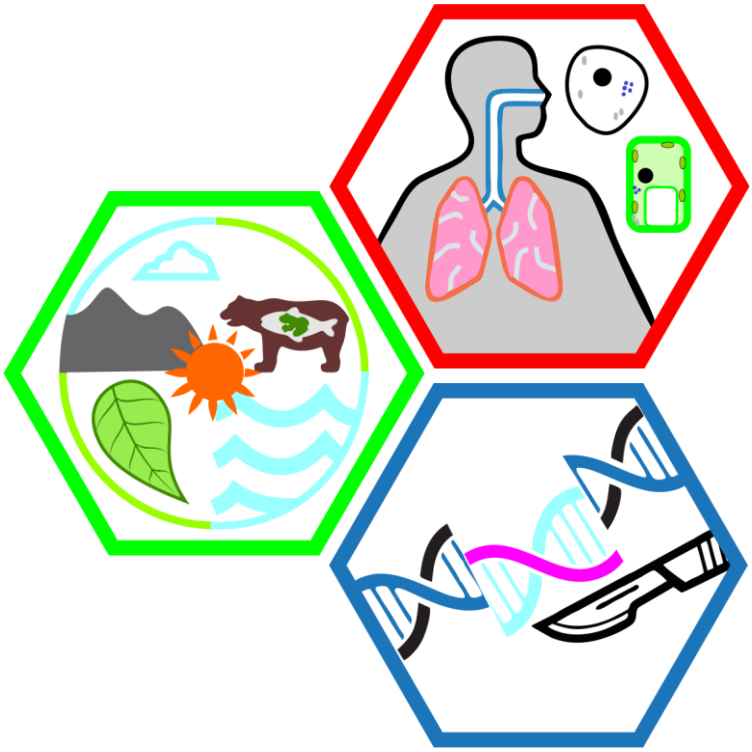
Biology Department

A Level Biology: Summer Tasks

2023-24



Big Ideas:
Organisms
Ecosystems
Genes

Understanding the A level Biology specification and its assessments

The specification is a useful reference document for you. You can download a copy from our website here.

The most relevant parts of the specification for students are the following:

Section 2c: Subject content
Section 5c: How Science Works
Section 5d: Mathematical requirements

In A level Biology, the subject content is arranged into six modules, all of which need to be covered over the 2 years. The six modules are listed below:

1 Development of practical skills in biology

The development of practical skills is a fundamental and integral aspect of the study of any scientific subject. These skills not only enhance learners' understanding of the subject but also serve as a suitable preparation for the demands of studying biology at a higher level. This is assessed through required practicals and practical examination questions.

2 Foundations in biology

This module focuses on the cellular structure, biochemistry, and function shared by living organisms. Learners use microscopy to study cell structure, examine important molecules, enzymes, and membrane structure. They also explore cell division, specialization, and the therapeutic potential of stem cells.

3 Exchange and transport

In this module, learners study gas exchange and transport systems in animals and plants. The importance of surface area to volume ratio in ventilation and gas exchange is emphasized. Examples from terrestrial plants and various animal phyla illustrate the principle.

4 Biodiversity, evolution and disease

In this module, learners explore organism biodiversity, classification, and measurement. It introduces ecology, emphasizing practical techniques and the importance of maintaining biodiversity. Learners also study pathogenic organisms, the evolution of defenses against disease, and the impact on disease treatment. Relationships between organisms, including variation, evolution, and phylogeny, are examined.

5 Communication, homeostasis and energy

This module focuses on how organisms respond to stimuli through communication within the body, which can be chemical or electrical. It covers homeostasis, including temperature and blood control. It also explores the biochemical pathways of photosynthesis and respiration, with a focus on ATP as an energy source.

6 Genetics and evolution

This module covers genes' role in regulating cells and development. It includes heredity, evolution, DNA techniques, medical applications, microorganisms in biotech, ethical considerations, recycling, ecosystem balance, and sustainable resource conservation.

Assessment structure

There are three final examinations you will sit in the summer of Year 13.

We will practice these styles of assessment throughout the course, but there will be two key events where you will sit substantial practice assessments:

- **End of Year 12 assessments – these determine suitability for Year 13 and help inform UCAS predictions**
- **Year 13 mock examinations – final practice opportunity before the real examinations**

Component	Contents	% contribution to final grade
Paper 1 2 hours 15 minutes	Modules 1, 2, 3 and 5	37%
Paper 2 2 hours 15 minutes	Modules 1, 2, 4 and 6	37%
Paper 3 1 hour 30 minutes	All modules	26%
Required practical endorsement	All modules	0% But endorsement required for university study

Other assessment criteria

At least 10% of the marks for A level Biology will assess mathematical skills, which will be equivalent to Level 2 (Higher Tier GCSE Mathematics) or above.

At least 15% of the marks will assess knowledge of practical procedures.

Tasks to complete

The following activities are to be completed between 1st and 18th September. There is no requirement to complete them earlier than this – enjoy the summer holiday!

At some point during the week beginning 18th September, you will sit an assessment that, in part, relies upon completion of these tasks.

Tasks:

1. **REVISE AND REVIEW:**
   Review the topics listed in the summer study specification found between pages 5-11:

   a. **It includes GCSE modules B2 to B5**
   b. **It also includes early parts of A level modules 2.1 and 2.2 that you will learn in the first few weeks of term**

2. **ENROL AND EXAMINE:**
   Performance on these assignments will help us and you determine whether the course is appropriate:

   a. **Join the following Seneca classroom – Click here to enrol**
   b. **Complete the B2: CELL DIVISION recap assignment – Click here**
   c. **Complete the B3: DIGESTION recap assignment – Click here**
   d. **Complete the B4: ORGANISATION (PART 1) recap assignment – Click here**
   e. **Complete the B4: ORGANISATION (PART 2) recap assignment – Click here**
   f. **Complete the B5: COMMUNICABLE DISEASES recap assignment – Click here**

3. **GRADES AND GOALS:**
   Complete an initial survey telling us about your GCSE grades, A level choices and future aims. Only complete this survey after you have successfully enrolled on all of your A level courses – Click here

Revise and Review

The following specification covers the range of topics that might feature in the assessment that will occur in the week beginning 18th September. This assessment will be approximately three weeks into the course and is designed to allow us and you know if you are meeting the academic demands of the course.

It includes mostly GCSE concepts, including modules B2 to B5, as well as the first taught modules from the A level.

Your task is to ensure that you have sufficiently reviewed the GCSE material, and that you have sufficiently learned the A level material – supported by your lessons in the first three weeks.

Modules B2 to B5 from GCSE Biology:

B2: Cell division
The nucleus of a cell contains chromosomes made of DNA molecules. Each chromosome carries a large number of genes.
In body cells the chromosomes are normally found in pairs.
Cells divide in a series of stages called the cell cycle. Students should be able to describe the stages of the cell cycle, including mitosis.
During the cell cycle the genetic material is doubled and then divided into two identical cells.
Before a cell can divide it needs to grow and increase the number of sub-cellular structures such as ribosomes and mitochondria. The DNA replicates to form two copies of each chromosome.
In mitosis one set of chromosomes is pulled to each end of the cell and the nucleus divides. Finally the cytoplasm and cell membranes divide to form two identical cells.
Students need to understand the three overall stages of the cell cycle but do not need to know the different phases of the mitosis stage.
Cell division by mitosis is important in the growth and development of multicellular organisms.
Students should be able to recognise and describe situations in given contexts where mitosis is occurring.
A stem cell is an undifferentiated cell of an organism which is capable of giving rise to many more cells of the same type, and from which certain other cells can arise from differentiation.
Students should be able to describe the function of stem cells in embryos, in adult animals and in the meristems in plants.
Stem cells from human embryos can be cloned and made to differentiate into most different types of human cells.
Stem cells from adult bone marrow can form many types of cells including blood cells.
Meristem tissue in plants can differentiate into any type of plant cell, throughout the life of the plant.
Knowledge and understanding of stem cell techniques are not required.
Treatment with stem cells may be able to help conditions such as diabetes and paralysis.
In therapeutic cloning an embryo is produced with the same genes as the patient. Stem cells from the embryo are not rejected by the patient's body so they may be used for medical treatment.
The use of stem cells has potential risks such as transfer of viral infection, and some people have ethical or religious objections.

Stem cells from meristems in plants can be used to produce clones of plants quickly and economically. • Rare species can be cloned to protect from extinction. • Crop plants with special features such as disease resistance can be cloned to produce large numbers of identical plants for farmers.
Cells are the basic building blocks of all living organisms.
Cells aggregate in the following ways: • A tissue is a group of cells with a similar structure and function. • Organs are aggregations of tissues performing specific functions. • Organs are organised into organ systems, which work together to form organisms.

B3: Organisation and the digestive system
The digestive system is an example of an organ system in which several organs work together to digest and absorb food.
Students should be able to describe the nature of enzyme molecules and relate their activity to temperature and pH changes.
Students should be able to carry out rate calculations for chemical reactions.
Enzymes catalyse specific reactions in living organisms due to the shape of their active site.
Students should be able to use the 'lock and key theory' as a simplified model to explain enzyme action.
Students should be able to recall the sites of production and the action of amylase, proteases and lipases. [Students should be able to understand simple word equations but no chemical symbol equations are required.]
Digestive enzymes convert food into small soluble molecules that can be absorbed into the bloodstream.
Carbohydrases break down carbohydrates to simple sugars. Amylase is a carbohydrase which breaks down starch.
Proteases break down proteins to amino acids.
Lipases break down lipids (fats) to glycerol and fatty acids
The products of digestion are used to build new carbohydrates, lipids and proteins. Some glucose is used in respiration.
Bile is made in the liver and stored in the gall bladder. It is alkaline to neutralise hydrochloric acid from the stomach. It also emulsifies fat to form small droplets which increases the surface area. The alkaline conditions and large surface area increase the rate of fat breakdown by lipase.
Required practical 4: use qualitative reagents to test for a range of carbohydrates, lipids and proteins. To include: Benedict's test for sugars; iodine test for starch; and Biuret reagent for protein.
Required practical 5: investigate the effect of pH on the rate of reaction of amylase enzyme. Students should use a continuous sampling technique to determine the time taken to completely digest a starch solution at a range of pH values. Iodine reagent is to be used to test for starch every 30 seconds. Temperature must be controlled by use of a water bath or electric heater.

B4: Organising plants and animals
Students should know the structure and functioning of the human heart and lungs, including how lungs are adapted for gaseous exchange.
The heart is an organ that pumps blood around the body in a double circulatory system. The right ventricle pumps blood to the lungs where gas exchange takes place. The left ventricle pumps blood around the rest of the body.
Knowledge of the blood vessels associated with the heart is limited to the aorta, vena cava, pulmonary artery, pulmonary vein and coronary arteries. Knowledge of the names of the heart valves is not required.
Knowledge of the lungs is restricted to the trachea, bronchi, alveoli and the capillary network surrounding the alveoli.
The natural resting heart rate is controlled by a group of cells located in the right atrium that act as a pacemaker. Artificial pacemakers are electrical devices used to correct irregularities in the heart rate.
The body contains three different types of blood vessel: • arteries • veins • capillaries
Students should be able to explain how the structure of these vessels relates to their functions.
Students should be able to use and carry out rate calculations for blood flow.
Blood is a tissue consisting of plasma, in which the red blood cells, white blood cells and platelets are suspended. [Students should know the functions of each of these blood components.]
Students should be able to recognise different types of blood cells in a photograph or diagram, and explain how they are adapted to their functions.
Students should be able to evaluate the advantages and disadvantages of treating cardiovascular diseases by drugs, mechanical devices or transplant.
In coronary heart disease layers of fatty material build up inside the coronary arteries, narrowing them. This reduces the flow of blood through the coronary arteries, resulting in a lack of oxygen for the heart muscle. Stents are used to keep the coronary arteries open. Statins are widely used to reduce blood cholesterol levels which slows down the rate of fatty material deposit.
In some people heart valves may become faulty, preventing the valve from opening fully, or the heart valve might develop a leak. Students should understand the consequences of faulty valves. Faulty heart valves can be replaced using biological or mechanical valves.
In the case of heart failure a donor heart, or heart and lungs can be transplanted. Artificial hearts are occasionally used to keep patients alive whilst waiting for a heart transplant, or to allow the heart to rest as an aid to recovery.

Students should be able to explain how the structures of plant tissues are related to their functions. Plant tissues include: • epidermal tissues • palisade mesophyll • spongy mesophyll • xylem and phloem • meristem tissue found at the growing tips of shoots and roots.
The leaf is a plant organ. Knowledge limited to epidermis, palisade and spongy mesophyll, xylem and phloem, and guard cells surrounding stomata.
Students should be able to explain how the structure of root hair cells, xylem and phloem are adapted to their functions.
Students should be able to explain the effect of changing temperature, humidity, air movement and light intensity on the rate of transpiration.
Students should be able to understand, use and calculate rate of transpiration.
Students should be able to: • translate information between graphical and numerical form • plot and draw appropriate graphs, selecting appropriate scales for axes • extract and interpret information from graphs, charts and tables.
The roots, stem and leaves form a plant organ system for transport of substances around the plant.
Students should be able to describe the process of transpiration and translocation, including the structure and function of the stomata.
Root hair cells are adapted for the efficient uptake of water by osmosis, and mineral ions by active transport.
Xylem tissue transports water and mineral ions from the roots to the stems and leaves. It is composed of hollow tubes strengthened by lignin adapted for the transport of water in the transpiration stream.
The role of stomata and guard cells are to control gas exchange and water loss.
Phloem tissue transports dissolved sugars from the leaves to the rest of the plant for immediate use or storage. The movement of food molecules through phloem tissue is called translocation.
Phloem is composed of tubes of elongated cells. Cell sap can move from one phloem cell to the next through pores in the end walls. [Detailed structure of phloem tissue or the mechanism of transport is not required.]

B5: Communicable diseases
Students should be able to explain how diseases caused by viruses, bacteria, protists and fungi are spread in animals and plants..
Students should be able to explain how the spread of diseases can be reduced or prevented.
Pathogens are microorganisms that cause infectious disease. Pathogens may be viruses, bacteria, protists or fungi. They may infect plants or animals and can be spread by direct contact, by water or by air.
Bacteria and viruses may reproduce rapidly inside the body.
Bacteria may produce poisons (toxins) that damage tissues and make us feel ill.

Viruses live and reproduce inside cells, causing cell damage
Bacteria multiply by simple cell division (binary fission) as often as once every 20 minutes if they have enough nutrients and a suitable temperature
Bacteria can be grown in a nutrient broth solution or as colonies on an agar gel plate
Uncontaminated cultures of microorganisms are required for investigating the action of disinfectants and antibiotics.
Students should be able to describe how to prepare an uncontaminated culture using aseptic technique. They should be able to explain why: • petri dishes and culture media must be sterilised before use • inoculating loops used to transfer microorganisms to the media must be sterilised by passing them through a flame • the lid of the Petri dish should be secured with adhesive tape and stored upside down • in school laboratories, cultures should generally be incubated at 25°C.
Students should be able to calculate cross-sectional areas of colonies or clear areas around colonies using πr^2.
Students should be able to calculate the number of bacteria in a population after a certain time if given the mean division time. Students should be able to express the answer in standard form.
Measles is a viral disease showing symptoms of fever and a red skin rash. Measles is a serious illness that can be fatal if complications arise. For this reason most young children are vaccinated against measles. The measles virus is spread by inhalation of droplets from sneezes and coughs.
HIV initially causes a flu-like illness. Unless successfully controlled with antiretroviral drugs the virus attacks the body's immune cells. Late stage HIV infection, or AIDS, occurs when the body's immune system becomes so badly damaged it can no longer deal with other infections or cancers. HIV is spread by sexual contact or exchange of body fluids such as blood which occurs when drug users share needles.
Tobacco mosaic virus (TMV) is a widespread plant pathogen affecting many species of plants including tomatoes. It gives a distinctive 'mosaic' pattern of discolouration on the leaves which affects the growth of the plant due to lack of photosynthesis.
Salmonella food poisoning is spread by bacteria ingested in food, or on food prepared in unhygienic conditions. In the UK, poultry are vaccinated against Salmonella to control the spread. Fever, abdominal cramps, vomiting and diarrhoea are caused by the bacteria and the toxins they secrete.
Gonorrhoea is a sexually transmitted disease (STD) with symptoms of a thick yellow or green discharge from the vagina or penis and pain on urinating. It is caused by a bacterium and was easily treated with the antibiotic penicillin until many resistant strains appeared. Gonorrhoea is spread by sexual contact. The spread can be controlled by treatment with antibiotics or the use of a barrier method of contraception such as a condom.
Rose black spot is a fungal disease where purple or black spots develop on leaves, which often turn yellow and drop early. It affects the growth of the plant as photosynthesis is reduced. It is spread in the environment by water or wind. Rose black spot can be treated by using fungicides and/or removing and destroying the affected leaves.

The pathogens that cause malaria are protists. The malarial protist has a life cycle that includes the mosquito. Malaria causes recurrent episodes of fever and can be fatal. The spread of malaria is controlled by preventing the vectors, mosquitos, from breeding and by using mosquito nets to avoid being bitten.
Students should be able to describe the non-specific defence systems of the human body against pathogens, including the: • skin • Nose • trachea and bronchi • stomach.
Students should be able to explain the role of the immune system in the defence against disease.
If a pathogen enters the body the immune system tries to destroy the pathogen.
White blood cells help to defend against pathogens by: • phagocytosis • antibody production • antitoxin production.

Module 2.1 from A level Biology
CELL STRUCTURE

(a)	the use of microscopy to observe and investigate different types of cell and cell structure in a range of eukaryotic organisms	To include an appreciation of the images produced by a range of microscopes; light microscope, transmission electron microscope, scanning electron microscope and laser scanning confocal microscope.
(b)	the preparation and examination of microscope slides for use in light microscopy	Including the use of an eye piece graticule and stage micrometer.
(c)	the use of staining in light microscopy	To include the use of differential staining to identify different cellular components and cell types.
(d)	the representation of cell structure as seen under the light microscope using drawings and annotated diagrams of whole cells or cells in sections of tissue	

(e)	the use and manipulation of the magnification formula	$magnification = \frac{image\ size}{object\ size}$
(f)	the difference between magnification and resolution	To include an appreciation of the differences in resolution and magnification that can be achieved by a light microscope, a transmission electron microscope and a scanning electron microscope.
(g)	the ultrastructure of eukaryotic cells and the functions of the different cellular components	To include the following cellular components and an outline of their functions: nucleus, nucleolus, nuclear envelope, rough and smooth endoplasmic reticulum (ER), Golgi apparatus, ribosomes, mitochondria, lysosomes, chloroplasts, plasma membrane, centrioles, cell wall, flagella and cilia.

Module 2.2 from A level Biology
BIOLOGICAL MOLECULES

(a)	how hydrogen bonding occurs between water molecules, and relate this, and other properties of water, to the roles of water for living organisms	A range of roles that relate to the properties of water, including solvent, transport medium, coolant and as a habitat **AND** roles illustrated using examples of prokaryotes and eukaryotes.
(b)	the concept of monomers and polymers and the importance of condensation and hydrolysis reactions in a range of biological molecules	
(c)	the chemical elements that make up biological molecules	C, H and O for carbohydrates C, H and O for lipids C, H, O, N and S for proteins C, H, O, N and P for nucleic acids
(d)	the ring structure and properties of glucose as an example of a hexose monosaccharide and the structure of ribose as an example of a pentose monosaccharide	To include the structural difference between an α- and a β-glucose molecule **AND** the difference between a hexose and a pentose monosaccharide.
(e)	the synthesis and breakdown of a disaccharide and polysaccharide by the formation and breakage of glycosidic bonds	To include the disaccharides sucrose, lactose and maltose.