# Year 9 Biology Revision

## Use the checklist below 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.

**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.
There are also some independent study guides for each topic, which includes some exam questions and answers. Go to http://www.bws-school.org.uk/Curriculum-Exams/Science/Files/Y9Files/ on the School website.

**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.

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| Features of eukaryotic cells | | | |
| Structure and function of the parts of bacterial cells (prokaryotic cells) | | | |
| 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 cell organelles are related to function | | | |
| Most animal cells have a nucleus, cytoplasm, a cell membrane, mitochondria, ribosomes. | | | |
| Plant cells also, often have: chloroplasts, a permanent vacuole with cell sap. | | | |
| Plant and algal cells also have a cell wall made of cellulose | | | |
| 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.<br>Cells may be specialised to carry out a particular function:<br>• sperm cells, nerve cells and muscle cells in animals<br>• root hair cells, xylem and phloem cells in plants | | | |
| **Cell differentiation** | | | |
| Students should be able to explain the importance of cell differentiation. | | | |
| 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 | | | |

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| Students should be able to carry out calculations involving magnification, real size and image size using the formula<br>**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) | | | |
| Bacteria can be grown in a nutrient broth solution or as colonies on an agar gel | | | |
| Students should be able to describe how to prepare an uncontaminated culture using aseptic technique. | | | |
| Students should be able to calculate cross-sectional areas of colonies or clear areas around colonies using $\pi r^2$. | | | |
| Students should be able to calculate the number of bacteria in a population after a certain time if given the mean division time. | | | |
| **Cell division** | | | |
| **Chromosomes** | | | |
| Know the difference between DNA, chromosomes and genes | | | |
| **Mitosis and the cell cycle** | | | |
| Students should be able to describe the stages of the cell cycle, including the events of mitosis. | | | |
| 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** | | | |
| Know what a stem cell is | | | |
| Students should be able to describe the function of stem cells in embryos, in adult animals and in the meristems in plants | | | |
| Treatment with stem cells may be able to help conditions such as diabetes and paralysis and their benefits | | | |
| Stem cells from meristems in plants can be used to produce clones quickly and economically for agriculture and can prevent extinction of rare plants. | | | |
| **Transport in cells** | | | |
| **Diffusion** | | | |
| Substances may move into and out of cells across the cell membranes via diffusion. | | | |
| Students should know the principles of diffusion | | | |
| Students should know which substances diffuse in and out of cells | | | |
| Students should be able to explain how the factors that affect the rate of diffusion. | | | |
| Students should know how surface areas to volume ratios affect uptake by diffusion in single celled and multicellular organisms | | | |
| Students should be able to calculate and compare surface area to volume ratios. | | | |
| Students should be able to explain how the small intestine and lungs in mammals, | | | |

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| gills in fish, and the roots and leaves in plants, are adapted for exchanging materials. | | | |
| **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:<br>• use simple compound measures of rate of water uptake<br>• use percentiles<br>• 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** | | | |
| Students should know the role and main features of active transport and where it occurs | | | |
| Students should be able to:<br>• describe how substances are transported into and out of cells by diffusion, osmosis and active transport<br>• 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. | | | |
| **Principles of organisation** | | | |
| Students should be able to define features and roles of cells, tissues, organs, organ systems | | | |
| **Animal tissues, organs and organ systems** | | | |
| **The human digestive system** | | | |
| This section assumes knowledge of the digestive system studied in Key Stage 3 science | | | |
| Students should be able to describe and explain the role of organs in the digestive system | | | |
| 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 due to the shape of their active site. | | | |

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| 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. | | | |
| Digestive enzymes convert food into small soluble molecules that can be absorbed into the bloodstream. | | | |
| The products of digestion are used to build new carbohydrates, lipids and proteins. Some glucose is used in respiration | | | |
| The role and action of bile | | | |
| Use qualitative reagents to test for a range of carbohydrates, lipids and proteins, including 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 | | | |
| **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. | | | |
| **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.<br>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. | | | |
| Organisms compete with members of their species and other species for resources | | | |
| How interdependence affects every species in an ecosystem. | | | |
| 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. | | | |
| 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. | | | |

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| 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. | | | |
| Some organisms (extremophiles) live in environments that are very extreme, such as at high temperature, pressure, or salt concentration. | | | |
| **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 | | | |
| 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:<br>• understand the terms mean, mode and median<br>• calculate arithmetic means<br>• 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. | | | |
| Understand predator prey relationships | | | |
| Students should be able to interpret graphs used to model these cycles. | | | |
| **How materials are cycled** | | | |
| Recall materials cycle through the abiotic and biotic components | | | |
| • 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 | | | |
| The water cycle. | | | |
| Students should be able to explain the role of microorganisms in cycling materials through an ecosystem | | | |
| **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:<br>• calculate rate changes in the decay of biological material<br>• translate information between numerical and graphical form<br>• 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 which can be made in Biogas generators | | | |

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| 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.<br>• The changes may be seasonal, geographic or caused by human interaction | | | |
| **Trophic levels in an ecosystem** | | | |
| 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 | | | |
| Apex predators are carnivores with no predators. | | | |
| The role of decomposers | | | |
| **Pyramids of biomass** | | | |
| Students should be able to construct pyramids of biomass using data | | | |
| **Transfer of biomass** | | | |
| Students should be able to describe pyramids of biomass and explain how biomass is lost between the different trophic levels. | | | |
| Producers transfer about 1% of incident energy from light for photosynthesis | | | |
| 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. | | | |

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| **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 |

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| | 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, 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 |