Year 9 AQA GCSE Biology Revision Checklist

Use this booklet to help you with your revision in preparation for your year 9 Biology exam and final examinations.

This is the work that you will have covered by the end of year 9.
The extension paper statements are highlighted in bold

How can you use this document to help you revise?
By looking at this document you can see the extent of the work that you need to fully cover and revise before you sit your year 9 exams. This checklist will help you to track your progress throughout the year and plan your revision.
Careful study and use of this document will ensure that you have sufficient time to cover all the work well before the exam.

BIOLOGY

Cell structure

Cells are the basic unit of all forms of life. In this section we explore how structural differences between types of cells enables them to perform specific functions within the organism. These differences in cells are controlled by genes in the nucleus. For an organism to grow, cells must divide by mitosis producing two new identical cells. If cells are isolated at an early stage of growth before they have become too specialised, they can retain their ability to grow into a range of different types of cells. This phenomenon has led to the development of stem cell technology. This is a new branch of medicine that allows doctors to repair damaged organs by growing new tissue from stem cells.

			
Plant and animal cells (eukaryotic cells) have a cell membrane, cytoplasm and genetic material enclosed in a nucleus.			
Bacterial cells (prokaryotic cells) are much smaller in comparison. They have cytoplasm and a cell membrane surrounded by a cell wall. The genetic material is not enclosed in a nucleus. It is a single DNA loop and there may be one or more small rings of DNA called plasmids.			
Students should be able to demonstrate an understanding of the scale and size of cells and be able to make order of magnitude calculations, including the use of standard form**.**			

Animal and plant cells

Students should be able to explain how the main sub-cellular structures, including the nucleus, cell membranes, mitochondria, chloroplasts in plant cells and plasmids in bacterial cells are related to their functions.			
Most animal cells have the following parts: • a nucleus, cytoplasm, a cell membrane, mitochondria, ribosomes. In addition to the parts found in animal cells, plant cells often have: • chloroplasts, a permanent vacuole filled with cell sap.			
Plant and algal cells also have a cell wall made of cellulose, which strengthens the cell.			
Students should be able to use estimations and explain what they should be used to judge the relative size or area of sub-cellular structures			

Cell specialisation

Students should be able to, when provided with appropriate information, explain how the structure of different types of cell relate to their function in a tissue, an organ or organ system, or the whole organism. Cells may be specialised to carry out a particular function: • sperm cells, nerve cells and muscle cells in animals • root hair cells, xylem and phloem cells in plants			

Cell differentiation

Students should be able to explain the importance of cell differentiation. As an organism develops, cells differentiate to form different types of cells.			

• Most types of animal cell differentiate at an early stage. • Many types of plant cells retain the ability to differentiate throughout life.			
In mature animals, cell division is mainly restricted to repair and replacement.			
As a cell differentiates it acquires different sub-cellular structures to enable it to carry out a certain function. It has become a specialised cell			
Microscopy			
Students should be able to: • understand how microscopy techniques have developed over time			
• explain how electron microscopy has increased understanding of sub-cellular structures. Limited to the differences in magnification and resolution			
An electron microscope has much higher magnification and resolving power than a light microscope. This means that it can be used to study cells in much finer detail. This has enabled biologists to see and understand many more sub-cellular structures			
Students should be able to carry out calculations involving magnification, real size and image size using the formula **magnification = size of image / size of real object**			
Students should be able to express answers in standard form if appropriate			
Culturing microorganisms			
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.			
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 and college laboratories, cultures should be incubated at a maximum temperature of 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.			

Cell division			
Chromosomes			
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			
Mitosis and 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.			
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			
Stem cells			
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			
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.			

Transport in cells			
Diffusion			
Substances may move into and out of cells across the cell membranes via diffusion.			
Diffusion is the spreading out of the particles of any substance in solution, or particles of a gas, resulting in a net movement from an area of higher concentration to an area of lower concentration.			
Some of the substances transported in and out of cells by diffusion are **oxygen** and **carbon dioxide** in gas exchange, and of the waste product **urea** from cells into the blood plasma for excretion in the kidney.			
Students should be able to explain how factors affect the rate of diffusion.			
Factors which affect the rate of diffusion are: • the difference in concentrations (concentration gradient) • the temperature • the surface area of the membrane.			
A single-celled organism has a relatively large surface area to volume ratio. This allows sufficient transport of molecules into and out of the cell to meet the needs of the organism.			
Students should be able to calculate and compare surface area to volume ratios.			
Students should be able to explain the need for exchange surfaces and a transport system in multicellular organisms in terms of surface area to volume ratio			
Students should be able to explain how the small intestine and lungs in mammals, gills in fish, and the roots and leaves in plants, are adapted for exchanging materials.			
In multicellular organisms, surfaces and organ systems are specialised for exchanging materials. This is to allow sufficient molecules to be transported into and out of cells for the organism's needs. The effectiveness of an exchange surface is increased by: • having a large surface area • a membrane that is thin, to provide a short diffusion path • (in animals) having an efficient blood supply • (in animals, for gaseous exchange) being ventilated			
Osmosis			
Water may move across cell membranes via osmosis. Osmosis is the diffusion of water from a dilute solution to a concentrated solution through a partially permeable membrane.			
Students should be able to: • use simple compound measures of rate of water uptake • use percentiles • calculate percentage gain and loss of mass of plant tissue			
Students should be able to plot, draw and interpret appropriate graphs.			
Investigate the effect of a range of concentrations of salt or sugar solutions on the mass of plant tissue.			

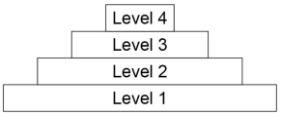
Active transport			
Active transport moves substances from a more dilute solution to a more concentrated solution (against a concentration gradient). This requires energy from respiration. Active transport allows mineral ions to be absorbed into plant root hairs from very dilute solutions in the soil. Plants require ions for healthy growth. It also allows sugar molecules to be absorbed from lower concentrations in the gut into the blood which has a higher sugar concentration. Sugar molecules are used for cell respiration.			
Students should be able to: • describe how substances are transported into and out of cells by diffusion, osmosis and active transport • explain the differences between the three processes			
Organisation			
In this section we will learn about the human digestive system which provides the body with nutrients and the respiratory system that provides it with oxygen and removes carbon dioxide. In each case they provide dissolved materials that need to be moved quickly around the body in the blood by the circulatory system. Damage to any of these systems can be debilitating if not fatal. Although there has been huge progress in surgical techniques, especially with regard to coronary heart disease, many interventions would not be necessary if individuals reduced their risks through improved diet and lifestyle. We will also learn how the plant's transport system is dependent on environmental conditions to ensure that leaf cells are provided with the water and carbon dioxide that they need for photosynthesis			
Principles of organisation			
Cells are the basic building blocks of all living organisms. 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.			
Animal tissues, organs and organ systems			
The human digestive system			
This section assumes knowledge of the digestive system studied in Key Stage 3 science including the structure of the digestive system and the role of digestion.			
Students should be able to describe and explain the role of organs in the digestive system			
The digestive system is an example of an organ system in which several organs work together to digest and absorb food.			
How small intestine is adapted for absorption, including the role of villi			
Students should be able to relate knowledge of enzymes to Metabolism (biochemical molecules and their reactions)			
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			
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.			
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			
Metabolism			
Students should be able to explain the importance of sugars, amino acids, fatty acids and glycerol in the synthesis and breakdown of carbohydrates, proteins and lipids.			
Metabolism is the sum of all the reactions in a cell or the body. The energy transferred by respiration in cells is used by the organism for the continual enzyme controlled processes of metabolism that synthesise new molecules.			
Metabolism includes: • conversion of glucose to starch, glycogen and cellulose • the formation of lipid molecules from a molecule of glycerol and three molecules of fatty acids • the use of glucose and nitrate ions to form amino acids which in turn are used to synthesise proteins • respiration • breakdown of excess proteins to form urea for excretion.			

Ecology			
The Sun is a source of energy that passes through ecosystems. Materials including carbon and water are continually recycled by the living world, being released through respiration of animals, plants and decomposing microorganisms and taken up by plants in photosynthesis. All species live in ecosystems composed of complex communities of animals and plants dependent on each other and that are adapted to particular conditions, both abiotic and biotic. These ecosystems provide essential services that support human life and continued development. In order to continue to benefit from these services humans need to engage with the environment in a sustainable way. In this section we will explore how humans are threatening biodiversity as well as the natural systems that support it. We will also consider some actions we need to take to ensure our future health, prosperity and well-being.			
Adaptations, interdependence and competition			
Communities			
Students should be able to describe: • different levels of organisation in an ecosystem from individual organisms to the whole ecosystem			
• the importance of interdependence and competition in a community. Students should be able to, when provided with appropriate information:			
Suggest the factors for which organisms are competing in a given habitat			
Suggest how organisms are adapted to the conditions in which they live.			
An ecosystem is the interaction of a community of living organisms (biotic) with the non-living (abiotic) parts of their environment			
To survive and reproduce, organisms require a supply of materials from their surroundings and from the other living organisms there.			
Plants in a community or habitat often compete with each other for light and space, and for water and mineral ions from the soil.			
Animals often compete with each other for food, mates and territory.			
Within a community each species depends on other species for food, shelter, pollination, seed dispersal etc. If one species is removed it can affect the whole community. This is called interdependence. A stable community is one where all the species and environmental factors are in balance so that population sizes remain fairly constant			
Students should be able to extract and interpret information from charts, graphs and tables relating to the interaction of organisms within a community			
Abiotic factors			
Students should be able to explain how a change in an abiotic factor would affect a given community given appropriate data or context. Abiotic (non-living) factors which can affect a community are: • light intensity • temperature • moisture levels • soil pH and mineral content • wind intensity and direction • carbon dioxide levels for plants			

• oxygen levels for aquatic animals			
Students should be able to extract and interpret information from charts, graphs and tables relating to the effect of abiotic factors on organisms within a community			
Biotic factors			
Students should be able to explain how a change in a biotic factor might affect a given community given appropriate data or context. Biotic (living) factors which can affect a community are: • availability of food • new predators arriving • new pathogens • one species outcompeting another so the numbers are no longer sufficient to breed.			
Students should be able to extract and interpret information from charts, graphs and tables relating to the effect of biotic factors on organisms within a community.			
Adaptations			
Students should be able to explain how organisms are adapted to live in their natural environment, given appropriate information.			
Organisms have features (adaptations) that enable them to survive in the conditions in which they normally live. These adaptations may be structural, behavioural or functional			
Some organisms live in environments that are very extreme, such as at high temperature, pressure, or salt concentration. These organisms are called extremophiles. Bacteria living in deep sea vents are extremophiles			
Organisation of an ecosystem			
Levels of organisation			
Students should understand that photosynthetic organisms are the producers of biomass for life on Earth.			
Feeding relationships within a community can be represented by food chains. All food chains begin with a producer which synthesises molecules. This is usually a green plant or alga which makes glucose by photosynthesis.			
A range of experimental methods using transects and quadrats are used by ecologists to determine the distribution and abundance of species in an ecosystem.			
In relation to abundance of organisms students should be able to: • understand the terms mean, mode and median • calculate arithmetic means • plot and draw appropriate graphs selecting appropriate scales for axes.			
Producers are eaten by primary consumers, which in turn may be eaten by secondary consumers and then tertiary consumers.			
Consumers that kill and eat other animals are predators, and those eaten are prey. In a stable community the numbers of predators and prey rise and fall in cycles.			
Students should be able to interpret graphs used to model these cycles.			

How materials are cycled			
• recall that many different materials cycle through the abiotic and biotic components of an ecosystem			
• explain the importance of the carbon and water cycles to living organisms.			
All materials in the living world are recycled to provide the building blocks for future organisms			
The carbon cycle returns carbon from organisms to the atmosphere as carbon dioxide to be used by plants in photosynthesis.			
The water cycle provides fresh water for plants and animals on land before draining into the seas. Water is continuously evaporated and precipitated.			
Students should be able to explain the role of microorganisms in cycling materials through an ecosystem by returning carbon to the atmosphere as carbon dioxide and mineral ions to the soil.			
Decomposition			
Students should be able to explain how temperature, water and availability of oxygen affect the rate of decay of biological material			
Students should be able to: • calculate rate changes in the decay of biological material • translate information between numerical and graphical form • plot and draw graphs selecting appropriate scales for the axes.			
Gardeners and farmers try to provide optimum conditions for rapid decay of waste biological material. The compost produced is used as a natural fertiliser for growing garden plants or crops.			
Anaerobic decay produces methane gas. Biogas generators can be used to produce methane gas as a fuel.			
Investigate the effect of temperature on the rate of decay of fresh milk by measuring pH change.			
Impact of environmental change			
Students should be able to evaluate the impact of environmental changes on the distribution of species in an ecosystem given appropriate information.			
Environmental changes affect the distribution of species in an ecosystem. These changes include: • temperature • availability of water • composition of atmospheric gases. The changes may be seasonal, geographic or caused by human interaction			
Trophic levels in an ecosystem			
Trophic levels			
Students should be able to describe the differences between the trophic levels of organisms within an ecosystem.			
Trophic levels can be represented by numbers, starting at level 1 with plants and algae. Further trophic levels are numbered subsequently according to how far the organism is along the food chain. Level 1: Plants and algae make their own food and are called producers. Level 2: Herbivores eat plants/algae and are called primary consumers.			

Level 3: Carnivores that eat herbivores are called secondary consumers. Level 4: Carnivores that eat other carnivores are called tertiary consumers.			
Apex predators are carnivores with no predators.			
Decomposers break down dead plant and animal matter by secreting enzymes into the environment. Small soluble food molecules then diffuse into the microorganism.			
Pyramids of biomass			
Pyramids of biomass can be constructed to represent the relative amount of biomass in level of a food chain. Trophic level 1 is at the bottom of the pyramid.  each			
Students should be able to construct accurate pyramids of biomass from appropriate data.			
Transfer of biomass			
Students should be able to: • describe pyramids of biomass • explain how biomass is lost between the different trophic levels.			
Producers are mostly plants and algae which transfer about 1% of the incident energy from light for photosynthesis			
Only approximately 10% of the biomass from each trophic level is transferred to the level above it. Losses of biomass are due to: • not all the ingested material is absorbed, some is egested as faeces • some absorbed material is lost as waste, such as carbon dioxide and water in respiration and water and urea in urine. • Large amounts of glucose are used in respiration.			
Students should be able to calculate the efficiency of biomass transfers between trophic levels by percentages or fractions of mass.			
Students should be able to explain how this affects the number of organisms at each trophic level.			

Independent variable	The variable that you change
Dependent variable	The variable that you measure
Controlled Variables	Variables that must be monitored and controlled to ensure a fair (valid) test
Control	A test carried out which can be used to assess the impact of the independent variable on the results.
Error	The difference between an individual measurement and the true value (or accepted reference value) of the quantity being measured
Resolution	The smallest change in the quantity being measured that can be detected by an instrument.
Confidence	A qualitative judgement expressing the extent to which a conclusion

	is justified by the quality of the evidence
Random errors	Errors caused by factors that we cannot control. Effect of random variation can be reduced by making more measurements and reporting the mean
Accuracy	How close a measurement is to its true value (what it would be if there were no errors) is a measure of the closeness of agreement between an individual test result and the true value
Continuous variable	Variables that can have any number value
Fair test	An investigation where only the independent variable has been changed
Categoric variable	Variables that are described by labels as they are distinct groups.
Random errors	Errors caused by factors that we cannot control. Effect of random variation can be reduced by making more measurements and reporting the mean
Accuracy	How close a measurement is to its true value (what it would be if no errors)
Systematic errors	Consistent errors caused by inaccurate equipment eg: balance always reading 5g less than it should.
Repeatability	Precision or how (reliable) similar results are when they repeated by the **same group or person** using the same equipment in the same place
Reproducibility	Precision or how (reliable) similar results **from different pupils or groups** are when they are compared
Validity of measurement	A measurement is valid if it measures what it is supposed to be measuring and this depends on the procedure and apparatus
Validity of experiment	Includes a fair test and controls that aims to assess the effect of the independent variable
True Value	The accurate value found if there were no errors at all
Precision	The closeness of agreement between readings obtained by repeated measurements obtained under the same conditions. It depends only on the distribution of random errors (i.e. the spread of measurements) and does not relate to the true value
Uncertainty	The interval within which the true value can be expected to lie with a given level of confidence Eg: 20 °C +/- °2 C with 95% confidence
Measurement error	Difference between measured value and true value. A person timing 100m would have a measurement error associated with timing (stop and start) – this can be calculated!
Range of results or variable	The maximum and minimum values of either the independent or dependent variables eg: 10, 20, 30, 40, 50 Range = 10-50
Range of variables	Distance between each reading eg: 10, 20, 30, 40, 50 - Interval = 10
Anomaly/Outlier	A value in a set of results that is judged not to be part of the pattern. 20, **56**, 21