Transition guide: AQA Level 3 Extended Certificate in Applied Science

We have created this student support resource to help you make the transition from GCSE to AQA Level 3 Extended Certificate in Applied Science.

Contents

You're studying Level 3 Extended certificate in Applied Science.

Studying Applied Science after your GCSEs really develops your practical and research skills. If you enjoy experimenting in the lab and individual/group investigations, you'll love it.

At first, you may find the jump in demand from GCSE a little daunting, but if you follow the tips and advice in this guide, you'll soon adapt.

We recommend you keep this somewhere safe, as you may like to refer to the information inside throughout your studies.

Why study Level 3 Applied Science?

Offered alongside the three traditional Science A-levels, this course will give you fundamental scientific knowledge and help you apply it in a practical way - a skill highly valued by both universities and employers.

You will develop knowledge and understanding of biology, chemistry and physics concepts, as well as plan and carry out a scientific investigation that you choose yourself. You will practise experimental scientific techniques and explore how these are applied in industry, as well as discover ways in which topical scientific issues are presented in the media.

Investigation of the role of scientists and the vast career pathways open to you are also explored, giving you a real insight into the industries you might want to join in the future.

Possible destinations on completion of the course.

Level 3 Applied Science is very valuable as it demonstrates to employers and universities alike an ability to handle information in a practical context. Apprenticeship providers are very keen on this as a qualification as are firms that employ laboratory technicians. Applied Science is useful subject for students who want to pursue a career in the health service such as nursing or midwifery.

Specification at a glance

Level 3 Extended Certificate in Applied Science: Unit summary

The acknowledged number of guided learning hours for this qualification is 360.

It is made up of five mandatory units, plus one optional unit from a choice of three.

	Unit title	Assessment type	Ofqual unit reference
Mandatory			
1	Key concepts in science	Written exam	J/507/6497
2	Applied experimental techniques	Portfolio	L/507/6498
3	Science in the modern world	Written exam with pre-release material	R/507/6499
4	The human body	Written exam	A/507/6500
5	Investigating science	Portfolio	F/507/6501
Optional			
6a	Microbiology	Portfolio	J/507/6502
6b	Medical physics	Portfolio	L/507/6503
6c	Organic chemistry	Portfolio	R/507/6504

Unit 1: Key concepts in science

This is predominantly a theoretical unit in which learners develop their knowledge and understanding of key concepts in science and how they are applied in the medical, healthcare, food, environmental, chemical, pharmaceutical, material and automotive industries.

Unit 2: Applied experimental techniques

All experimental techniques should relate to their application in research and development for new pharmaceutical products, the quality control of existing products and the investigation of new materials, ecological investigations, consideration of the most suitable material to use for a specific application, or in a forensic or pathology laboratory. It is important that learners are able to describe the usefulness of each technique in a setting outside the school or college laboratory.

Unit 3: Science in the modern world

This unit will enable learners to develop their analytical, evaluative and critical thinking skills. These are important skills for scientists and technicians working in research, product development and scientific testing.

Unit 4: The human body

This is predominantly a theoretical unit in which learners develop their knowledge and understanding of human anatomy and physiology. However, the applications of these ideas in the health and sports science industries can be explored through practical work.

Unit 5: Investigating science

Many industries employ scientists who are involved in research and investigation. They test out new ideas and report their findings to a suitable audience, to fellow scientists, and eventually to the public. These scientists are responsible for developments in industries which provide both services and products, such as pharmaceuticals, automotive, construction, food production, radiology and countless others. The context of the investigation will enable learners to use their knowledge and skills in carrying out a scientific investigation that relates to science in the real world.

Unit 6b: Medical physics

Many professionals working in medicine need to have an understanding of physics and its applications when using diagnostic and therapeutic equipment and techniques.

For more detailed information use this link to download the complete specification

Useful information and activities

Greek letters

Greek letters are used often in science. They can be used as symbols for numbers (such as π = 3.14…), as prefixes for units to make them smaller (eg μm = 0.000 000 001 m) or as symbols for particular quantities (such as λ which is used for wavelength).

The Greek alphabet is shown below.

A	α	alpha
B	β	beta
Γ	γ	gamma
Δ	δ	delta
E	ε	epsilon
Z	ζ	zeta
H	η	eta
Θ	θ	theta
I	ι	iota
K	κ	kappa
Λ	λ	lambda
M	μ	mu

N	ν	nu
Ξ	ξ	ksi
O	ο	omicron
Π	π	pi
P	ρ	rho
Σ	ς or σ	sigma
T	τ	tau
Y	υ	upsilon
Φ	φ	phi
X	χ	chi
Ψ	ψ	psi
Ω	ω	omega

SI units

Every measurement must have a size (eg 2.7) and a unit (eg metres or °C). Sometimes, there are different units available for the same type of measurement. For example ounces, pounds, kilograms and tonnes are all used as units for mass.

To reduce confusion, and to help with conversion between different units, there is a standard system of units called the SI units which are used for most scientific purposes.

These units have all been defined by experiment so that the size of, say, a metre in the UK is the same as a metre in China.

The seven SI base units are:

Physical quantity	Usual quantity symbol	Unit	Abbreviation
mass	m	kilogram	kg
length	l or x	metre	m
time	t	second	s
electric current	I	ampere	A
temperature	T	kelvin	K
amount of substance	N	mole	mol

All other units can be derived from the SI base units. For example, area is measured in square metres (written as m^2) and speed is measured in metres per second (written as ms^{-1}).

Some derived units have their own unit names and abbreviations, often when the combination of SI units becomes complicated. Some common derived units are:

Physical quantity	Usual quantity symbol	Unit	Abbreviation	SI unit
Force	F	newton	N	kg m s^{-2}
Energy	E or W	joule	J	kg m^2 s^{-2}
Frequency	f	hertz	Hz	S^{-1}

It is not always appropriate to use a full unit. For example, measuring the width of a hair or the distance from Manchester to London in metres would cause the numbers to be difficult to work with.

Prefixes are used to multiply each of the units. You will be familiar with centi (meaning 1/100), kilo (1000) and milli (1/1000) from centimetres, kilometres and millimetres.

There is a wide range of prefixes. The majority of quantities in scientific contexts will be quoted using the prefixes that are multiples of 1000. For example, a distance of 33 000 m would be quoted as 33 km. The most common prefixes you will encounter are:

Prefix	Symbol	Multiplication factor		
Tera	T	10^{12}	1 000 000 000 000	
Giga	G	10^{9}	1 000 000 000	
Mega	M	10^{6}	1 000 000	
kilo	k	10^{3}	1000	
deci	d	10^{-1}	0.1	1/10
centi	c	10^{-2}	0.01	1/100
milli	m	10^{-3}	0.001	1/1000
micro	μ	10^{-6}	0.000 001	1/1 000 000
nano	n	10^{-9}	0.000 000 001	1/1 000 000 000
pico	p	10^{-12}	0.000 000 000 001	1/1 000 000 000 000
femto	f	10^{-15}	0.000 000 000 000 001	1/1 000 000 000 000 000

Activity 1

Which SI unit and prefix would you use for the following quantities?

1. The length of a finger
2. The temperature of boiling water
3. The time between two heart beats
4. The width of an atom
5. The mass of iron in a bowl of cereal
6. The current in a simple circuit using a 1.5 V battery and bulb

Activity 2

Re-write the following in SI units.

1. 1 minute
2. 1 hour
3. 1 tonne

Activity 3

Re-write the following quantities:

1. 1502 metres in kilometres
2. 0.000 45 grams in micrograms
3. 0.000 45 metres in millimetres
4. 1055 kilometres in metres
5. 180 megaseconds in seconds
6. 2500 centimetres in millimetres

With research playing an important part of the course, a skill you need to develop is citing your sources of information that you have used in the course of your research. This is an invaluable skill to acquire especially if you plan on going onto higher education and a relevant degree course.

The most used system of citing your sources is the Harvard style and is described on the next page.

Harvard referencing:

The following show how to set out your references in an Appendix at the rear of your work/research.

Book

Family name, INITIAL(S). Year. Title. Edition (if not first edition). Place of publication: Publisher.

Adams, A.D. 1906. Electric transmission of water power. New York: McGraw.

Kane, M. and Trochim, W. 2007. Concept mapping for planning and evaluation. Thousand Oaks: Sage

Publications.

Chapter in edited book

If you are referencing a book with chapters written by different authors, you need to give details of the chapter, and the book in which you read it:

Family name, INITIAL(S). Year. Chapter title. In: Family name, INITIAL(S) (of editor). ed(s). Title of book. Place of publication: Publisher, page numbers.

Coffin, J.M. 1999. Molecular biology of HIV. In: Crandell, K.A. ed. The evolution of HIV. Baltimore: Johns Hopkins Press, pp.3-40.

Journal article (print)

Family name, INITIAL(S). Year. Title of article. Journal Title. Volume(issue number), page numbers.

Pajunen, K. 2008. Institutions and inflows of foreign direct investment: a fuzzy-set analysis. Journal of International Business Studies. 39(4), pp.652-669.

N.B. Use p. to reference a single page, and pp. if it is a range of pages.

Journal article (online)

Family name, INITIAL(S). Year. Title of article. Journal Title. [Online]. Volume(issue number), page

numbers. [Date accessed], Available from: URL.

El Gharras, H. 2009. Polyphenols: food sources, properties and applications - a review. International Journal of Food Science & Technology. [Online]. 44(12), pp.2512-2518. [Accessed 10 June 2013]. Available from: http://onlinelibrary.wiley.com

Website or webpage

Family name, INITIAL(S) (or company name). Year. Title. [Online]. [Date accessed]. Available from: URL

Hawking, S. 2000. Professor Stephen Hawking's website. [Online]. [Accessed 9 February 2009]. Available from: http://www.hawking.org.uk/home/hindex.html

Environment Agency. 2013. River and coastal maintenance programmes 2013-14. [Online]. [Accessed 12 July 2013]. Available from: http://www.environment-agency.gov.uk

N.B. If the source has multiple authors, you should include all of the authors in the reference.

Activity 4

Over the summer we would like you to research Fracking.

We would like you to research the topic and then use your research to produce an essay,

which you will need to bring with you to your first lesson, which covers:

1. **What is fracking?**
2. **What are the positive points about fracking?**
3. **What are the negative points about fracking?**
4. **What is your opinion on fracking? Why?**

You will need to provide a reference page and in your references you will need to evaluate

each one, was it helpful or not and why? Remember to complete using *Harvard Referencing*

Is it a reliable source of information and why?

Compare the articles from generalist media against the specialist media information such

as briefings and for e.g.reports from friends of the earth and other environmentalist groups and identify how these approaches and styles are used for different audiences.

Suggested websites:

http://www.talkfracking.org/resources/

https://www.foe.co.uk/page/key-information-fracking-shale-gas

environmentamerica.org/sites/environment/files/reports/EA_FrackingNumbers_scrn.pdf

drillordrop.com/2015/12/18/fracking-by-numbers-figures-from-the-new-oil-and-gas-licences/

www.frack-off.org.uk/resources

Activity 5

As the work you will be completing for this course will be Level 3 standard you will see a large difference in the amount of detail that is required in your evidence/examination questions. To prepare yourself for this "step up" we would like you to research and make some organised notes on both animal, plant and bacterial cell ultrastructure.

http://www.cellsalive.com/

This website contains information about cell ultrastructure.

Find pictures of and explain the function of the following cell organelles:

Nucleus (and nucleolus), smooth endoplasmic reticulum (SER), rough endoplasmic reticulum (RER), mitochondria, vesicles, lysosomes, Golgi apparatus, chloroplasts, vacuoles, cell walls, ribosomes (70S and SOS), flagella, nucleoid, plasmids, mesosomes, pili, slime capsules

Activity 6

Read the information on the following pages of BBC Bitesize:

http://www.bbc.co.uk/schools/gcsebitesize/science/triple_aqa/movement_of_molecules/ and

http://www.bbc.co.uk/schools/gcsebitesize/science/triple_aqa/transport_systems/

Produce a summary, in your own words, detailing the extra knowledge and understanding you have gained from this reading.

This could be presented in whatever form – as long as it is accurate and detailed – for instance, as handwritten paragraphs, or a detailed mind map.

Activity 7

You will have encountered basic physical chemistry at GCSE. At level 3 you will need a sound ability in maths including standard form conversions, a knowledge of significant figures and the ability to rearrange equations.

Look at the following online resources to help you with your understanding of chemical calculations;

http://www.bbc.co.uk/education/guides/zysk7ty/revision

http://www.bbc.co.uk/education/guides/zgg7hyc/revision

http://www.bbc.co.uk/schools/gcsebitesize/science/add_ocr_gateway/periodic_table/ionicrev3.shtml

https://www.youtube.com/watch?v=qAMV0fWKrmE

http://www.bbc.co.uk/bitesize/ks3/maths/measures/use_of_measure/revision/5/

Use your research to summarise how to calculate;

(i) The relative formula mass of a substance

(ii) The number of moles in a substance given the mass

(iii) The moles of a gas given the volume.

Activity 8

- **Write a step by step guide on how to perform a titration**
- **Write a step by step guide on how to make a series of dilutions on copper sulphate solution.**

Write an essay on ionic and covalent compounds. This should be at between 500- 1000 words, detailing how they form a bond, examples of compounds for both (Inc. diagrams) and properties.

Remember to reference your work using the Harvard style of referencing. This is extremely important.

Activity 9

Join the boxes to link the word to its definition.

Accurate	A statement suggesting what may happen in the future.
Data	An experiment that gives the same results when a different person carries it out, or a different set of equipment or technique is used.
Precise	A measurement that is close to the true value.
Prediction	An experiment that gives the same results when the same experimenter uses the same method and equipment.
Range	Physical, chemical or biological quantities or characteristics.
Repeatable	A variable that is kept constant during an experiment.
Reproducible	A variable that is measured as the outcome of an experiment.
Resolution	This is the smallest change in the quantity being measured (input) of a measuring instrument that gives a perceptible change in the reading.
Uncertainty	The interval within the true value can be expected to lie.
Variable	The spread of data, showing the maximum and minimum values of the data.
Control variable	Measurements where repeated measurements show very little spread.
Dependent variable	Information, in any form, that has been collected.

Hope this gives you an insight into this excellent course and we look forward to seeing you all in September,

Team Science