| **Year** | **LESSON** | **Lesson title** | **Lesson objectives** |
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| TOPIC 1 - CELLS | | | |
| Year 9 | 1.1 | Looking at cells | * Describe the structure of eukaryotic cells. * Explain how the main sub-cellular structures are related to their functions. |
| Year 9 | 1.2 | The light microscope | * Observe plant and animal cells with a light microscope. * Understand the limitations of light microscopy. |
| Year 9 | 1.3 | Looking at cells in more detail | * Identify the differences in the magnification and resolving power of light and electron microscopes. * Explain how electron microscopy has increased our understanding of sub-cellular structures. |
| Year 9 | 1.4 | Required practical: Using a light microscope to observe and record animal and plant cells | * Apply knowledge to select techniques, instruments, apparatus and materials to observe cells. * Make and record observations and measurements. * Present observations and other data using appropriate methods. |
| Year 9 | 1.5 | Primitive cells | * Describe the differences between prokaryotic cells and eukaryotic cells. * Explain how the main sub-cellular structures of prokaryotic and eukaryotic cells are related to their functions. |
| Year 9 | 1.6 | Cell division | * Describe the process of mitosis in growth, and mitosis as part of the cell cycle. * Describe how the process of mitosis produces cells that are identical genetically to the parent cell. |
| Year 9 | 1.7 | Cell differentiation | * Explain the importance of cell differentiation. * Describe how cells, tissues, organs and organ systems are organised to make up an organism. * Understand size and scale in relation to cells, tissues, organs and organ systems. |
| Year 9 | 1.8 | Cancer | * Describe cancer as a condition resulting from changes in cells that lead to their uncontrolled growth, division and spread. * Understand some of the risk factors that trigger cells to become cancerous. |
| Year 9 | 1.9 | Stem cells | * Describe the function of stem cells in embryonic and adult animals. * Discuss potential benefits and risks associated with the use of stem cells in medicine. |
| Year 9 | 1.10 | Stem cell banks | * Discuss potential benefits and risks associated with the use of stem cells in medicine. |
| Year 9 | 1.11 | Key concept: Cell development | * Give examples of where mitosis is necessary to produce identical daughter cells. * Understand the need for reduction division, meiosis. * Describe the use and potential of cloned cells in biological research. |
| Year 9 | 1.12 | Cells at work | * Explain the need for energy. * Describe aerobic respiration as an exothermic reaction. |
| Year 9 | 1.13 | Living without oxygen | * Describe the process of anaerobic respiration. * Compare the processes of aerobic and anaerobic respiration. * Explain how the body removes lactic acid produced during anaerobic respiration. |
| Year 9 | 1.14 | Maths skills: Size and number | * Make estimates of the results of simple calculations, without using a calculator. * Be able to use ratio and proportion to calibrate a microscope. * Recognise and use numbers in decimal and standard form. |
| TOPIC 2 - PHOTOSYNTHESIS | | | |
| Year 9 | 2.1 | Explaining photosynthesis | * Identify the raw materials and products of photosynthesis. * Describe photosynthesis using an equation. * Explain gas exchange in leaves. |
| Year 9 | 2.2 | Looking at photosynthesis | * Explain the importance of photosynthesis. * Explain how plants use the glucose they produce. |
| Year 9 | 2.3 | Investigating leaves | * Identify the internal structures of a leaf. * Explain how the structure of a leaf is adapted for photosynthesis. * Recall that chloroplasts absorb energy from light for photosynthesis. |
| Year 9 | 2.4 | Required practical: Investigate the effect of light intensity on the rate of photosynthesis using an aquatic organism such as pondweed | * Use scientific ideas to evaluate a hypothesis. * Use the correct sampling techniques to ensure that readings are representative. * Present results in a graph. |
| Year 9 | 2.5 | Increasing photosynthesis | * Identify factors that affect the rate of photosynthesis. * Interpret data about the rate of photosynthesis. * Explain the interaction of factors in limiting the rate of photosynthesis. |
| Year 9 | 2.6 | Increasing food production | * Explain how factors that increase food production can be controlled. * Evaluate the benefits of manipulating the environment to increase food production. * Understand and use the inverse square law in the context of light intensity and photosynthesis. |
| Year 9 | 2.7 | Key concept: Diffusion in living systems | * Describe the conditions needed for diffusion to occur. * Calculate and compare surface area to volume ratios. * Explain how materials pass in and out of cells. |
| Year 9 | 2.8 | Looking at stomata | * Describe transpiration in plants. * Describe the function of stomata. * Explain the relationship between transpiration and leaf structure. |
| Year 9 | 2.9 | Moving water | * Describe the structure and function of xylem and roots. * Describe how xylem and roots are adapted to absorb water. * Explain why plants in flooded or waterlogged soil die. |
| Year 9 | 2.10 | Investigating transpiration | * Describe how transpiration is affected by different factors. * Explain the movement of water in the xylem. |
| Year 9 | 2.11 | Moving sugar | * Describe the movement of sugar in a plant as translocation. * Explain how the structure of phloem is adapted to its function in the plant. * Explain the movement of sugars around the plant. |
| Year 9 | 2.12 | Maths skills: Surface area to volume ratio | * Be able to calculate surface area and volume. * Be able to calculate surface area to volume ratio. * Know how to apply ideas about surface area and volume. |
| TOPIC 3 – MOVING AND CHANGING MATERIALS | | | |
| Year 9 | 3.1 | Explaining water movement | * Describe how water moves by osmosis in living tissues. * Identify factors that affect the rate of osmosis. * Explain what the term ‘partially permeable membrane’ means. |
| Year 9 | 3.2 | Required practical: Investigate the effect of a range of concentrations of salt or sugar solutions on the mass of plant tissue | * Use scientific ideas to develop a hypothesis. * Plan experiments to test a hypothesis. * Draw conclusions from data and compare these with hypotheses made. |
| Year 9 | 3.3 | Learning about active transport | * Describe active transport. * Explain how active transport is different from diffusion and osmosis. * Explain why active transport is important. |
| Year 9 | 3.4 | Key concept: Investigating the need for transport systems | * Describe how the size of an organism affects the rate of diffusion. * Explain how changes in conditions affect the rate of diffusion. * Explain the need for exchange surfaces and transport systems using surface area to volume ratio. |
| Year 9 | 3.5 | Explaining enzymes | * Describe what enzymes are and how they work. * Explain the lock-and-key theory. * Use the collision theory to explain enzyme action. |
| Year 9 | 3.6 | Required practical: Investigate the effect of pH on the rate of reaction of amylase enzyme | * Describe how safety is managed, apparatus is used and accurate measurements are made. * Explain how representative samples are taken. * Make and record accurate observations. * Draw and interpret a graph from secondary data using knowledge and observations. |
| Year 9 | 3.7 | Learning about the digestive system | * Identify and locate the organs in the digestive system, and describe their functions. * Describe how the products of digestion are absorbed into the body. * Explain why the small intestine is an efficient exchange surface. |
| Year 9 | 3.8 | Explaining digestion | * Describe how physical digestion helps to increase the rate of chemical digestion. * Name the sites of production and action of specific enzymes. * Interpret data about digestive enzymes. |
| Year 9 | 3.9 | Required practical: Use qualitative reagents to test for a range of carbohydrates, lipids and proteins | * Suggest appropriate apparatus for the procedures. * Describe how safety is managed and apparatus is used. * Describe how accurate measurements are made. * Interpret observations and make conclusions. |
| Year 9 | 3.10 | Learning about plants and minerals | * Describe how mineral ions from the soil help plants to grow. * Explain how root hair cells are adapted for efficient osmosis. * Describe the function of different mineral ions in a plant. |
| Year 9 | 3.11 | Investigating how plants use minerals | * Describe why plants need different mineral ions. * Explain the effects of mineral deficiencies on plant growth. * Explain the importance of fertilisers. |
| Year 9 | 3.12 | Learning about the circulatory system | * Identify the parts of the circulatory system. * Describe the functions of the parts of the circulatory system. * Explain how the structure of each part of the circulatory system relates to its function. |
| Year 9 | 3.13 | Exploring the heart | * Describe the structure and functions of the heart. * Identify the functions and adaptations of the parts of the heart. * Explain the movement of blood around the heart. |
| Year 9 | 3.14 | Studying blood | * Identify the parts of the blood and their functions. * Explain the adaptations of red blood cells. * Explain how red blood cells and haemoglobin transport oxygen efficiently. |
| Year 9 | 3.15 | Investigating gas exchange | * Identify the parts of the human gas exchange system and know their functions. * Explain how gas exchange occurs in humans. * Explain the adaptations of the gas exchange surfaces. |
| Year 9 | 3.16 | Learning about coronary heart disease | * Identify the causes and symptoms of coronary heart disease. * Describe possible treatments for coronary heart disease. * Evaluate the possible treatments for coronary heart disease. |
| Year 9 | 3.17 | Maths skills: Extracting and interpreting information | * To extract and interpret information from tables, charts and graphs. |
| TOPIC 4 – HEALTH MATTERS | | | |
| Year 9 | 4.1 | Learning about health **(HT)** | * Recall the difference between health and disease. * Explain how some diseases interact. * Evaluate data about lifestyle and health. **(HT)** |
| Year 9 | 4.2 | Key concept: Looking at risk factors **(HT)** | * Recall the causes of some non-communicable diseases. * Describe the impact of lifestyle on non-communicable diseases. * Explain the impact of lifestyle on non-communicable diseases. **(HT)** |
| Year 9 | 4.3 | Exploring non-communicable diseases **(HT)** | * Identify risk factors for cancer. * Explain the differences between types of tumours. * Explain the impact of non-communicable diseases**(HT)** |
| Year 9 | 4.4 | Analysing and evaluating data **(HT)** | * Translate information between graphical and numerical forms. * Use scatter diagrams to identify correlations. * Evaluate the strength of evidence. **(HT)** |
| Year 9 | 4.5 | Studying pathogens **(HT)** | * Recall the definition of a pathogen. * Explain how communicable diseases can be controlled. * Distinguish between epidemics and pandemics. **(HT)** |
| Year 9 | 4.6 | Learning about viral diseases **(HT)** | * Describe the symptoms of some viral diseases. * Describe the transmission and control of some viral diseases. * Explain how some viral diseases are spread. **(HT)** |
| Year 10 | 4.7 | Studying bacterial diseases **(HT)** | * Describe the symptoms of some bacterial diseases. * Explain how some bacterial diseases can be controlled. * Compare and contrast bacterial and viral diseases. **(HT)** |
| Year 10 | 4.8 | Looking at fungal diseases **(HT)** | * Recall the name and symptoms of a fungal disease. * Describe the transmission and treatment of rose black spot. * Explain how rose black spot affects the growth of the plant. **(HT)** |
| Year 10 | 4.9 | Learning about malaria | * Recall that malaria is a protist disease. * Describe the lifecycle of the malarial vector. |
| Year 10 | 4.10 | Protecting the body **(HT)** | * Describe how the body protects itself from pathogens. * Explain how the body protects itself from pathogens. * Explain how communicable diseases can be spread. **(HT)** |
| Year 10 | 4.11 | Exploring white blood cells **(HT)** | * Describe phagocytosis. * Explain how antibody production can lead to immunity. * Explain the specificity of immune system responses. **(HT)** |
| Year 10 | 4.12 | Using antibiotics and painkillers **(HT)** | * Describe the uses of antibiotics and painkillers. * Explain how antibiotics and painkillers can be used to treat diseases. * Explain the limitations of antibiotics. **(HT)** |
| Year 10 | 4.13 | Building immunity **(HT)** | * Recall how vaccinations prevent infection. * Explain how mass vaccination programmes reduce the spread of a disease. * Evaluate the global use of vaccination. **(HT)** |
| Year 10 | 4.14 | Making new drugs | * Recall some traditional drugs and their origins. * Describe how new drugs are developed. * Explain why ‘double-blind’ trials are conducted. |
| Year 10 | 4.15 | Maths skills: Sampling and scientific data | * Understand why sampling is used in science. * Be able to explain different sampling techniques. * Be able to extract and interpret information from graphs. |
| TOPIC 5 – COORDINATION AND CONTROL | | | |
| Year 10 | 5.1 | Homeostasis | * Explain the importance of homeostasis in regulating internal conditions in the body. * Recall that these control systems involve nervous or chemical responses. * Describe how control systems involve receptors, coordination centres and effectors. |
| Year 10 | 5.2 | The nervous system | * Explain how the nervous system is adapted to its functions. * Describe the structure of the central nervous system and nerves. |
| Year 10 | 5.3 | Reflex actions | * Explain the importance of reflex actions. * Describe the path of a reflex arc. * Explain how the structures in the reflex arc relate to their function. |
| Year 10 | 5.4 | Required practical: Investigating reaction time | * Select appropriate apparatus and techniques for the measurement of biological processes. * Carry out physiological experiments safely. * Use appropriate techniques in problem-solving contexts. |
| Year 10 | 5.5 | The endocrine system | * Recall that the endocrine system is made up of glands that secrete hormones into the blood. * Know the location of the major endocrine glands. * Understand why the pituitary gland is the ‘master gland’. |
| Year 10 | 5.6 | Controlling blood glucose **(HT)** | * Recall that blood glucose is monitored and controlled by the pancreas. * Understand how insulin controls blood glucose levels. * Understand how insulin works with another hormone – glucagon – to control blood sugar levels. **(HT)** |
| Year 10 | 5.7 | Diabetes | * Understand the causes of Type 1 and Type 2 diabetes. * Compare Type 1 and Type 2 diabetes. * Evaluate information on the relationship between obesity and diabetes, and make appropriate recommendations. **(HT)** |
| Year 10 | 5.8 | Diabetes recommendations | * Understand the causes of Type 1 and Type 2 diabetes. * Compare Type 1 and Type 2 diabetes. * Evaluate information on the relationship between obesity and diabetes, and make appropriate recommendations. |
| Year 10 | 5.9 | Negative feedback **(HT only)** | * Explain the role of thyroxine in the body. * Understand the principles of negative feedback, as applied to thyroxine. **(HT)** |
| Year 10 | 5.10 | Human reproduction **(HT)** | * Describe the roles of hormones in sexual reproduction. * Explain how hormones interact in the menstrual cycle. **(HT)** |
| Year 10 | 5.11 | IVF **(HT only)** | * Explain the use of hormones in technologies to treat infertility. * Describe the technique of *in-vitro* fertilisation. * Evaluate the scientific, emotional, social and ethical issues of *in-vitro* fertilisation. **(HT)** |
| Year 10 | 5.12 | IVF evaluation **(HT only)** | * Describe the technique of *in-vitro* fertilisation. * Evaluate the scientific, emotional, social and ethical issues of *in-vitro* fertilisation. **(HT)** |
| Year 10 | 5.13 | Systems working together **(HT only)** | * Describe the effects of adrenaline. * Understand that automatic control systems may involve nervous responses and chemical responses. * Understand that combinations of hormones work to produce a response. **(HT)** |
| Year 10 | 5.14 | Contraception | * Understand that fertility can be controlled by different hormonal and non-hormonal methods of contraception. * Evaluate the different methods of contraception. |
| Year 10 | 5.15 | Which contraceptive? | * Understand that fertility can be controlled by different hormonal and non-hormonal methods of contraception. * Evaluate the different methods of contraception. |
| Year 10 | 5.16 | Maths skills: The spread of scientific data | * Be able to calculate means and ranges of data. * Understand how to estimate uncertainty from a set of measurements. |
| TOPIC 6 - GENETICS | | | |
| Year 10 | 6.1  Partial coverage only | DNA and genes | * Describe the structure of DNA. * Describe a gene as a small section of DNA that codes for a protein. |
| Year 10 | 6.2 | The human genome **(HT)** | * Describe a gene as a small section of DNA that codes for a protein. * Explain the importance of understanding the human genome. **(HT)** |
| Year 10 | 6.3 | Tracing human migration | * Explain the importance of understanding the human genome. * Discuss the use of the human genome in understanding human migration patterns. |
| Year 10 | 6.4 | Meiosis | * Explain how meiosis halves the number of chromosomes for gamete production. * Explain how fertilisation restores the chromosome number. * Understand that the four gametes produced by meiosis are genetically different. |
| Year 10 | 6.5  Partial coverage only | Asexual and sexual reproduction | * Understand that asexual reproduction involves just one parent and produces genetically identical offspring. * Understand that sexual reproduction leads to variety in the offspring. |
| Year 10 | 6.6 | Genetics | * Understand and be able to use genetics terms, such as gamete, chromosome, gene, dominant, recessive, genotype, phenotype, homozygous and heterozygous. * Know that some human conditions are caused by a recessive allele. |
| Year 10 | 6.7 | Genetic crosses | * Use the terms dominant, recessive, genotype, phenotype, homozygous and heterozygous. * Know that some human conditions, such as cystic fibrosis, are caused by a recessive allele. * Complete or construct a Punnett square to predict the outcome of a genetic cross. |
| Year 10 | 6.8 | Tracking gene disorders | * Understand the use of a family tree to show the inheritance of a characteristic. * Explain economic, social and ethical issues concerned with embryo screening. |
| Year 10 | 6.9 | Key concept: Genetics is simple – or is it? | * Explain how certain characteristics are controlled by a single gene. * Understand that many characteristics are the result of multiple genes interacting. * Describe the search for genes that are linked to disease. |
| Year 10 | 6.10 | Maths skills: Fractions, ratio, proportion and probability | * Understand and use fractions and percentages. * Understand and use ratio and proportion. * Understand and use probability when predicting the outcomes of genetic crosses. |
| TOPIC 7 – VARIATION AND EVOLUTION | | | |
| Year 10 | 7.1  Partial coverage only | Variation | * Recall that differences in the characteristics of individuals in a population is called variation. * Understand the genetic and environmental differences leading to variation. |
| Year 10 | 7.2 | The theory of evolution | * Recall that all species of living things have evolved from simple life forms. * Explain how evolution occurs through natural selection. |
| Year 10 | 7.3 | The origin of species by natural selection | * Explain the evidence that led Darwin to propose the theory of evolution by natural selection. * Describe the process of natural selection. |
| Year 10 | 7.4 | Fossil evidence | * Understand how, and the situations in which, fossils are formed. * Understand how fossils are used as evidence for evolution of species from simpler life forms. |
| Year 10 | 7.5 | How much have organisms changed? | * Understand why the fossil record is incomplete. * Use the fossil record to understand how much, or how little, organisms have changed as life developed on Earth. |
| Year 10 | 7.6 | Evidence of natural selection and evolution? | * Understand how scientific theories develop over time. * Plan experiments to test hypotheses |
| Year 10 | 7.7 | Antimicrobial resistance | * Recall that bacteria develop that are resistant to antibiotics, which is evidence of evolution. * Understand the mechanism by which antibiotic resistance develops. * Understand the effects of the development of antibiotic resistance on the treatment of disease. |
| Year 10 | 7.8 | Combatting antimicrobial resistance | * Describe how to reduce the rate of development of antibiotic resistance. * Understand the requirement for, and the impact of, new antibiotics. |
| Year 10 | 7.9 | Selective breeding | * Describe the process of selective breeding. * Recall how selective breeding enables humans to choose desirable characteristics in animals. * Explain how selective breeding can lead to inbreeding. |
| Year 10 | 7.10 | Producing new plant varieties | * Describe the process of selective breeding. * Recall how selective breeding enables humans to choose desirable characteristics in plants. |
| Year 10 | 7.11 | Genetic engineering **(HT)** | * Give examples of how plant crops have been genetically engineered to improve products and describe how fungus cells are engineered to produce human insulin. * Describe the process of genetic engineering. **(HT)** |
| Year 10 | 7.12 | Genetically modified crops: the science | * Explain the benefits of, and concerns about, genetic modification. * Explain the ethical concerns about genetic engineering. |
| Year 10 | 7.13 | Is genetic modification safe? | * Explain the concerns that people have about genetic modification. * Explain the possible safety issues of genetic engineering in agriculture and medicine. |
| Year 10 | 7.14 | Ethically wrong, or essential? | * Explain the benefits of, and concerns about, genetic modification. * Explain the ethical issues of genetic engineering in agriculture and medicine. |
| Year 10 | 7.15 | The tree of life | * Describe how living things have been classified into groups using a system devised by Linnaeus. * Describe how new models of classification have developed. |
| Year 10 | 7.16 | Extinction…or survival? | * List the causes of extinction. * Explain how new predators, competitors and diseases can lead to extinctions. |
| Year 10 | 7.17 | Maths skills: Using charts and graphs to display data | * Understand when and how to use bar charts. * Understand how to show sub-groups on bar charts. * Understand how to plot histograms. |
| TOPIC 8 – ECOLOGY IN ACTION | | | |
| Year 11 | 8.1 | Key concept: Learning about ecosystems | * Describe what an ecosystem is. * Explain the importance of high biodiversity. * Explain what is meant by a self-supporting ecosystem |
| Year 11 | 8.2 | Changing abiotic factors | * Identify factors that affect ecosystems. * Explain changes in the distribution of species in an ecosystem. * Describe stable and unstable populations. |
| Year 11 | 8.3 | Investigating predator­–prey relationships | * Describe how changes in one population affect another. * Explain interdependent relationships. * Explain how predator–prey population cycles have cyclical changes. |
| Year 11 | 8.4 | Competing for resources | * Describe how competition impacts on populations. * Explain why animals in the same habitat are in competition. * Explain interspecific and intraspecific competition. |
| Year 11 | 8.5 | Required practical: Measure the population size of a common species in a habitat | * Use scientific ideas to develop a hypothesis. * Plan experiments to test a hypothesis. * Explain the apparatus and techniques used to sample a population. * Explain how a representative sample was taken. * Develop a reasoned explanation for some data. |
| Year 11 | 8.6 | Adapting for survival in animals | * Recall why animals have adaptations. * Explain some adaptations. * Use surface area to volume ratio to explain some adaptations. |
| Year 11 | 8.7 | Adapting for survival in plants | * Identify some adaptations of plants and bacteria. * Explain the importance of adaptations. * Explain a range of plant adaptations. |
| Year 11 | 8.8 | Cycling materials | * Recall that many materials are recycled in nature. * Explain the stages in the water and carbon cycles. * Explain the importance of recycling materials. |
| Year 11 | 8.9 | Cycling carbon | * Recall that plants take in carbon as carbon dioxide. * Explain how carbon is recycled. * Interpret a diagram of the carbon cycle. |
| Year 11 | 8.10 | Learning about land use | * Identify why land use has changed. * Describe the effects of changing land use. * Evaluate a change in land use. |
| Year 11 | 8.11 | Changing the landscape | * Identify the reasons for deforestation. * Describe the impact of peat bog destruction and deforestation. * Evaluate the destruction of peat bogs and forests. |
| Year 11 | 8.12 | Thinking about global warming | * Recall what global warming is. * Describe the causes of global warming. * Explain how global warming impacts on biodiversity. |
| Year 11 | 8.13 | Looking at waste management | * Describe how waste production is linked to human population growth. * Describe the impact of waste on ecosystems. * Explain how waste impacts on biodiversity. |
| Year 11 | 8.14 | Investigating pollution | * Identify pollution levels using indicator species. * Explain how indicator species measure pollution. * Compare different methods of measuring pollution. |
| Year 11 | 8.15 | Maintaining biodiversity | * Describe some conservation measures. * Describe the impact of breeding programmes. * Explain how habitats are regenerated. |
| Year 11 | 8.16 | Maths skills: Using graphs to show relationships | * To recognise direct proportionality in a graph. * To calculate reaction rates in linear graphs. * To use the gradient of a graph to calculate the rate. |