INVICTUS TH FORM

A-Level Biology

Welcome to A Level Biology. In this booklet you will be given an overview of what A Level Biology involves and some introductory tasks for you to get back into the swing of things!

What is the subject about?

Biology is the study of living things, but not just animals and plants. You'll also learn about the molecules that make living things work, the cells that they're made from, the systems within plants and animals, and the interconnections between organisms.
Biology is different from physics and chemistry, in that living things don't always do what you expect them to do. You can't test one organism and assume all the rest will be the same, so you'll learn about the statistical analysis behind making claims.
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.

What skills will I need and develop in this course?

You will need numerical, problem solving and communication skills, which you will develop further. You will also develop your practical and research skills – i.e. how to find relevant scientific information and how to analyse and evaluate scientific data.

What can the course lead to in terms of higher education and future careers?

Studying Biology at A-level or degree opens up all sorts of career opportunities.

- Doctor
- Clinical molecular geneticist
- Nature conservation officer
- Pharmacologist
- Research scientist
- Vet
- Secondary school teacher
- Marine biologist
- Dentist.

What we do in A-level Biology

Course overview

Content Overview	Assessment Overview	
Content is split into six teaching modules: • Module 1 – Development of practical skills in biology • Module 2 – Foundations in biology • Module 3 – Exchange and transport • Module 4 – Biodiversity, evolution and disease • Module 5 – Communication, homeostasis and energy • Module 6 – Genetics, evolution and ecosystems Component 01 assesses content from modules 1, 2, 3 and 5. Component 02 assesses content from modules 1, 2, 4 and 6. Component 03 assesses content from all modules (1 to 6).	Biological processes (01) 100 marks 2 hour 15 minutes written paper	**37%** of total A level
	Biological diversity (02) 100 marks 2 hour 15 minutes written paper	**37%** of total A level
	Unified biology (03) 70 marks 1 hour 30 minutes written paper	**26%** of total A level
	Practical Endorsement in biology (04) (non exam assessment)	**Reported separately** (see section 5f)

Extra-Curricular Activities

Birmingham University lectures, STEM, revision classes and A level live lecture.

Biology Advanced Level Useful Information

Equipment

Below are the minimum stationery requirements to successfully cater for your A-level Biology course:

- 2 x A4 folders
- Dividers
- Lined paper
- Scientific Calculator
- Pens
- Pencils
- Ruler
- Rubber
- Highlighters

Websites

These are websites that you should bookmark. They are extremely useful to either help you do additional research, explain a topic you are finding difficult or support your revision program.

1. OCR website www.ocr.org.uk/qualifications/as-a-level-gce-biology-a-h020-h420-from-2015

You will find:

- The specification – this explains exactly what you need to learn for your exams.
- Practice exam papers
- Lists of command words and subject specific vocabulary – so you understand the words to use in exams
- Past papers from the old specification. Some questions won't be relevant to the new AS and A-level so please check with your teacher.
- Maths skills support.

2. Royal Society of Biology www.rcb.co.uk

3. The student room www.thestudentroom.co.uk
Join the A-level Biology forums and share thoughts and idea with other students if you're stuck with your homework.

4. Youtube
YouTube has thousands of Biology videos. Just be careful to look at who produced the video and why because some videos distort the facts. Check the author, date and comments – these help indicate whether the clip is reliable. If in doubt, ask your teacher

Magazines/Articles

You may want to subscribe to:

Focus, New Scientist or Philip Allan updates can help you put the biology you're learning in context.

Summer homework Introductory tasks.

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
luminous intensity	*(not used at A-level)*	candela	cd

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}).
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 time between heart beats
2. The length of a leaf
3. The distance that a migratory bird travelled each year
4. The width of a cheek cell
5. The mass of a rabbit
6. The mass of iron in the body
7. The volume of the trunk of a large tree

Sometimes, there are units that are used that are not combinations of SI units and prefixes.
These are often multiples of units that are helpful to use. For example, one litre is 0.001 m3, or one day is 86 400 seconds.

Activity 2

Choose the most appropriate unit, and estimate the size of each of the following.

1. The mass of an elephant
2. The mass of an earthworm
3. The volume of water in a teardrop
4. The volume of water in a pond
5. The time taken for a sunflower to grow
6. The temperature difference between the blood in the heart and in the ear on a cold da
7. The width of a hair
8. The length that your fingernails grow each day
9. The total length of each of the hairs on your head

Activity 3

Put the following in order of size:

height of an elephant; length of DNA strand; width of a hair; height of a tree; width of a sodium ion; length of a nerve cell; length of a heart; width of a red blood cell; size of a virus; length of a finger; length of a mosquito; length of a human digestive system; width of a field; length of a water molecule.

Important vocabulary for practical work

There are many words used in practical work. You will have come across most of these words in your GCSE studies. It is important you are using the right definition for each word.

Activity 4

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.

Analysing data

Biological investigations often result in large amounts of data being collected. It is important to be able to analyse this data carefully in order to pick out trends.

Activity 5: Mean, media, mode and scatter graphs

A student investigated an area of moorland where succession was occurring. She used quadrats to measure the area covered by different plant species, bare ground and surface water every 10 metres along a transect. She also recorded the depth of soil at each quadrat. Her results are shown in the table.

	Area covered in each quadrat A to E in cm^2				
	A	B	C	D	E
Bog moss	55	40	10	–	–
Bell heather	–	–	–	15	10
Sundew	10	5	–	–	–
Ling	–	–	–	15	20
Bilberry	–	–	–	15	25
Heath grass	–	–	30	10	5
Soft rush	–	30	20	5	5
Sheep's fescue	–	–	25	35	30
Bare ground	20	15	10	5	5
Surface water	15	10	5	–	–
Soil depth / cm	3.2	4.7	8.2	11.5	14.8

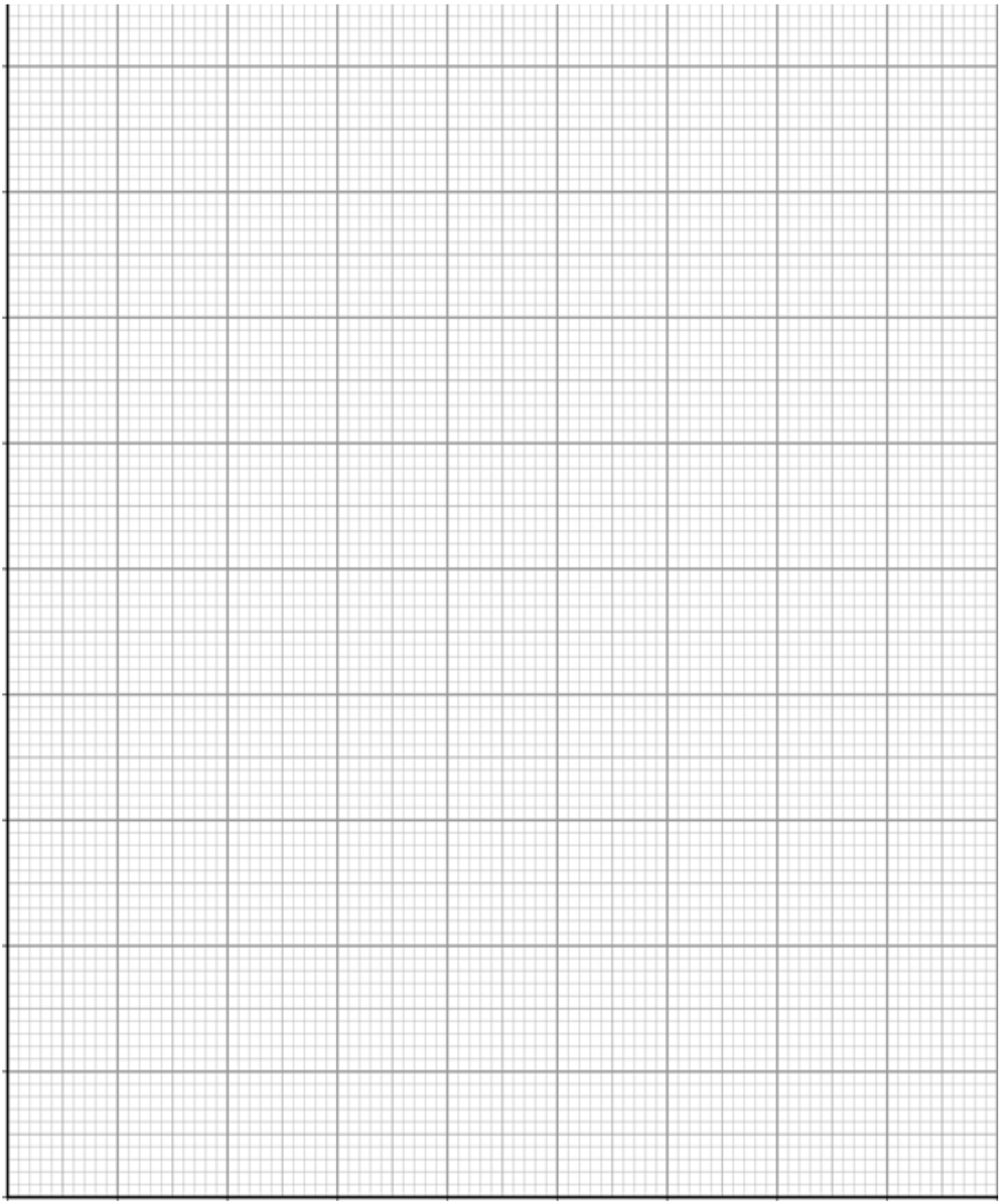
– Indicates zero cover.

Calculate:

1. The mode area of soft rush in the sample.
2. The mean soil depth.
3. The median amount of bare ground in the sample.

Activity 6: Mean, media, mode and scatter graphs (continued)

Use the data from the table to plot a scatter graph of soil depth against the area covered by bare ground, soft rush and bog moss (use different colours or markers for each).



Activity 7: Mean, media, mode and scatter graphs (continued)

What conclusions does your graph suggest?

How confident are you in these conclusions?

Rearch task – Activity 8:

Choose **1** of the following tasks to complete based on your interests.

BIOLOGY Preparation task 1

DNA and the genetic code

In living organisms nucleic acids (DNA and RNA have important roles and functions related to their properties. The sequence of bases in the DNA molecule determines the structure of proteins, including enzymes. The double helix and its four bases store the information that is passed from generation to generation. The sequence of the base pairs adenine, thymine, cytosine and guanine tell ribosomes in the cytoplasm how to construct amino acids into polypeptides and produce every characteristic we see. DNA can mutate leading to diseases including cancer and sometimes anomalies in the genetic code are passed from parents to babies in disease such as cystic fibrosis, or can be developed in unborn foetuses such as Downs Syndrome.

Read the information on these websites: http://www.bbc.co.uk/education/guides/z36mmp3/revision http://www.s-cool.co.uk/a-level/biology/dna-and-genetic-code

And take a look at these videos:
http://ed.ted.com/lessons/the-twisting-tale-of-dna-judith-hauck http://ed.ted.com/lessons/where-do-genes-come-from-carl-zimmer

Task: Produce a wall display to put up in your classroom in September. You might make a poster or do this using PowerPoint or similar Your display should use images, keywords and simple explanations to: Define gene, chromosome, DNA and base pair Describe the structure and function of DNA and RNA Explain how DNA is copied in the body Outline some of the problems that occur with DNA replication and what the consequences of this might be.

Biology Preparation task 2

Evolution

Transfer of genetic information from one generation to the next can ensure continuity of species or lead to variation within a species and possible formation of new species. Reproductive isolation can lead to accumulation of different genetic information in populations potentially leading to formation of new species (speciation). Sequencing projects have read the genomes of organisms ranging from microbes and plants to humans. This allows the sequences of the proteins that derive from the genetic code to be predicted. Gene technologies allow study and alteration of gene function in order to better understand organism function and to design new industrial and medical processes.

Read the information on these websites: http://www.bbc.co.uk/education/guides/z237hyc/revision/4 http://www.s-cool.co.uk/a-level/biology/evolution

And take a look at these videos: http://ed.ted.com/lessons/how-to-sequence-the-human-genome-mark-j-kiel http://ed.ted.com/lessons/the-race-to-sequence-the-human-genome-tien-nguyen

Task: Produce a one page revision guide for an AS Biology student that recaps the key words and concepts in this topic. Your revision guide should: Describe speciation Explain what a genome is Give examples of how this information has already been used to develop new treatments and technologies

Biology preparation task 3

Biodiversity

The variety of life, both past and present, is extensive, but the biochemical basis of life is similar for all living things. Biodiversity refers to the variety and complexity of life and may be considered at different levels. Biodiversity can be measured, for example within a habitat or at the genetic level. Classification is a means of organising the variety of life based on relationships between organisms and is built around the concept of species. Originally classification systems were based on observable features but more recent approaches draw on a wider range of evidence to clarify relationships between organisms. Adaptations of organisms to their environments can be behavioural, physiological and anatomical. Adaptation and selection are major factors in evolution and make a significant contribution to the diversity of living organisms.

Read the information on these websites: http://www.s-cool.co.uk/a-level/biology/ecological-concepts http://www.s-cool.co.uk/a-level/biology/classification

And take a look at these videos: http://ed.ted.com/lessons/why-is-biodiversity-so-important-kim-preshoff http://ed.ted.com/lessons/can-wildlife-adapt-to-climate-change-erin-eastwood

Task: Write a persuasive letter to an MP, organisation or pressure group promoting conservation to maintain biodiversity. Your letter should: Define what is meant by species and classification Describe how species are classified Explain one way scientists can collect data about a habitat, giving an example Explain adaptation and how habitat change may pose a threat to niche species

Biology Preparation task 4

Exchange and Transport

Organisms need to exchange substances selectively with their environment and this takes place at exchange surfaces. Factors such as size or metabolic rate affect the requirements of organisms and this gives rise to adaptations such as specialised exchange surfaces and mass transport systems. Substances are exchanged by passive or active transport across exchange surfaces. The structure of the plasma membrane enables control of the passage of substances into and out of cells

Read the information on these websites:
http://www.s-cool.co.uk/a-level/biology/gas-exchange http://www.s-cool.co.uk/a-level/biology/nutrition-and-digestion/revise-it/human-digestive-system

And take a look at these videos: http://ed.ted.com/lessons/insights-into-cell-membranes-via-dish-detergent-ethan-perlstein http://ed.ted.com/lessons/what-do-the-lungs-do-emma-bryce

Task: Create a poster or display to go in your classroom in September. Your poster should either: compare exchange surfaces in mammals and fish or compare exchange surfaces in the lungs and the intestines. You could use a Venn diagram to do this. Your poster should: Describe diffusion, osmosis and active transport Explain why oxygen and glucose need to be absorbed and waste products removed Compare and contrast your chosen focus.

Biology Preparation task 5

Biological Molecules

Biological molecules are often polymers and are based on a small number of chemical elements. In living organisms carbohydrates, proteins, lipids, inorganic ions and water all have important roles and functions related to their properties. DNA determines the structure of proteins, including enzymes. Enzymes catalyse the reactions that determine structures and functions from cellular to whole-organism level. Enzymes are proteins with a mechanism of action and other properties determined by their tertiary structure. ATP provides the immediate source of energy for biological processes.

Read the information on these websites: http://www.s-cool.co.uk/a-level/biology/biological-molecules-and-enzymes http://www.bbc.co.uk/education/guides/zb739j6/revision

And take a look at these videos:
https://www.youtube.com/watch?v=H8WJ2KENlK0 http://ed.ted.com/lessons/activation-energy-kickstarting-chemical-reactions-vance-kite

Task: Krabbe disease occurs when a person doesn't have a certain enzyme in their body. The disease effects the nervous system. Write a letter to a GP or a sufferer to explain what an enzyme is. Your poster should: Describe the structure of an enzyme Explain what enzymes do inside the body