| **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 | 6.1Partial 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 | 6.5Partial 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 | 7.1Partial 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.
 |