Coloma Sixth Form

BIOLOGY

We must learn to think not only logically,

but bio-logically.

Specification

Subject 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)

Sections 1– 4 are covered in the first year of the A level and sections 5-8 are covered in the second year.

Aims of the course:

To develop essential knowledge and understanding of different areas of the subject and how they relate to each other.

To develop and demonstrate a deep appreciation of the skills, knowledge and understanding of scientific methods.

To develop competence and confidence in a variety of practical, mathematical and problem solving skills.

To develop an interest in and enthusiasm for the subject, including developing an interest in further study and careers associated with the subject.

To understand how society makes decisions about scientific issues and how the sciences contribute to the success of the economy and society.

The specification is available at:

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

Mathematical Skills

Overall, at least 10% of the marks in assessments for Biology will require the use of mathematical skills. These skills will be applied in the context of Biology and will be at least the standard of higher tier GCSE mathematics.

The following table illustrates the mathematical skills that will be developed during the course.

Arithmetic and numerical computation	**Handling data**	**Algebra**	**Graphs**	**Geometry and trigonometry**
Recognise and make use of appropriate units in calculations Recognise and use expressions in decimal and standard form Use ratios, fractions and percentages Estimate results Use calculators to find and use power, exponential and logarithmic functions	Use an appropriate number of significant figures Find arithmetic means Construct and interpret frequency tables and diagrams, bar charts and histograms Understand simple probability Understand the principles of sampling as applied to scientific data Understand the terms mean, median and mode Use a scatter diagram to identify a correlation between two variables Make order of magnitude calculations Select and use a statistical test Understand measures of dispersion, including standard deviation and range Identify uncertainties in measurements and use simple techniques to determine uncertainty when data are combined	Understand and use the symbols: =, <, <<, >>, >, ∝, . Change the subject of an equation Substitute numerical values into algebraic equations using appropriate units for physical quantities Solve algebraic equations Use logarithms in relation to quantities that range over several orders of magnitude	Translate information between graphical, numerical and algebraic forms Plot two variables from experimental or other data Understand that $y = mx + c$ represents a linear relationship Determine the intercept of a graph Calculate rate of change from a graph showing a linear relationship Draw and use the slope of a tangent to a curve as a measure of rate of change	Calculate the circumferences, surface areas and volumes of regular shapes

Assessments

The table below summarises the examination assessment. Practical skills are also assessed throughout the course.

Paper1	Paper2	Paper3
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**

Practical Assessment

Practical work is at the heart of Biology. There is a rich diet of practical work within A level Biology which is essential to develop students' manipulative skills and understanding of the processes of scientific investigation. It also contributes to teaching and learning of the concepts within the specification.

15% of the marks in the papers will relate to practical work.

All students carry out the required practical activities shown below but in additional we will carry out numerous other practical activities to enhance learning and understanding of each topic as it is taught.

Required activity
Investigation into the effect of a named variable on the rate of an enzyme-controlled reaction
Preparation of stained squashes of cells from plant root tips; set-up and use of an optical microscope to identify the stages of mitosis in these stained squashes and calculation of a mitotic index
Production of a dilution series of a solute to produce a calibration curve with which to identify the water potential of plant tissue
Investigation into the effect of a named variable on the permeability of cell-surface membranes
Dissection of animal or plant gas exchange system or mass transport system or of organ within such a system
Use of aseptic techniques to investigate the effect of antimicrobial substances on microbial growth
Use of chromatography to investigate the pigments isolated from leaves of different plants, e.g. leaves from shade-tolerant and shade-intolerant plants or leaves of different colours
Investigation into the effect of a named factor on the rate of dehydrogenase activity in extracts of chloroplasts
Investigation into the effect of a named variable on the rate of respiration of cultures of single-celled organisms
Investigation into the effect of an environmental variable on the movement of an animal using either a choice chamber or a maze
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
Investigation into the effect of a named environmental factor on the distribution of a given species

What could this qualification lead to?

Biology A level will give you the skills to make connections and associations with all living things around you. Biology literally means the study of life and if that's not important, what is?

Being such a broad topic, you're bound to find a specific area of interest, plus it opens the door to a fantastic range of interesting careers.

Possible careers include:

Doctor

Geneticist

Nature conservation officer

Pharmacologist

Research scientist

Vet

Teacher/lecturer

Marine biologist

Dentist

Science writer

Brewing technologist

Forensic scientist

Toxicologist

Food scientist

Botanist

Environmental health officer

Nurse/midwife

Relevant links to websites for careers

https://www.rsb.org.uk

https://www.grows.ac.uk

https://nationalcareersservice.direct.gov.uk/job-profiles/biologist

https://www.learnhowtobecome.org/science-technology-careers/biology/

www.biology.ox.ac.uk

www.bio.cam.ac.uk

Tips for success in A level Biology

1. Commit key facts to memory on a regular basis.
2. Learn model answers to frequently asked questions.
3. Complete as many past examination questions as possible but scrutinise the mark schemes to ensure correct phrasing and terminology is being used.
4. Learn work on a very regular basis.
5. Review the previous lesson's work before the next lesson.
6. Check and edit your work carefully.
7. Read the textbook and use it to make your own summaries or notes.
8. As you read the textbook or other material, highlight important facts and write down any queries or questions that you need to ask the teacher or investigate further by yourself.
9. Read around the subject. There is a wealth of useful resources online and journals/ magazines aimed at A level students or above e.g. Biological Sciences Review Magazine or The New Scientist.
10. Ensure that all work set is completed and brought to lessons.
11. Ask and answer questions during lessons.
12. Watch science/nature programmes on the television to broaden your knowledge e.g. Planet Earth, Human Planet, Spring watch to name a few.
13. Complete futurelearn courses to enhance and extend your background knowledge. https://www.futurelearn.com/

Summer Work

It is hoped that you find these new topics stimulating. Don't worry, if at this stage, you do not understand absolutely everything you read and find out.

Kindly bring any work to your **first Biology lesson** in September 2022.

Your Biology teachers are looking forward to meeting you.

Task One

Carry out research about the structures (called organelles) inside eukaryotic cells (cells that contain a nucleus).

In particular, discover the structures and functions of:

- Mitochondria
- Chloroplasts in plants
- Ribosomes
- Rough endoplasmic reticulum
- Smooth endoplasmic reticulum
- Lysosomes (a type of Golgi vesicle that releases lysozymes)
- Nucleus and the nucleolus
- Golgi body (or called Golgi apparatus) and Golgi vesicles
- Cell walls, in plants/algae and in fungi
- Cell vacuole in plants
- Cell surface membrane

Produce a booklet to show:

- facts
- key terminology
- explanations
- descriptions
- drawings/diagrams

This work may be hand-written or typed/printed. However**, all diagrams and drawings must be hand-drawn and labelled.** You will need to select and collate the information therefore printing pages directly from websites **will not be acceptable**.

Larger libraries stock suitable books. Also there are many useful websites. If you search using terms such as: *A level biology/ A level biology revision/ eukaryotic cell structure/ cell biology for A level / organelles and A level biology,* then you will find a lot of information.

Task Two

Please print then complete all questions on the sheets shown on the following pages. There are two titles:

- GCSE Biology Checker Task- Biological Molecules
- Basic Skills – Why Are Units Important in Biology?

Please present all work in an organised and neat style

Biological Molecules

Different types of food are needed in correct amounts to maintain a healthy body. The main food groups are **carbohydrates**, **lipids** and **proteins**.

Complete the following task and questions on the sheet:

Task

Complete the table below by placing a tick (✔) if the statement is correct for each food group or a cross (✘) if incorrect.

Statement	Carbohydrate	Lipids	Proteins
Major component found in the plant cell wall – cellulose			
Provides thermal insulation			
Can be either found as fats (animals) or oils (plants)			
Needed to build up muscles in animals			
Main compound used in respiration			
Amino acids are the building blocks			
Made up of fatty acids and glycerol			
Examples include enzymes, hormones and haemoglobin			
Includes glucose, sucrose and starch			
Denature/break down at high temperature			

Questions

1 Name the compound that is the source of energy in respiration.

2 What are built up from amino acids?

3 Which compound serves as a reserve source of energy in plants and animals?

4 What has a structural role in the plant cell wall?

5 List two functions of lipids.

6 What compound is made up of glycerol and fatty acids?

7 This forms compounds that carry oxygen in the blood.

8 Name the storage molecule found in plant cells.

Why are units important in Biology?

In Biology you will be making many observations and measurements that need appropriate units; it is therefore important that a universal system is followed. *Le Système International d'Unités* (abbreviated to SI) is a metric system that is used in science. It ensures that all scientists work in the same standard units.

The table below shows the common measurements you will come across in Biology.

Name	Unit	Symbol
area	square metre	m^2
concentration	moles per cubic decimetre	mol dm^{-3}
energy	Joule	J
length	metre	m
mass	kilogram	kg
pressure	Pascal	Pa
temperature	degree centigrade	°C
time	second	s
volume	cubic decimetre	dm^3

What do prefixes mean?

A prefix can be used for units. This is usually a multiplier for that unit, such as 'kilo', which is 1,000 multiples of the unit – you could have kilometre, kilograms and kilojoules, for example.

Below is a list of the units (some with prefixes) you will need to know.

Name	Symbol
kilometre	km
metre	m
centimetre	cm
millimetre	mm
micrometre	μm
nanometre	nm

From the table above, you can see that nm is the smallest measurement used by the A-level biologist.

- To convert mm to µm, you need to multiply by 1,000.
- To convert µm to nm, you need to multiply by 1,000.
- To convert µm to mm, you need to divide by 1,000.
- To convert nm to µm, you need to divide by 1,000.

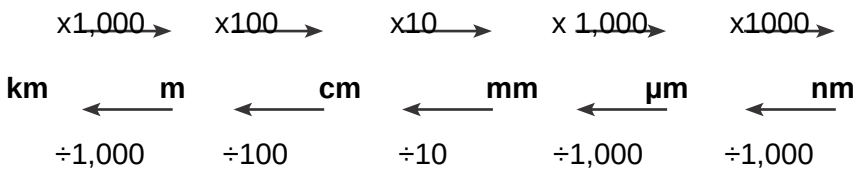
An easy way to remember whether you need to divide or multiply by 1,000 is to…

1 Look at the figure and decide if it needs to be made bigger or smaller.

2 Then look at the units it needs to be converted into.

3 If the figure needs to be made bigger… **MULTIPLY by 1,000 (or 100)**.

4 If the figure needs to be made smaller… **DIVIDE by 1,000 (or 100)**.



You will also need to be confident at recognising each of the units when they are written as **powers of ten** (length has been used in the following table to illustrate this).

Name of unit	Multiple or fraction of a metre
kilometre (km)	10^3 = 1,000m
metre (m)	1m
centimetre (cm)	10^{-2}= 0.01m
millimetre (mm)	10^{-3}= 0.001m
micrometre (µm)	10^{-6}= 0.000001m
nanometre (nm)	10^{-9}= 0.000000001m

Task and Questions

Complete the table below showing conversions between different units. Some have already been done for you, and these should help you to fill in the blanks.

Unit	m	cm	mm	µm	nm
Height of a rosebush		145			
Length of a fingernail			16		
Diameter of a liver cell				25	
Diameter of a cell membrane					10

Questions

1 Convert 75µm into mm.

2 How many nm are there in 450mm?

3 Write 84µm in mm.

4 Susan uses an optical microscope to look at a liver cell that is 4mm in diameter.

a) How would she write this figure in cm?

b) How would she write this figure in um?

5 Write 180µm as mm.

6 Write 0.2mm in µm.

7 Convert 2.5m into µm.

8 George measures the size of the nucleus in a plant cell as 30mm. What is this value in nm?

9 The length of a salmon was measured as 0.5m. Convert this into µm.

10 A holly leaf was measured and had a diameter of 6.5cm.

a) What is its diameter in mm?

b) What is its diameter in m?

c) What is its diameter in nm?

Extra Suggestions for the Summer

Here is a list of books/journals you could read, places you could visit, podcasts you could listen to and programmes you could watch over the summer to enhance your learning in this subject.

Visits

Science Museum*
Anaesthesia Heritage Centre*
British Dental association Museum*
Florence Nightingale Museum
Hunterian Museum*
The Museum at the Royal Institution*
Museum at St. Bartholomew's Museum*
The Old Operating Theatre and Herb Garret
Wellcome Collection*
Natural History Museum*

***free entry but you now have to book a time slot to visit**

Biology background reading/listening/watching

Free resources, and highly recommended:

1. Big Picture
There are 20+ magazines available to read or download for free on a range of topics linked to human health. Most of the magazines are interesting and full of information.

https://bigpictureeducation.com/

or Google…..*all issues of Big Picture Wellcome Trust*

2. The Naked Scientist

https://www.thenakedscientists.com/

There is a very wide range of interesting items from the Naked Scientists based at Cambridge University. There a lots of really interesting podcasts and articles.

3. Ted talks

www.ted.com/talks

Use the science filter. There is a wide range of biology related talks. Some students only view talks related to human biology but there are many, many others which contain fascinating biology.

4. Science podcasts

30 animals that made us smarter
https://www.bbc.co.uk/sounds/play/p07rfjc1

The infinite monkey cage
https://www.bbc.co.uk/programmes/b00snr0w

bbc podcasts
https://www.bbc.co.uk/podcasts

Magazine and journal reading ideas

Biological Sciences Review Magazine (Philip Allan Updates)

New Scientist

BBC Science Focus Magazine

Nature

The Biologist (RSB)

Popular science books relevant to Biology:

You will be asked to select a book to read during June. You will deliver a presentation to your classmates in a Biology lesson. Your Biology teacher will explain the expectations in the summer term. In your Biology lessons, you will have an opportunity to view a range of popular science books to give you ideas for book selection. You can ask to look in the *book box* at any time.

For example:

Richard Dawkins:
The Selfish Gene
The Blind Watchmaker
Unweaving the Rainbow
Climbing Mount Improbable
The Ancestor's Tale

Steve Jones:
Y: The Descent of Men
In the Blood: God, Genes and Destiny
Almost Like a Whale: The 'Origin of Species' Updated
The Language of the genes

Matt Ridley:
Genome: The Autobiography of a Species in 23 Chapters
The Red Queen: Sex and the Evolution of Human Nature
The Language of Genes

Francis Crick:
Discoverer of the Genetic Code
Nature via Nurture: Genes, Experience and What Makes Us Human

James Watson:
DNA: The Secret of Life
The Double Helix: Personal Account of the Discovery of the Structure of DNA.

Lewis Thomas:
The Lives of a Cell: Notes of a Biology Watcher
The Medusa and the Snail: More Notes of a Biology Watcher

Barry Gibb:
The Rough Guide to the Brain (Rough Guides Reference Titles).

Charles Darwin:
The origin of species

Armand Marie Leroi:
Mutants: on the Form, Varieties and Errors of the Human Body.

David S Goodsell:
The Machinery of Life

Ernst Mayr:
This is Biology: The Science of the Living World

George C Williams:
Plan and Purpose in Nature

Steve Pinker:
The Language Instinct

Edward O Wilson: The Diversity of Life