Prior Pursglove College

Summer School

Applied Science

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.

Specification overview.

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 can 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 6a: Microbiology.

This is predominantly a practical unit in which learners develop their knowledge and understanding of microorganisms through completing investigations involving the cultivation of microorganisms.

For more detailed information you can download the specification using this link.

Greek letters

These often used 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	N	ν	nu
B	β	beta	Ξ	ξ	ksi
Γ	γ	gamma	O	ο	omicron
Δ	δ	delta	Π	π	pi
E	ε	epsilon	P	ρ	rho
Z	ζ	zeta	Σ	ς or σ	sigma
H	η	eta	T	τ	tau
Θ	θ	theta	Y	υ	upsilon
I	ι	iota	Φ	φ	phi
K	κ	kappa	X	χ	chi
Λ	λ	lambda	Ψ	ψ	psi
M	µ	mu	Ω	ω	omega

SI units

Every measurement must have a size (e.g. 2.7) and a unit (e.g. metres or ºC). 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	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	Symbol	Unit	Abbreviation	SI unit
Force	F	Newton	N	$Kgms^{-1}$
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.

Prefix	Symbol	Multiplication factor	
Tera	T	10^{12}	1000 000 000 000
Giga	G	10^{9}	1000 000 000
Mega	M	10^{6}	1000 000
kilo	k	10^{3}	1000
deci	d	10^{-1}	0.1
centi	c	10^{-2}	0.01
milli	m	10^{-3}	0.001
micro	µ	10^{-6}	0.000001
nano	n	10^{-9}	0.00000001
pico	p	10^{-12}	0.00000000000
femto	f	10^{-15}	0.000000000000001

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. 2 minutes.

2. 1.5 hours.

3. 1 tonne.

Activity 3

Re-write the following quantities:

1. 15020 metres in kilometres.

2. 0.00045 grams in micrograms.

3. 0.00045 metres in millimetres.

4. 1055 kilometres in metres.

5. 1800 mega seconds in seconds.

6. 2500 centimetres in millimetres.

Harvard referencing

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 during 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.

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:

https://www.bbc.co.uk/bitesize/guides/zc7k2nb/revision/9

and

https://www.bbc.co.uk/bitesize/guides/zc9tyrd/revision/5

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 – if 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.s

html

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

1. Write a step-by-step guide on how to perform a titration.
2. 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.