Getting Ready for...

# KS5 (A Level) Biology

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# Activities

## 1. Monomers and polymers, carbohydrates, lipids and proteins

It is inescapable that success in A level Biology also requires a good understanding of chemistry. This first section requires you to think about your chemistry.

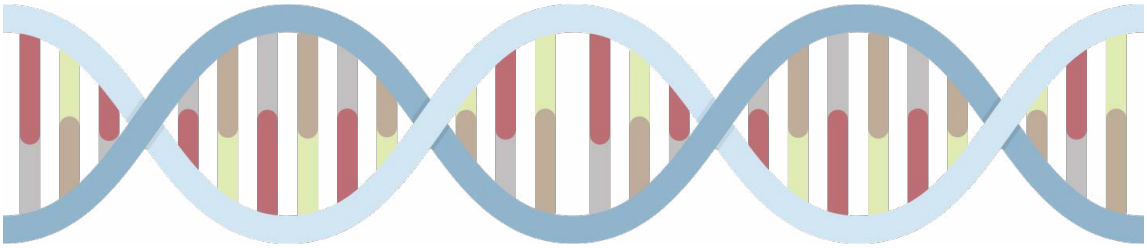
- Can you explain the difference between monomers and polymers and name examples in a biological context, such as amino acids and proteins, nucleic acids and DNA?
- Can you explain what is meant by a condensation reaction and hydrolysis?
- Are you able to describe the elements found in carbohydrates, lipids and proteins? Can you explain the importance of sugars, fatty acids, glycerol and amino acids in the breakdown and synthesis of carbohydrates, lipids and proteins? Can you describe the qualitative tests for carbohydrates, lipids and proteins that you will have carried out in a required practical?

## 2. Enzymes

- Are you clear that many proteins are enzymes and all enzymes are proteins? The action of enzymes is dependent on their 3D shape. Can you explain the terms enzyme, substrate and active site and are you familiar with the Lock and Key model? Practise sketching diagrams that show this.
- Can you explain why enzymes are sensitive to conditions of temperature and pH? Practise sketching graphs that show the relationship between rate of reaction (involving enzymes) at different temperatures and pHs.
- Can you name the enzymes that are involved in digestion? Can you name their sites of action and production? Can you name their substrates and products? Can you describe the investigation of the effect of amylase that you will have carried out in a required practical?

## 3. DNA and the genetic code

- Learn the meanings of the terms gamete, chromosome, gene, genome, allele, genotype, phenotype, karyotype, dominant, recessive, homozygous and heterozygous.
- Can you describe the structure of DNA? This includes the complementary pairing of bases and non-coding parts of the molecule. You need to be able to explain how a triplet of 3 bases codes for a certain amino acid and how the (primary) sequence of amino acids leads to the formation of the protein.
- Can you describe how proteins are synthesised from amino acids on ribosomes and then fold into a 3D shape which is vital for their function?



## 4. Genetic diversity and adaptation

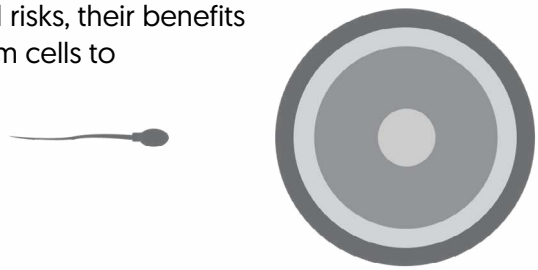
- Can you describe what variation is and how it arises, including the influence of mutation on phenotypes and on species?
- Can you explain the theory of evolution by natural selection and in turn how new species are formed (speciation)?
- Can you describe how our understanding of genetics has changed over time, including the work of Gregor Mendel and the importance of this?
- Are you able to describe and explain the process of selective breeding? Learn specific examples of traits that we have selectively bred into animals and plants such as milk production in cattle, meat production in pigs, and hardiness to drought in crops.
- Learn how we conduct genetic engineering and the use enzymes and vectors in the process. You will need to be able to interpret diagrams and label them, so practise doing that. Can you explain the benefits and concerns relating to genetic engineering and name examples of where we have carried this out?
- Can you explain what is meant by cloning and describe different examples of where we carry this out, such as tissue culture, cuttings, embryo transplants and adult cell cloning?
- Can you explain the evidence for evolution and causes of extinction? Can you describe what fossils are and how they are formed?

## 5. The features of prokaryotic and eukaryotic cells and how we observe and study them

- Can you describe the structures found in prokaryotic and eukaryotic cells and explain their functions? Can you name examples of specialised cells and explain in what ways they are specialised? Practise drawing and labelling both specialised animal and plant cells such as sperm cells, epithelial cells, red blood cells and palisade cells.
- Are you able to explain how to focus a light microscope to create a clear image of a cell slide? Practise labelling a diagram of a microscope so that you can learn the names of the parts. Can you explain how to use a graticule to measure the size a cell and are you able to describe the relative size of different cells? You will need to be able to calculate magnitude and magnification and estimate sizes of structures within cells.
- Learn the definitions of magnification and resolution. Can you compare the magnification and resolution of a light and an electron microscope?
- Can you describe how bacteria reproduce and the conditions required? Can you describe how to make an uncontaminated culture and explain the reasons for the steps taken in doing so? Yo should also be able to describe how to carry out an investigation of the effect of antibiotics on bacterial cultures grown on agar plates.
- Can you calculate cross-sectional areas or areas around colonies using $\pi \times r^2$ and calculate the number of bacteria in a colony given division time? Can you express your answers in standard form?

## 6. Cell division

- Can you define gene, chromosome, DNA and nucleus? Can you describe how the chromosomes are arranged in human body cells and the function of the sex chromosomes? Can you explain how sex is determined? Practise genetic crosses that show sex inheritance and practise interpreting examples of different species karyotypes (usually in the context of body cells and sex cells) when presented with them in diagrams or tables.
- Are you able to describe the processes involved in the cell cycle, including mitosis?
- Can you describe and explain the stages of meiosis and compare meiosis with mitosis?
- Can you describe stem cells, their uses and risks, their benefits and the possible ethical issues of using stem cells to treat some conditions?



## 7. Transport across cell membranes and mass transport

- Can you explain diffusion using the idea of particles and predict the net movement of molecules in different situations? Are you able to relate this to being a passive process (not energy requiring)? Do you understand that osmosis is the movement of water across a semi-permeable membrane from an area of low solute concentration to one of high? Can you interpret diagrams that show osmosis and predict net movement of water and the effect? Practise drawing diagrams that show osmosis, perhaps with Visking tubing to model it.
- Can you describe the process of osmosis and calculate water uptake and percentage gain/loss in mass? Can you describe an investigation that you undertook to study the effect of concentration of sugar or salt on the mass of plant tissue? Practise drawing the net flow of water in different scenarios and look at questions that ask you to predict the outcomes of different strength solutions.
- Can you explain what is meant by active transport and the difference between active transport, diffusion and osmosis?
- Can you describe and explain what is meant by surface area:volume ratio and can you calculate it? Do so for cubes of different sizes: try 1–5 cm sides. Can you explain how exchange surfaces are adapted to increase their efficiency and name examples, such as the villi in the small intestine? Create a list of the exchange surfaces, for example, gut, roots, kidney, lungs and gills and list how each is adapted to improve exchange (and what is being exchanged).

## 8. Respiration and photosynthesis

- Can you write the word equations that summarise aerobic and anaerobic respiration and photosynthesis? Make sure that you are familiar with the formulas for carbon dioxide, oxygen, glucose and water.
- Can you compare aerobic and anaerobic respiration and the need for oxygen, the different products and amounts of energy released?
- Can you explain why photosynthesis is an endothermic reaction? Can you explain how the limiting factors affect the rate of photosynthesis? Practise sketching the graphs that show the limiting effects of light, carbon dioxide and temperature and be able to relate these to situations like the economics of growth in greenhouses.
  Make sure you are able to describe an experiment investigating the effect of light on pondweed and to explain the steps taken and possible limitations of the experiment.
- Can you explain what metabolism is and can you describe what plants do with the glucose that they make during photosynthesis?

## 9. Gas exchange, digestion and mass transport

- Can you describe how a leaf is adapted for gas exchange, including the role of stomata? Sketch a section through a leaf and label it and identify adaptations that help with photosynthesis. Make sure that you know the functions of the epidermis, palisade cells, the spongy mesophyll, air spaces, xylem, phloem and the meristem.
- Can you describe the processes of transpiration and translocation in plants, the factors that affect transpiration and adaptations of the leaf to reduce it?
- Can you describe the structure and function of the parts of the human heart and lungs? Practise drawing and labelling a human heart and the different types of blood vessels; capillaries, veins and arteries. Can you explain how the heart moves blood around the body and the function of the different components of blood?
- Can you describe how the digestive system works (and name the parts)? Can you explain how the products of digestion are used? Can you describe how the body responds to changes in blood glucose level and how the hormones insulin and glucagon interact to control blood sugar levels?

## 10. Immunity and the fight against disease

- Can you explain how antibiotic resistance has arisen and spread (relate this to natural selection) and how we are trying to reduce, control and combat this?
- Can you explain what pathogens are and how they are spread and cause damage in the body? Learn examples of viral, bacterial, fungal and protist pathogens. Can you describe defences that stop them entering the body?
- Can you describe how white cells destroy pathogens? Can you describe what monoclonal antibodies are, how they are produced and why they are useful?
- Can you explain how vaccination works?
- How are antibiotics and painkillers used to treat diseases, how are they different and what are their limitations?
- Can you describe how drugs for the treatment of disease have changed over time and how they are developed, including pre-clinical testing and clinical trials?