and inspired the ecological movement.)
Anna Lewington: Plants for People (A book that inspired the Eden Project)

Anthropology
Richard Leaky: The Origin of Humankind

General Texts
Edward O Wilson: Letters to a Young Scientist
Primo Levi: The Periodic Table
(Primo Levi is best known for his extraordinary accounts of his time in Auschwitz as a prisoner of the Nazis, how he lived, how he survived, and how he finally found his way home. But Levi was an industrial chemist by training, and another of his books, the unpromisingly titled The Periodic Table, celebrates this first love. Forget the title. Each chapter has the name of an element, and each is a self-contained story. Carbon, the best of all, narrates the journey of a carbon atom as it travels into and out of the living world. These are wonderful stories, wholly original and utterly compelling. Highly recommended.)
Richard Fortey: Life: An Unauthorised Biography – a natural history of the first 4,000,000,000 years of life on Earth.
***Ben Goldacre:** Bad Science (a hilarious, invigorating and ultimately alarming journey through the bad science we are fed daily by hacks and quacks.)
***Bill Bryson:** A Short History of Nearly Everything
***Bill Bryson**: The body

GCSE to A-level – What's the difference?

What are the main differences between GCSE and A Level Biology?

Although there is much overlap in topics and terms, there is quite a lot of *new material* that you won't have met before. Also, you need to go into more *detail* regarding the topics you are already familiar with and your level of *thinking and explaining* has to be deeper.

- **New material**

There will be many more facts and unfamiliar terms to learn and recall in exams than there were at GCSE. Examples of new areas include the structure of cell membranes, the immune response and classification. Don't be put off by all the complex terms you will start to come across, they are important for scientists to communicate *precisely* what they mean, and as your A Level course progresses you will become more comfortable and confident with using them.

- **Detail**

You must be prepared to go into a topic or subtopic in much more detail than at GCSE. This sometimes means using specific examples of what you know in general (e.g. named examples of types of body tissues). It might involve describing something in much more detail than before (e.g. exactly how your heart beats and how this is controlled). Another good example is mitosis – if you can't remember what it is, have a quick look at your GCSE notes! For A Level Biology you need to name and explain what happens in each *stage* of mitosis and show an *understanding* of why these things happen. This brings us on to ...

- **Thinking and explaining**

As well as going into more detail and giving examples wherever you can, you need to *justify* your statements and *apply* your knowledge and skills to unfamiliar examples. Justifying what you are saying in A Level Biology often involves relating structure to function, i.e. explaining why something looks the way it does or why a particular structure allows it to function. For example, knowing the detailed structure of the cell membrane allows you to explain its many functions. Now you can apply this knowledge to discuss how an unfamiliar medical drug might work by changing the structure of the membrane.

There are also some terms or ideas that you shouldn't use at A Level. You will come across these as the course progresses but one example is the *fair test* – at A Level you would instead talk about *controlling variables* and making reliable, repeatable measurements.

In order to be a successful Biology student you will need to develop various skills, attitudes, attributes, and behaviours. These are all a part of your 'Learning Journey". Any student can achieve the very highest quality work and grades; improvement and excellence is achieved through commitment, focus and effort.

In the table below you can see some broad descriptions of steps that you might take on your journey. We have called these steps Novice, Apprentice, Practitioner, Expert, and Master. It is possible that you will start your journey at Novice or Apprentice level, it is hoped that by the end of your course you will be working at Expert or Master level. The sooner you work at the higher levels the better your time on the course and, therefore, your outcomes will be.

SKILL LEVEL	DESCRIPTION
Limited	Level of knowledge and understanding varies significantly across major areas of the specification and the motivation to address this is currently lacking. Demonstrates poor time management and is often behind with work. Seems to have little real interest in the subject and is not particularly proactive in asking questions or seeking answers. Lacks the ability or motivation to work with any real degree of independence. Is unlikely to be successful in the study of Biology without a change of attitude and application.
Basic	Can work well under teacher direction and with some degree of independence. Knowledge and understanding varies significantly across major areas of the specification and this is an area that would need to be addressed before attaining basic level in Biology. To reach basic level student needs to demonstrate that he/she can prioritise. In addition, a student working towards this level has to learn to be more resourceful and resilient and to be proactive in asking questions and seeking solutions to problems. It is important that an adequate amount of time is spent on addressing difficult concepts and appropriate revision strategies are employed.
Competent	Working with a higher degree of independence in addition to working well under teacher direction. A competent student manages time reasonably well, asks good questions and is proactive in seeking answers. He/She is a good communicator and collaborates with others well, recalling and using scientific knowledge that reflects his/her ability from within the constraints of the specification. He/She shows good understanding of the principles and concepts used and can apply knowledge reasonably well in familiar contexts. He/She can plan investigations, has good observation skills, can gather accurate, precise and reliable data when carrying out practical work and has the ability to draw informed conclusions.

SKILL LEVEL	DESCRIPTION
Confident	To become confident students need to work with a high degree of independence, to manage time very effectively, to formulate and ask very good questions and to demonstrate that he/she is keen to learn more. He/She needs to become practically adept, a very good communicator, to collaborate effectively with others and be confident to take risks. Students need to recall and use scientific knowledge that reflects the content of the exam specification and to show very good understanding of the principles and concepts covered. He/She needs to select only appropriate information from which to solve problems. A confident student can bring together fundamental principles from different content areas of the subject and demonstrates a reasonable understanding of the relationships between these. He/She can carry out calculations well and can apply knowledge to familiar contexts and is beginning to do so effectively in unfamiliar situations.
Fluent	Can recall and use scientific knowledge that goes beyond the constraints of the exam specifications and reflects his/her interests and aspirations. He/She needs to show excellent understanding of the principles and concepts used, selecting only appropriate information with which to solve problems. At this level students need to demonstrate an ability to work independently and to manage time very effectively. A fluent student has excellent practical skills, questions well, and is curious to find out more and proactive in relation to this. He/She is an effective communicator, collaborates well, and is creative and very confident to take risks. He/She can bring together fundamental principles from different content areas of the subject and demonstrates a clear understanding of the relationships between these. He/She can apply knowledge well in both familiar and unfamiliar contexts, demonstrating excellent understanding of the underlying relationships between physical quantities and can carry out all elements of extended calculations correctly and without guidance.