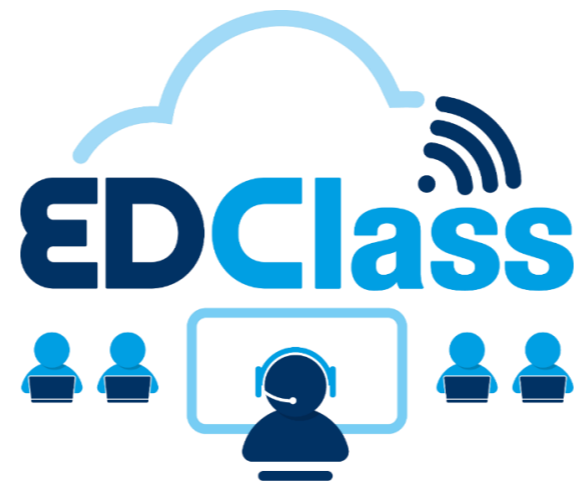


EDClass Science Curriculum and Scheme of work



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SCIENCE

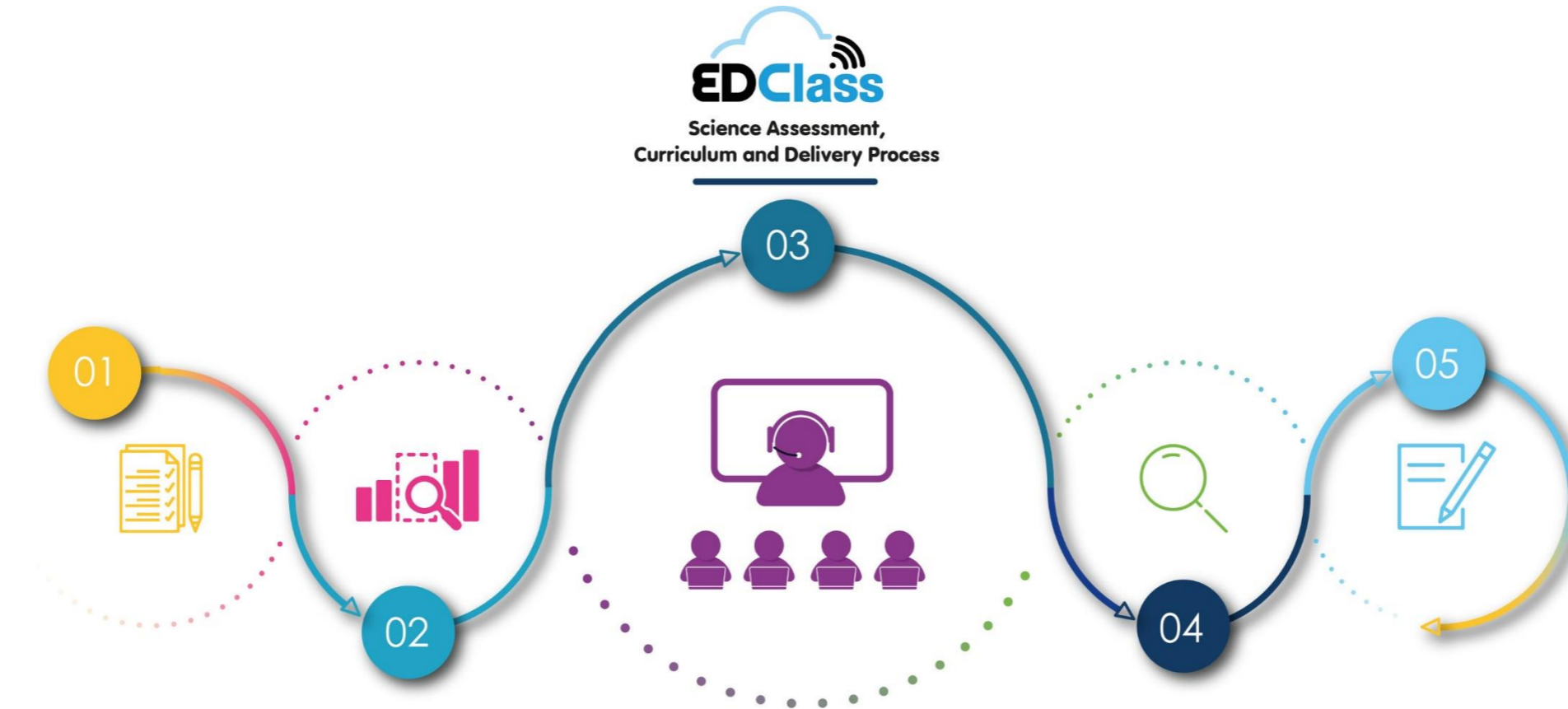
Overall objectives within this scheme of work

Learners will demonstrate an understanding of the scientific principles found within biology, chemistry and physics.
 Learners will apply knowledge and understanding of scientific principles, in order to plan, perform and evaluate scientific experiments and calculations.
 Learners will use scientific theories, principles and evidence to explain real world phenomena.

Biology

Chemistry

Physics



The purpose of the initial assessment is to determine the learner's starting point and evaluate their current level of understanding.

After conducting the initial assessment, we present the results in a R.A.G table to highlight gaps in knowledge. This helps us create a personalised learning pathway tailored to the academic needs of the learner.

Learners engage with digital lessons that evaluate their understanding of topics with the Science curriculum, alongside video-based lessons. They can interact with qualified teachers live, while accessing the aforementioned content. The teachers also provide live lessons based on the curriculum and address any skill gaps within the learner population.

Our lessons incorporate a series of questions that are placed to assess the learners' knowledge and understanding throughout their learning experience. The answers are monitored and documented, providing the commissioner with a clear overview of the learners' engagement and progress.

After completing the learning pathway, a second assessment is conducted to assess whether the gaps have been filled, if further intervention is required, or if the learner is prepared to advance to the next stage of learning. This cycle is then repeated to enable learners to progress further in the Science curriculum or to address any remaining knowledge gaps.

Experiences that pupils will gain through our Science KS3 and KS4 curriculum, lessons and resources

Experiences in EDClass	The principle of EDClass is that we are a re-engagement and intervention provision working in direct partnership with the commissioners to provide a safe, positive and secure learning environment that breaks any barrier to their learning. Our teaching and learning team give pupils cross-curriculum delivery and positive experiences in linguistic, mathematical, scientific, technological, human and social, physical, aesthetic and creative education. Students can also engage in general chat with our teachers to create a relaxed atmosphere whilst also gaining subject-specific support.
Diagnostic assessments	Diagnostic assessments inform personalised pathways of lessons for learners. They also inform the live lessons being delivered.
Language development / linguistics	Language development/linguistics is recognised as necessary for cognitive development and reasoning. Learners' linguistic development is part of every subject and is the responsibility of all teachers and learners.
How EDClass gives pupils experience in science education	<p>In general support chats, predicting is often a part of the learners' experience i.e. "what would be the outcome of..." to help develop possible hypotheses. Their experience is often related to real-life, relatable contexts such as the home. Teachers will often amend or confirm a learner's understanding of scientific applications and methodologies, and likely result after addressing misconceptions.</p> <p>Risk assessments will also be a part of discussions in safety conversations. Methodologies are modelled with different variables, demonstrated and reinforced through multiple, deliberate and specific explorations in all lesson types. Learners' application of knowledge gauges their curiosity and gives learners the experience of progressing towards independent work.</p> <p>Diagrams are a large part of the learners' experience of science. Lessons and lesson sets are arranged for learners to link concepts to real-life scenarios. Concepts and theories are supported through experiments/investigations. Results and hypotheses are then discussed. This lends itself to mastery of the science curriculum. Progression through the key stages builds on a learner's prior knowledge as scenarios become more complex.</p> <p>Learners experience cross-curricular links between science, maths, technology and humanities, where applicable.</p> <p>Learners are taught how to analyse and interpret questions to make direct links between curriculum knowledge and the question being asked.</p> <p>Learners experience scaffolded learning opportunities to develop confidence and independence.</p> <p>Misconceptions are viewed as valuable learning opportunities, both academically and as part of personal growth.</p>
How EDClass gives pupils experience in mathematical education	<p>Resilience in numeracy, problem-solving and mathematics is encouraged by breaking tasks down into logical, sequenced, real-world steps.</p> <p>Steps may include processes of measuring, data handling, recording time and handling money.</p> <p>Barriers concerning the accessibility of maths are acknowledged and anticipated by explaining different methodologies and approaches to promote a positive maths culture and demonstrate an appreciation of its importance.</p> <p>Methodologies and techniques are modelled, demonstrated and reinforced through multiple, deliberate and specific examples in all lesson types. Learners' application of methodologies gives opportunity to address misconceptions, develop confidence and progress towards independent work.</p> <p>Lessons and lesson sets are arranged for learners to experience progression in a concept from the concrete, to the pictorial, to the abstract (CPA approach). Such structures lend themselves to mastery of mathematical concepts.</p> <p>The curriculum links prior knowledge to new applications that are revisited, especially in terms of exam preparation and technique.</p> <p>Learners experience cross-curricular links between maths, science, technology and humanities, where applicable.</p> <p>A visualiser is used to aid subject-specific maths support to make visuals and highlight the importance of demonstrating clear and logical methods when solving problems.</p> <p>Learners experience scaffolded learning opportunities to develop confidence and independence. Mistakes are seen as valuable learning opportunities, both academically and as part of personal growth.</p>
How EDClass gives pupils experience in human and social education	<p>Teachers will gain knowledge of reasons why learners are using an AP platform as well as SEND needs and/or vulnerabilities and check on their welfare and well-being accordingly. Learners can expect stable routines such as an early greeting followed by opportunities to express any worries/concerns regarding well-being, mental health etc., as well as academic assistance.</p> <p>Teachers will gauge a learner's emotional readiness for learning and how they can assist/provide guidance</p> <p>Learners are encouraged to be positive and polite.</p> <p>Learners are encouraged to be reflective, considering any implications of their actions regarding behaviour and choices on others and the environment around them. This supports a successful reintegration into a school environment and a positive influence in the wider community.</p> <p>Learners are encouraged to appreciate the learning style that online AP allows: working independently, at their own pace, outside the influence of other influences/an audience of peers.</p> <p>Learners can experience goal setting and achievements celebrated by teachers, including the little wins.</p> <p>Learners are encouraged to consider careers, apprenticeships, the guidance they should seek and routes into further education.</p> <p>Our curriculum covers British values, spiritual, moral, cultural and social education. In addition to this, it covers personal, social, health and economic education (PSHE), behaviour repair, relationships and being part of a group/community/citizenship. Feedback and subject-specific support are implemented with a growth mindset and learners are encouraged to adopt a positive approach to their learning.</p> <p>Learners are encouraged to reflect on their learning and respond to feedback to maximise their outcomes on their learning journey and to be aware of where they</p>
How EDClass gives pupils experience in aesthetic and creative education	<p>Creative hobbies and interests are encouraged and promoted, including group activities that can provide social interaction outside the classroom environment. Teachers often share their own experiences beyond the virtual classroom, not only for pleasure, but to promote well-being.</p> <p>Learners' artistic creations are celebrated by teachers. Learners often share their projects on camera or by email, which is encouraged.</p> <p>Virtual whiteboards can be used as a creative hook to motivate learners.</p> <p>Learners experience creative writing in different forms: poetry, drama and prose (fiction and nonfiction). This encourages a love of writing beyond the classroom and informs exam preparation.</p> <p>English lesson sets cover how a writer creates effects and are guided on how to explain their methods.</p> <p>Learners are encouraged, through feedback, to take pride in their own work and its presentation.</p> <p>World celebration days such as 'World Book Day' are marked and learners are invited to contribute their favourite book to date with reasoning.</p>



How EDClass gives pupils experience in technological education

Learners' initial experience of the platform is a check that they understand the functionality, how to access learning, how to communicate with teachers and what to do should they feel unsafe in their location. Discussions will take place regarding diagnostic work to personalise learning pathways set after identifying strengths and areas to improve. Learners are informed that they can personalise the appearance of their lessons in line with potential SEND needs (fonts, colours, text size). Online safety (e-safety) will be discussed and reported should learners disclose issues around social media bullying/cyberbullying etc. They are also assigned the online safety lesson pathway or the behavioural pathway (visit here). Learners can be set lessons that directly relate to the subject of ICT which encourages digital fluency. Lessons and lesson sets cover online safety and behaviour. Learners are encouraged to inform teachers of any technical issues so that they can be resolved and learn themselves how to troubleshoot.



Biology

The EDClass teaching staff will use a combination of professional judgement, diagnostic assessment, the information provided by school staff and SLT through the admissions process, and learner feedback to create a personalised, flexible and challenging learning pathway that offers eLearning, video clips, recorded sessions and live learning lessons for all learners on the subject of biology.

KS4 Biology

Cell Biology	Respiration	Microorganisms	Photosynthesis	Transport
Enzymes and Digestion	Exchange and Circulation	Health and Disease	Co-ordination and Control	Plant Hormones
Inheritance and Genetics	Evolution and Natural Selection	Ecology		

KS3 Biology

Cells and Organisation	The Skeletal and Muscular Systems	Nutrition and Digestion	Reproduction	Health
Photosynthesis	Cellular Respiration	Relationships in an Ecosystem	Inheritance, Chromosomes, DNA and Genes	

KS2 Biology

Living Things and Their Habitats	Animals, Including Humans	Evolution and Inheritance
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KS4 Biology

Objectives	<p>Learners should gain an understanding of the science of life:</p> <p>That life depends on photosynthesis, respiration and cells, which form highly adapted structures such as tissues, organs and organ systems.</p> <p>That both eukaryotic and prokaryotic organisms may form populations, which interact to form communities and ecosystems.</p> <p>The characteristics of living organisms are influenced by genes and the environment. Evolution occurs by the process of natural selection and explains the wide variety of life on the Earth.</p>
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Cell Biology

Lesson Set Objectives To learn about the structure of cells, different types of cells and their roles, the equipment used to observe and measure cells, how cells reproduce, what happens when things go wrong with cell division, stem cells and their use in medicine.

Previous skills, themes or concepts	Builds on knowledge from the KS3 topic of 'Cells and Organisation'.	Assessment used within this topic	The KS4 science diagnostic assessment incorporates questions on the topic of 'Cell Biology' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of 'Cell Biology'.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of 'Cell Biology'. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Cell Biology'.
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This lesson set includes the following lessons:

- Looking at Cells
- Light Microscope
- Light Microscope (Practical Lesson)
- Primitive Cells
- Cell Division
- Cell Differentiation
- Cancer
- Stem Cells
- Stem Cell Therapy and Cloning.

Lesson Objectives

- Describe the structure of eukaryotic cells. Explain how the main sub cellular structures are related to their functions.
- Describe how to use a microscope. Observe plant and animal cells. Explain the limitations of light microscopy. Outline the differences in the magnification and resolving power of light and electron microscopes.
- Apply knowledge to select instruments to observe cells. Make and record observations and measurements.
- Describe the differences between prokaryotic and eukaryotic cells. Identify organelles in prokaryotic and eukaryotic cells.
- 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 to the parent cell.
- Explain the importance of cell differentiation. Identify specialised cells and explain how they are adapted to their function.
- Describe cancer as a condition resulting from changes in cells that lead to their uncontrolled growth, division and spread. Explain some of the risk factors that trigger cells to become cancerous. Use data to analyse and evaluate the impact of cancer.
- Explain that a stem cell is an undifferentiated cell of an organism which is capable of giving rise to many more cells of the same type, or differentiating into specialised cells. Describe the function of stem cells in embryos, in adult animals and in the meristems in plants. Look at how stem cells from human embryos can be cloned and made to differentiate into most different types of human cells. Explain how stem cells from adult bone marrow can form many types of cells, including blood cells.
- Explore the use of stem cells in medicine. Identify the risks of using stem cells. Evaluate the uses of stem cells. Describe the process of cloning.

Respiration

Lesson Set Objectives To learn about the different conditions in which cellular respiration occur, the word and symbol equations used to represent these reactions and the differences between aerobic and anaerobic respiration.

Previous skills, themes or concepts	Builds on knowledge from the KS3 topic of 'Cellular Respiration'.	Assessment used within this topic	The KS4 science diagnostic assessment incorporates questions on the topic of 'Respiration' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Respiration' topic.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Respiration' topic. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Respiration'.
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This lesson set includes the following lessons:

- Cells at Work / Respiration
- Living Without Oxygen/Anaerobic Respiration

Lesson Objectives

- Recognise that all organisms respire. Explain respiration as the process of releasing energy. Describe aerobic respiration as an exothermic reaction.
- Describe the process of anaerobic respiration. Explain when anaerobic processes occur. Compare the processes of aerobic and anaerobic respiration.

Microorganisms

Lesson Set Objectives To learn how microorganisms are grown in the laboratory, how to investigate the effectiveness of antimicrobial chemicals, and how new drugs are developed and tested.

Previous skills, themes or concepts	Builds on knowledge from the KS3 topic of 'Cells and Organisation'.	Assessment used within this topic	The KS4 science diagnostic assessment incorporates questions on the topic of 'Microorganisms' to test and evaluate a learner's prior learning and knowledge gaps.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Microorganisms' topic.
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Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Microorganisms' topic.

Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Microorganisms'.

This lesson set includes the following lessons:

Lesson Objectives

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| <ul style="list-style-type: none"> ■ Growing Microorganisms ■ Testing New Antibiotics ■ Investigate Disinfectant (Practical Lesson) | <ul style="list-style-type: none"> ■ Describe the techniques used to produce uncontaminated cultures of microorganisms. Describe how bacteria reproduce by binary fission. Calculate the number of bacteria in a population. ■ Describe the process of testing new drugs. Explain why new drugs need to be tested before they can be used. Give an example of the consequences of failing to properly test new drugs. ■ Carry out experiments with due regard to health and safety. Present and process data, identifying anomalous results. Evaluate methods and suggest further investigations. |
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Photosynthesis

Lesson Set Objectives

To learn about the chemical reaction of photosynthesis (including the word equation and symbol equation), the structure of leaves and how they are adapted to maximise photosynthesis, what factors affect the rate of photosynthesis and how to investigate this.

Previous skills, themes or concepts

Builds on knowledge from the KS3 topic of 'Photosynthesis'.

Assessment used within this topic

The KS4 science diagnostic assessment incorporates questions on the topic of 'Photosynthesis' to test and evaluate a learner's prior learning and knowledge gaps.

Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Photosynthesis' topic.

Resilience

Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Photosynthesis' topic.

Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Photosynthesis'.

This lesson set includes the following lessons:

Lesson Objectives

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| <ul style="list-style-type: none"> ■ Explaining Photosynthesis ■ Looking at Photosynthesis ■ Investigating Leaves ■ Effect of Light Intensity on Photosynthesis (Practical Lesson) ■ Increasing Photosynthesis, Increasing Food | <ul style="list-style-type: none"> ■ Identify the raw materials and products of photosynthesis. Describe photosynthesis using word and symbol equations. Explain gas exchange in leaves. ■ Explain the importance of photosynthesis. Explain how plants use the glucose they produce. ■ Identify common parts of most leaves. Explain why the cells that photosynthesise the most are located at the top of the leaf. Describe the role of stomata and guard cells. Recall the formula for photosynthesis. Describe how leaves are adapted to perform their function. ■ Describe some of the factors that influence the rate of photosynthesis. Explain how we can measure the effect of changing light intensity on the rate of photosynthesis. ■ Describe the main factors affecting the rate of photosynthesis (light, water, temperature) and explain how they limit the reaction. |
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Transport

Lesson Set Objectives To learn about diffusion, the factors that affect the rate of diffusion, gas exchange in leaves, the transpiration stream in plants, active transport, osmosis and how to plan an investigation into how concentration effects the rate of osmosis.

Previous skills, themes or concepts	Builds on knowledge from the KS3 topic of 'Cells and Organisation'.	Assessment used within this topic	The KS4 science diagnostic assessment incorporates questions on the topic of 'Transport' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Transport' topic.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Transport' topic. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Transport'.
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This lesson set includes the following lessons:

- Diffusion in Living Systems
- Looking at Stomata
- Moving Water and Sugar
- Investigating Transpiration
- Surface Area and Volume
- Explaining Water Movement (Osmosis)
- Investigating the Effect of Concentration on Osmosis (Practical Lesson)
- Active Transport

Lesson Objectives

- Use concentration gradients to explain the direction of diffusion. Apply the principles of diffusion to the movement of different substances in plants.
- Describe transpiration in plants. Explain the structure and function of stomata. Explain the relationship between transpiration and leaf structure.
- Describe the structure and function of the xylem, phloem and root hair cells. Explain how the xylem, phloem and root hair cells are adapted to perform their functions. Explain why plants in flooded or waterlogged soil die, and how wilting occurs. Describe and explain the movement of sugar in a plant (translocation).
- Describe how transpiration is affected by different factors. Explain the movement of water through the xylem.
- 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.
- 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.
- Use scientific ideas to develop a hypothesis. Plan an experiment to test a hypothesis. Draw conclusions from mathematical data and compare these with hypotheses made.
- Describe active transport. Explain how active transport is different from diffusion and osmosis. Explain why active transport is important.

Enzymes and Digestion

Lesson Set Objectives To learn about enzymes and their role in digestion, the factors that affect the rate of enzyme-controlled reactions, how physical digestion helps increase chemical digestion and how to carry out an investigation that tests for a range of different food types.

Previous skills, themes or concepts	Builds on knowledge from the KS3 topic of 'Nutrition and Digestion'.	Assessment used within this topic	The KS4 science diagnostic assessment incorporates questions on the topic of 'Enzymes and Digestion' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Enzymes and Digestion' topic.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Enzymes and Digestion' topic. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Enzymes and Digestion'.
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This lesson set includes the following lessons:

- Enzymes
- How pH Affects Enzyme Activity (Practical Lesson)
- Explaining Digestion
- Food Tests (Practical Lesson)

Lesson Objectives

- Describe what enzymes are and how they work. Explain how enzymes work using the lock-and-key theory. Use the collision theory to explain enzyme action.
- Describe how safety is managed, apparatus is used and accurate measurements are made. Describe and explain how enzyme activity is affected by pH.
- Describe how physical digestion helps to increase the rate of chemical digestion. Name the sites of production and actions of specific enzymes. Interpret data about digestive enzymes.
- 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.

Exchange and Circulation

Lesson Set Objectives To learn about gas exchange in a range of animals, how plants obtain and use mineral ions, and the circulatory systems of complex animals.

Previous skills, themes or concepts	Builds on knowledge from the KS3 topic of 'Gas Exchange Systems'.	Assessment used within this topic	The KS4 science diagnostic assessment incorporates questions on the topic of 'Exchange and Circulation' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Exchange and Circulation' topic.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Exchange and Circulation' topic. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Exchange and Circulation'.
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This lesson set includes the following lessons:

- Looking at More Exchange Surfaces (Gas Exchange in Animals)
- Plants and Minerals
- How Plants use Minerals
- Learning About Circulation
- Exploring the Heart
- Studying Blood
- Investigating Gas Exchange

Lesson Objectives

- Identify the structures responsible for gas exchange in fish, amphibians and insects. Describe the adaptations of different gas exchange surfaces. Explain the gas exchange surfaces in amphibians.
- Describe why plants need different mineral ions. Explain the effects of mineral deficiencies on plant growth. Explain the importance of fertilisers.
- Describe how mineral ions from the soil help plants to grow. Explain how root hair cells are adapted for efficient osmosis and active transport. Describe the function of different mineral ions in a plant.
- Identify the different parts of the circulatory system. Describe the functions of the different parts of the circulatory system.
- 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.
- Identify the different parts of blood and their function. Explain the adaptations of red blood cells. Explain how red blood cells and haemoglobin transport oxygen efficiently.
- Identify the different parts of the human gas exchange system and know their functions. Explain how gas exchange occurs in humans. Explain the adaptations of gas exchange surfaces.

Health and Disease

Lesson Set Objectives To learn about non-communicable diseases (such as CHD) and their associated risk factors, examples of viral, bacterial, fungal and protist diseases, the body's natural defences against disease, the impact of medical science in fighting disease, plant disease and defences.

Previous skills, themes or concepts	Builds on knowledge from the KS3 topics of 'Cells and Organisation'.	Assessment used within this topic	The KS4 science diagnostic assessment incorporates questions on the topic of 'Health and Disease' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Health and Disease' topic.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Health and Disease' topic. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Health and Disease'.
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This lesson set includes the following lessons:

- Coronary Heart Disease
- Learning About Health
- Looking at Risk Factors
- Non-communicable Diseases
- Viral and Bacterial Diseases
- Fungal Diseases
- Malaria and Other Protist Diseases
- Protecting the Body
- White Blood Cells
- Antibiotics and Painkillers
- Making New Drugs
- Monoclonal Antibodies (HT)
- Plant Diseases and Defences

Lesson Objectives

- Identify the causes and symptoms of coronary heart disease and heart failure. Describe the possible treatments of coronary heart disease and heart failure. Evaluate the possible treatments of coronary heart disease and heart failure.
- Recall the difference between health and disease. Explain how some diseases interact. Evaluate data about lifestyle and health.
- Recall the causes of some non-communicable diseases. Describe and explain the impact of lifestyle on non-communicable diseases.
- Identify risk factors for cancer. Explain the different types of tumours. Explain the impact of non-communicable diseases on health and society.
- Describe the symptoms of some viral diseases. Describe the transmission and control of some viral diseases. Describe the how spread of some viral diseases is controlled. Describe the symptoms of some bacterial diseases. Explain how the spread of some bacterial diseases can be controlled. Compare and contrast bacterial and viral diseases.
- 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 plants.
- Recall that malaria is a protist disease. Describe the lifecycle of the malarial vector. Evaluate control methods for the spread of malaria.
- Describe how the body protects itself from pathogens. Explain how the body protects itself from pathogens. Explain how communicable diseases can be spread.
- Describe phagocytosis. Explain how antibody production can lead to immunity. Explain the specificity of immune system responses.
- Describe the uses of antibiotics and painkillers. Explain how antibiotics and painkillers can be used to treat diseases. Explain the limitations of antibiotics.
- Recall some traditional drugs and their origins. Describe how new drugs are developed. Explain why 'double-blind' trials are conducted.
- Describe uses of monoclonal antibodies. Explain how monoclonal antibodies are produced. Evaluate the use of monoclonal antibodies.
- Recall the causes of plant diseases. Describe the symptoms and identification methods of some plant diseases. Explain the use of monoclonal antibodies in identifying plant pathogens. Recall some physical plant defence responses. Explain how mechanical and chemical plant defence systems help plants to survive.

Co-ordination and Control

Lesson Set Objectives

To learn about homeostasis, the nervous system and reflex responses, how to investigate reaction time and factors that affect this, how the body controls temperature, blood glucose levels and water levels, the endocrine system and how hormone levels are controlled, human reproduction and the role of hormones within this, IVF and contraception.

Previous skills, themes or concepts	Builds on knowledge from the KS3 topic of 'Reproduction'.	Assessment used within this topic	<p>The KS4 science diagnostic assessment incorporates questions on the topic of 'Co-ordination and Control' to test and evaluate a learner's prior learning and knowledge gaps.</p> <p>Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Co-ordination and Control' topic.</p>	Resilience	<p>Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Co-ordination and Control' topic.</p> <p>Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Co-ordination and Control'.</p>
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This lesson set includes the following lessons:

- Homeostasis
- The Nervous System and Reflex Actions
- The Brain
- Investigating Reaction Time
- The Eye and Defects of the Eye
- Controlling Body Temperature
- The Endocrine System
- Blood Glucose and Diabetes
- The Kidneys and Water Balance
- Negative Feedback - Thyroxine and Adrenaline (HT)
- Human Reproduction
- IVF
- Contraception

Lesson Objectives

- 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, co-ordination centres and effectors.
- Describe the structure and function of the nervous system. Explain how the nervous system is adapted to its functions. Describe the structure of sensory, motor and relay neurones. 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.
- Recall that the brain controls complex behaviour using billions of interconnected neurones. Identify the three main regions of the brain and describe their functions. Describe how the regions of the brain are mapped.
- Select appropriate apparatus and techniques for the measurement of biological processes. Carry out physiological experiments safely. Use appropriate techniques in problem-solving contexts.
- Relate the structures of the eye to their functions. Explain how the eye is adapted to seeing in colour and in dim light. Understand how the eye is able to focus on near or distant objects. Describe and understand why short-sightedness (myopia) occurs. Describe and understand why long-sightedness (hyperopia) occurs. Demonstrate how techniques are used to correct eye defects.
- Describe the mechanisms by which body temperature is controlled when too hot or too cold. Explain how body temperature can be controlled in a specific context.
- Recall that the endocrine system is made up of glands that secrete hormones into the bloodstream. Know the location of the major endocrine glands. Understand why the pituitary gland is known as the 'master gland'.
- Recall that blood glucose is monitored and controlled by the pancreas. Understand how insulin controls blood glucose levels. 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 treatment recommendations.
- Recall that excess water, ions and urea are removed from the body by urine which comes from the kidneys. Describe how the kidneys produce urine. Explain how the hormone ADH regulates the amount of water in the urine, and therefore in the body. Recall the ways in which the body loses water. Explain how excess protein is converted into urea for excretion.
- Explain the role of thyroxine in the body. Understand the principles of negative feedback, as applied to thyroxine.
- Describe the roles of hormones in sexual reproduction. Explain how hormones interact in the menstrual cycle.
- 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.
- Describe the advantages and disadvantages of different contraceptive methods. Use data to evaluate the effectiveness of different contraceptive methods.

Plant Hormones

Lesson Set Objectives

To learn about the effect of auxins on plant growth, how plants respond to light and gravity, and the effect of different plant hormones and gibberellins on plants.

Previous skills, themes or concepts	Builds on knowledge from the KS3 topics of 'Cells and Organisation' and 'Photosynthesis'.	Assessment used within this topic	The KS4 science diagnostic assessment incorporates questions on the topic of 'Plant Hormones' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Plant Hormones' topic.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Plant Hormones' topic. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Plant Hormones'.
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This lesson set includes the following lessons:

Lesson Objectives

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| <ul style="list-style-type: none"> ■ Auxins ■ The Effect of Light / Gravity on Seedlings (Practical Lesson) ■ Other Plant Hormones / Gibberellins (HT) | <ul style="list-style-type: none"> ■ Recall that plants produce hormones to co-ordinate and control growth, and responses to light and gravity. Describe how the unequal distribution of auxins causes unequal growth rates in plant shoots and roots. Explain that auxins act on 'stem cells' in plants called meristems. ■ Describe how an experiment is planned for a specific purpose. Make and record observations and translate data from one form to another. Interpret observations and other data, identify patterns and trends, make inferences and draw conclusions. ■ Recall that gibberellins are important in seed germination, and ethene in cell division and the ripening of fruit. Explain the applications of the plant hormones ethane and gibberellins. |
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Inheritance and Genetics

Lesson Set Objectives

To learn about the structure of DNA, protein synthesis, meiosis and the advantages of sexual reproduction, genetic crosses and Punnet squares, the work of Gregor Mendel, as well as a range of genetic disorders.

Previous skills, themes or concepts	Builds on knowledge from the KS3 topic of 'Inheritance, Chromosomes, DNA and Genes'.	Assessment used within this topic	The KS4 science diagnostic assessment incorporates questions on the topic of 'Inheritance and Genetics' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Inheritance and Genetics' topic.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Inheritance and Genetics' topic. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Inheritance and Genetics'.
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This lesson set includes the following lessons:

Lesson Objectives

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| <ul style="list-style-type: none"> ■ DNA , Genes and the Human Genome ■ The Structure of DNA ■ Protein Synthesis ■ Mutations ■ Meiosis ■ Asexual and Sexual Reproduction ■ Genetic Crosses ■ Genetic Disorders ■ Gregor Mendel ■ Simple Genetics | <ul style="list-style-type: none"> ■ Describe and explain the structure of DNA. Describe a gene as a small section of DNA that codes for a protein. Explain the importance of understanding the human genome. Discuss the use of the human genome in understanding human migration patterns. ■ Describe the structure of DNA as repeating nucleotide units. Identify the four bases in DNA. Explain that the bases A and T, and C and G, are complementary. ■ Describe how proteins are synthesised according to the DNA template of a gene. Explain that the genetic code of a gene specifies the protein to be made. ■ Model changes to the base sequences of DNA to illustrate mutations. Describe the negative, and sometimes positive effects of mutations. Describe how mutations can affect protein function. ■ 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. ■ Understand that asexual reproduction involves just one parent and produces genetically identical offspring. Understand that sexual reproduction leads to variety in the offspring. ■ 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. ■ Understand the use of a family tree to show the inheritance of a characteristic. Explain the economic, social and ethical issues concerned with embryo screening. ■ Plan experiments to explore phenomena and test hypotheses. Draw conclusions from given observations. Evaluate data in terms of reproducibility. ■ Explain how certain characteristics are controlled by a single gene. Understand that many characteristics are the result of multiple genes which interact. Describe the search for genes that are linked to disease. |
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Evolution and Natural Selection

Lesson Set Objectives

To learn about variation, fossil evidence, the work of Darwin and Wallace, natural selection, the evolution of drug resistant bacteria, genetic engineering and extinction.

Previous skills, themes or concepts	Builds on knowledge from the KS3 topic of 'Inheritance, Chromosomes, DNA and Genes'.	Assessment used within this topic	<p>The KS4 science diagnostic assessment incorporates questions on the topic of 'Evolution and Natural Selection' to test and evaluate a learner's prior learning and knowledge gaps.</p> <p>Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Evolution and Natural Selection' topic.</p>	Resilience	<p>Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Evolution and Natural Selection' topic.</p> <p>Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Evolution and Natural Selection'.</p>
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This lesson set includes the following lessons:

- Variation
- The Theory of Evolution
- The Origin of Species by Natural Selection
- Fossil Evidence - How Much Have Organisms Changed ?
- Darwin and Wallace
- A New Species - Evidence of Natural Selection
- Evolution - Fitting the Pieces of the Jigsaw
- Antimicrobial Resistance
- Selective Breeding
- Genetic Engineering
- Cloning
- The Tree of Life
- Extinction or Survival

Lesson Objectives

- Recall that differences in the characteristics of individuals in a population is called variation.
- Recall that all species of living things are thought to have evolved from simple life forms. Explain how evolution occurs through natural selection.
- Explain the evidence that led Darwin to propose the theory of evolution by natural selection. Explain how evolution occurs through natural selection. Outline different mechanisms of speciation.
- 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. 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.
- Recognise how Darwin and Wallace proposed, independently, the theory of evolution. Describe how Alfred Wallace gathered evidence for evolution, including warning coloration and mimicry.
- Understand that when natural selection operates differently on populations, new species are produced. Understand that when populations become very different, they can no longer interbreed, leading to the formation of a new species.
- Describe the work of Mendel, Darwin and Wallace. Explain how Mendel, Darwin and Wallace contributed to the theory of evolution. Appreciate that many scientists have contributed to the gene theory.
- 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. Describe how to reduce the rate of development of antibiotic resistance.
- Describe the process of selective breeding. Recall how selective breeding enables humans to choose desirable characteristics in animals and plants.
- Explain what is meant by the term "genetic engineering". Give examples of how plant crops have been genetically engineered to improve produce. Describe how fungal cells are genetically engineered to produce human insulin. Explain the ethical concerns regarding genetic engineering.
- Describe how cuttings and tissue culture are used to produce new plants. Describe the use of embryo transplants and adult cell cloning in animals.
- Describe how living things have been classified into groups using a system devised by Linnaeus. Describe how new models of classification have developed.
- List the causes of extinction. Explain how new predators, competitors and diseases can lead to extinction.

Ecology

Lesson Set Objectives

To learn about ecosystems, changing biotic and abiotic factors, predator prey relationships, trophic levels, competition between organisms, adaptation in plants and animals, the cycling of materials, biodiversity and the impact of human activity on ecosystems.

Previous skills, themes or concepts	Builds on knowledge from the KS3 topic of 'Relationships in an Ecosystem'.	Assessment used within this topic	<p>The KS4 science diagnostic assessment incorporates questions on the topic of 'Ecology' to test and evaluate a learner's prior learning and knowledge gaps.</p> <p>Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Ecology' topic.</p>	Resilience	<p>Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Ecology' topic.</p> <p>Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Ecology'.</p>
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This lesson set includes the following lessons:

- Ecosystems
- Changing Abiotic Factors
- Predator Prey Relationships
- Trophic Levels

- Competing for Resources
- Measuring Population Size (Practical Lesson)
- Adaptation in Animals
- Adaptation in Plants
- Cycling Materials

- Investigating Decay
- Effect of Temperature on Decay Rate (Practical Lesson)
- Changing the Environment
- Learning About Land Use
- Changing the Landscape (lesson needs completing)
- Global Warming
- Waste Management
- Pollution
- Biodiversity
- Food Security

- Biotechnology

Lesson Objectives

- Describe what an ecosystem is. Explain the importance of high biodiversity. Explain what is meant by a self-supporting ecosystem.
- Identify the abiotic factors that affect ecosystems. Explain how changes in the distribution of different species occurs within in an ecosystem. Describe stable and unstable populations.
- Describe how changes in one population may affect another. Explain interdependent relationships. Explain how predator prey populations have cyclical changes.
- Explain trophic levels. Explain and construct pyramids of biomass. Explain the difficulties in constructing pyramids of biomass. Identify how biomass is lost. Discuss the efficiency of biomass transfers.
- Describe how competition impacts on populations. Explain why animals in the same habitat are in competition. Explain interspecific and intraspecific competition.
- Describe a suitable method to investigate population size. Estimate the size of a population. Explain the effect of sample size.
- Recall why animals have adaptations. Explain some adaptations in animals. Use surface-area-to-volume ratios to explain some adaptations in animals.
- Identify some adaptations of plants and bacteria. Explain the importance of plant adaptations. Explain a range of plant adaptations.
- Recall that many materials are recycled in nature. Explain the stages in the water cycle and decay cycle. Explain how carbon is recycled. Interpret a diagram of the carbon cycle. Recall that plants take in carbon as carbon dioxide.
- Recall the factors needed for decay. Describe how different factors affect decay. Explain extracellular digestion.
- Describe how safety is managed, apparatus is used and accurate measurements are made. Make and record observations and make accurate measurements. Evaluate methods and suggest possible improvements and further investigations.
- Recall the causes of environmental change. Describe and explain the impact of environmental changes on ecosystems.
- Identify why land use has changed. Describe the effects of changing land use. Evaluate a change in land use.
- Identify the reasons for deforestation. Describe the impact of peat bog destruction and deforestation. Evaluate the destruction of peat bogs and forests.

- Recall what global warming is. Describe the causes of global warming. Explain how global warming impacts on biodiversity.
- Describe how waste production is linked to human population growth. Describe the impact of waste on ecosystems. Explain how waste impacts on biodiversity.
- Identify pollution levels using indicator species. Explain how indicator species measure pollution. Compare different methods of measuring pollution.
- Describe some conservation measures. Describe the impact of breeding programmes. Explain how habitats are regenerated.
- Identify factors affecting food security. Describe how different factors affect food security. Interpret data to evaluate food security. Describe some intensive farming methods. Describe methods that maintain sustainable fisheries.
- Describe some uses of biotechnology. Explain the advantages of some uses of biotechnology. Evaluate some uses of biotechnology.

SCIENCE

KS3 Biology

Objectives	<p>Learners should gain an understanding of the science of life:</p> <p>That cells and their components are the fundamental unit of living organisms, and can be studied using a light microscope.</p> <p>The structure and function of the human musculoskeletal system, digestive system, respiratory system and reproductive systems.</p> <p>The composition of a healthy diet, the impact of recreational drugs, exercise and lifestyle on the health of organ systems.</p> <p>The processes of respiration and photosynthesis, how plants are adapted for photosynthesis and how they obtain the raw materials for photosynthesis.</p> <p>The interdependence of organisms in an ecosystem and the effect of human activities on ecosystems.</p> <p>How genetic information is passed from one generation to the next.</p> <p>The importance of variation between individuals and how this can lead to the evolution of new species by natural selection.</p>
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Cells and Organisation

Lesson Set Objectives To learn about plant and animal cells, the parts of cells, single celled organisms, how materials get in and out of cells, and how cells build larger bodies.

Previous skills, themes or concepts	Buils on knowledge from the KS2 topics of 'Animals, Including Humans' and 'Living Things and Their Habitats'.	Assessment used within this topic	<p>The KS3 science diagnostic assessment incorporates questions on the topic of 'Cells and Organisation' to test and evaluate a learner's prior learning and knowledge gaps.</p> <p>Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Cells and Organisation' topic.</p>	Resilience	<p>Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Cells and Organisation' topic.</p> <p>Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Cells and Organisation'.</p>
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This lesson set includes the following lessons:

- Looking at Cells
- Parts of Cells
- Plant and Animal Cells
- Moving Materials in and out of Cells
- Single Celled Organisms
- Building Larger Bodies

Lesson Objectives

- Describe cells as the fundamental unit of living organisms. Explain how to observe, interpret and record cell structure using a light microscope.
- Be able to explain the functions of the cell wall, cell membrane, cytoplasm, nucleus, vacuole, mitochondria and chloroplasts.
- Explain the similarities and differences between plant and animal cells.
- Explain the role of diffusion in the movement of materials in and between cells.
- Describe the structural adaptations of some unicellular organisms.
- Explain the hierarchical organisation of multicellular organisms.

The Skeletal and Muscular Systems

Lesson Set Objectives To learn how the skeleton and muscles work together to help animals move.

Previous skills, themes or concepts	Buils on knowledge from the KS2 topics of 'Animals, Including Humans' and 'Living Things and Their Habitats'.	Assessment used within this topic	<p>The KS3 science diagnostic assessment incorporates questions on the topic of 'The Skeletal and Muscular Systems' to test and evaluate a learner's prior learning and knowledge gaps.</p> <p>Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of 'The Skeletal and Muscular Systems' topic.</p>	Resilience	<p>Support is provided throughout this lesson set to assist a learner's development in their knowledge of 'The Skeletal and Muscular Systems' topic.</p> <p>Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'The Skeletal and Muscular Systems'.</p>
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This lesson set includes the following lessons:

- The Skeleton
- How Animals Move
- Muscles and Movement

Lesson Objectives

- Describe the structure and functions of the human skeleton, including its role in support, protection, movement and making blood cells.
- Explain how the interaction between the skeleton and muscles, including the measurement of force exerted by different muscles, allows animals to move.
- Describe the function of muscles and examples of antagonistic muscle pairs.

Nutrition and Digestion

Lesson Set Objectives To learn about a balanced diet, how food is digested, the role of bacteria in digestion and photosynthesis as the source of all food.

Previous skills, themes or concepts	Builds on knowledge from the KS2 topic of 'Animals, Including Humans'.	Assessment used within this topic	<p>The KS3 science diagnostic assessment incorporates questions on the topic of 'Nutrition and Digestion' to test and evaluate a learner's prior learning and knowledge gaps.</p> <p>Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Nutrition and Digestion' topic.</p>	Resilience	<p>Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Nutrition and Digestion' topic.</p> <p>Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Nutrition and Digestion'.</p>
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This lesson set includes the following lessons:

- A Balanced Diet
- The Digestive System
- Not all Bugs are Bad
- The Source of all Food

Lesson Objectives

- Describe content of a healthy human diet to include: carbohydrates, lipids (fats and oils), proteins, vitamins, minerals, dietary fibre and water. Explain why each food group is needed in a healthy diet. Be able to calculate the energy requirements for a healthy diet.
- Describe the tissues and organs of the human digestive system. Explain how these structures break down and digest food. Explain the role of enzymes in digestion.
- Outline the importance of bacteria in the human digestive system.
- Explain how plants convert water and minerals in to carbohydrates.

Gas Exchange Systems

Lesson Set Objectives To learn how oxygen gets into our blood cells, things that can affect our breathing, and how plants get the gases they need for photosynthesis.

Previous skills, themes or concepts	Builds on knowledge from the KS2 topic of 'Animals, Including Humans'.	Assessment used within this topic	<p>The KS3 science diagnostic assessment incorporates questions on the topic of 'Gas Exchange Systems' to test and evaluate a learner's prior learning and knowledge gaps.</p> <p>Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Gas Exchange Systems' topic.</p>	Resilience	<p>Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Gas Exchange Systems' topic.</p> <p>Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Gas Exchange Systems'.</p>
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This lesson set includes the following lessons:

- Getting Oxygen
- Things that Affect our Breathing
- Do Plants Breathe?

Lesson Objectives

- Describe the structure and function of the gas exchange system in humans, including how its adaptations relate to its function. Explain how the mechanism of breathing moves air in and out of the lungs. Use a pressure model to explain the movement of gases in and out of the lungs.
- Explain the impact of exercise, asthma and smoking on the human gas exchange system.
- Explain the role of leaf stomata in gas exchange in plants.

Reproduction

Lesson Set Objectives To learn how a range of animals and plants reproduce.

Previous skills, themes or concepts	Builds on knowledge from the KS2 topic of 'Living Things and Their Habitats'.	Assessment used within this topic	The KS3 science diagnostic assessment incorporates questions on the topic of 'Reproduction' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Reproduction' topic.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Reproduction' topic. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Reproduction'.
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This lesson set includes the following lessons:

- Reproduction in Animals
- Reproduction in Plants

Lesson Objectives

- Describe reproduction in humans (as an example of a mammal), including the structure and function of the male and female reproductive systems. Describe the menstrual cycle (without details of hormones). Explain how fertilisation takes place. Describe gestation and birth. Explain the effect of maternal lifestyle on the foetus, and how the placenta is involved in this.
- Discuss reproduction in plants, including flower structure, wind and insect pollination, fertilisation, seed and fruit formation and dispersal. Investigate seed dispersal mechanisms.

Health

Lesson Set Objectives To learn about the impact that recreational drugs have on the body.

Previous skills, themes or concepts	Builds on knowledge from the KS2 topic of 'Animals, Including Humans'.	Assessment used within this topic	The KS3 science diagnostic assessment incorporates questions on the topic of 'Health' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Health' topic.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Health' topic. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Health'.
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This lesson set includes the following lesson:

- Recreational Drugs

Lesson Objectives

- Explain the effects of recreational drugs (including substance misuse) on behaviour, health and life processes.

Photosynthesis

Lesson Set Objectives To learn how plants make their own food by photosynthesis, and use the products of photosynthesis, combined with minerals from the soil to build their cells and tissues.

Previous skills, themes or concepts	Builds on knowledge from the KS2 topic of 'Living Things and Their Habitats'.	Assessment used within this topic	The KS3 science diagnostic assessment incorporates questions on the topic of 'Photosynthesis' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Photosynthesis' topic.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Photosynthesis' topic. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Photosynthesis'.
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This lesson set includes the following lessons:

- Photosynthesis

Lesson Objectives

- Describe the dependence of almost all life on Earth, on the ability of photosynthetic organisms (such as plants and algae) to use sunlight in photosynthesis, to build organic molecules that are an essential energy store. Explain how plants maintain levels of oxygen and carbon dioxide in the atmosphere. Investigate the adaptations of leaves for photosynthesis.

Cellular Respiration

Lesson Set Objectives To learn how cells release energy through the process of respiration, using glucose, both with and without oxygen.

Previous skills, themes or concepts	Builds on knowledge from the KS2 topics of 'Animals, Including Humans' and 'Living Things and Their Habitats'.	Assessment used within this topic	The KS3 science diagnostic assessment incorporates questions on the topic of 'Cellular Respiration' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Cellular Respiration' topic.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Cellular Respiration' topic. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Cellular Respiration'.
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This lesson set includes the following lessons:

- Aerobic Respiration
- Anaerobic Respiration

Lesson Objectives

- Explain the process of aerobic respiration in living organisms, including the breakdown of organic molecules to enable all the other chemical processes necessary for life. Recall the word equation for aerobic respiration.
- Explain the process of anaerobic respiration in humans and microorganisms, including fermentation, and give a word equation for anaerobic respiration. Outline the differences between aerobic and anaerobic respiration in terms of the reactants, the products formed and the implications for the organism.

Relationships in an Ecosystem

Lesson Set Objectives To learn about the interdependence of organisms, the importance of plants in food chains, and the impact of pollution on ecosystems.

Previous skills, themes or concepts	Builds on knowledge from the KS2 topic of 'Living Things and Their Habitats'.	Assessment used within this topic	The KS3 science diagnostic assessment incorporates questions on the topic of 'Relationships in an Ecosystem' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Relationships in an Ecosystem' topic.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Relationships in an Ecosystem' topic. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Relationships in an Ecosystem'.
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This lesson set includes the following lessons:

- The Interdependence of Organisms
- Maintaining Plants for Food (Plant Reproduction)
- Environment and Pollution

Lesson Objectives

- Investigate the interdependence of organisms in an ecosystem, using food chains and food webs to show interactions. Describe and explain the importance of insect pollinated crops.
- Explain the importance of plant reproduction (through insect pollination), in human food security.
- Investigate how organisms affect, and are affected by, their environment, including the accumulation of toxic materials.

Inheritance, Chromosomes, DNA and Genes

Lesson Set Objectives To learn how characteristics are inherited, the structure of DNA and chromosomes, the importance of variation, and the process of evolution by natural selection.

Previous skills, themes or concepts	Builds on knowledge from the KS2 topic of 'Evolution and Inheritance'.	Assessment used within this topic	The KS3 science diagnostic assessment incorporates questions on the topic of 'Inheritance, Chromosomes, DNA and Genes' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Inheritance, Chromosomes, DNA and Genes' topic.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Inheritance, Chromosomes, DNA and Genes' topic. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Inheritance, Chromosomes, DNA and Genes'.
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This lesson set includes the following lessons:

- Inheritance
- Variation
- Natural Selection
- Evolution and Extinction

Lesson Objectives

- Describe inheritance as the process by which genetic information is passed from one generation to the next. Explain a simple model of chromosomes, genes and DNA. Explain the role of Watson, Crick, Wilkins and Franklin in the development of the DNA model.
- Explain how the variation between individuals within a species can be continuous, or discontinuous. Investigate variation using measurements and graphical representations.
- Explain how the variation between species and between individuals of the same species, means some organisms compete more successfully, which can drive natural selection.
- Explain how changes in the environment may leave individuals within a species, and some entire species, less well adapted to compete successfully and reproduce, which in turn may lead to extinction. Explain the importance of maintaining biodiversity, and the use of gene banks to preserve genetic material to help aid this.

SCIENCE

KS2 Biology

Objectives	Learners should gain an understanding of the science of life: That living organisms reproduce and their habitats depend on energy transfers through food chains. That lifestyle choices affect human health, including organ systems such as the circulatory and digestive systems. That the wide variety of life on Earth is a result of adaptation and variation over millions of years.
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Living Things and Their Habitats

Lesson Set Objectives	To learn about the life cycles of living organisms, how plants and animals reproduce, how organisms are classified, and how energy is passed through a food chain.
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Previous skills, themes or concepts	Buils on knowledge from the KS1 topics of 'Living Things and Their Habitats', 'Animals, Including Humans' and 'Plants'.	Assessment used within this topic	The KS2 science diagnostic assessment incorporates questions on the topic of 'Living Things and Their Habitats' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Living Things and Their Habitats' topic.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Living Things and Their Habitats' topic. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Living Things and Their Habitats'.
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This lesson set includes the following lessons:

- Animal Life Cycles
- Reproduction in Plants and Animals
- Classifying Organisms
- Food Chains and Trophic Levels

Lesson Objectives

- Describe the differences in the life cycle of a mammal, a bird, an amphibian and an insect.
- Describe how a range of different animals and plants reproduce.
- Recall that living things are assigned to groups that have common features. Be able to assign living things to these groups. Describe the six kingdoms of life.
- Demonstrate how energy passes through a habitat along a food chain. Recall that all food chains start with a green plant. Recall that each step in a food chain is a trophic level.

Animals, Including Humans

Lesson Set Objectives	To learn about the stages of human life, the digestive system, the circulatory system, and how health is affected by lifestyle.
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Previous skills, themes or concepts	Buils on knowledge from the KS1 topic of 'Animals, Including Humans'.	Assessment used within this topic	The KS2 science diagnostic assessment incorporates questions on the topic of 'Animals Including Humans' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Animals Including Humans' topic.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Animals Including Humans' topic. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Animals Including Humans'.
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This lesson set includes the following lessons:

- Human Life Cycle
- Circulation
- The Impact of Lifestyle on Health
- The Digestive System

Lesson Objectives

- Recall all the stages of the human life cycle.
- Be able to identify different types of blood vessels. Explain the role of the heart as a pump. Recall the structure of the heart. Explain the role of circulation. Describe the function and composition of blood.
- Recall the impact of tobacco and alcohol on health. Recall the impact of poor diet on health.
- Describe the structure of the human digestive system.

Evolution and Inheritance

Lesson Set Objectives To learn about evolution, and the variation and adaptation of organisms.

<p>Previous skills, themes or concepts</p>	<p>Builds on knowledge from the KS1 topics of 'Living Things and Their Habitats' and 'Animals, Including Humans'.</p>	<p>Assessment used within this topic</p>	<p>The KS2 science diagnostic assessment incorporates questions on the topic of 'Evolution and Inheritance' to test and evaluate a learner's prior learning and knowledge gaps.</p> <p>Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Evolution and Inheritance' topic.</p>	<p>Resilience</p>	<p>Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Evolution and Inheritance' topic.</p> <p>Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Evolution and Inheritance'.</p>
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This lesson set includes the following lessons:

Lesson Objectives

- Adaptation and Variation
- Evolution
- Recall that individuals are different from other members of their species and that this is called variation. Explain that some variations make organisms better adapted to their way of life.
- Recall that the majority of animals are extinct.

Chemistry

The EDClass teaching staff will use a combination of professional judgement, diagnostic assessment, the information provided by school staff and SLT through the admissions process, and learner feedback to create a personalised, flexible and challenging learning pathway that offers eLearning, video clips, recorded sessions and live learning lessons for all learners on the subject of chemistry.

KS4 Chemistry

<input type="checkbox"/> Atomic Structure and the Periodic Table	<input type="checkbox"/> Structure Bonding / Properties of Matter	<input type="checkbox"/> Chemical Quantities and Calculations	<input type="checkbox"/> Chemical Changes	<input type="checkbox"/> Energy Changes
<input type="checkbox"/> Rate and Extent of Chemical Change	<input type="checkbox"/> Hydrocarbons	<input type="checkbox"/> Chemical Analysis	<input type="checkbox"/> The Atmosphere	<input type="checkbox"/> Sustainable Development

KS3 Chemistry

<input type="checkbox"/> The Particle Model of Matter	<input type="checkbox"/> Atoms, Elements and Compounds	<input type="checkbox"/> Pure and Impure Substances	<input type="checkbox"/> Chemical Reactions	<input type="checkbox"/> Chemical Energetics
<input type="checkbox"/> The Periodic Table	<input type="checkbox"/> Materials	<input type="checkbox"/> Earth and Atmosphere		

KS2 Chemistry

<input type="checkbox"/> Properties and Changes of Materials
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KS4 Chemistry

Objectives

Learners should gain an understanding of the science of matter:
 That all matter is made of atoms, which are bonded together by the sharing, or exchanging of electrons.
 The arrangement of electrons in an atom decides its position in the periodic table and its chemical properties.
 The shape of molecules influences the way they behave.
 Reactions occur when molecules collide and the speed at which they collide affects the rate of reactions.
 Energy is conserved in chemical reactions and can neither be created or destroyed.
 The impact of the chemical industry on modern society and the need for sustainability.
 The importance of identifying and quantifying chemicals.

Atomic Structure and the Periodic Table

Lesson Set Objectives

To learn about the difference between elements, compounds and mixtures, chemical formulae, the structure of the atom and how this relates to the periodic table, the chemical properties of the elements in groups 1, 7 and 0 and the transition metals, how our understanding of atoms and the periodic table developed.

Previous skills, themes or concepts

Builds on knowledge from the KS3 topics of 'Atoms, Elements and Compounds' and 'The Periodic Table'.

Assessment used within this topic

The KS4 science diagnostic assessment incorporates questions on the topic of 'Atomic Structure and the Periodic Table' to test and evaluate a learner's prior learning and knowledge gaps.

Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Atomic Structure and the Periodic Table' topic.

Resilience

Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Atomic Structure and the Periodic Table' topic.

Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Atomic Structure and the Periodic Table'.

This lesson set includes the following lessons:

- Elements, Compounds, Atoms, Formulae and Equations
- Mixtures
- Diffusion
- Changing Ideas About Atoms
- Modelling the Atom / Sub Atomic Particles

- Electronic Structure
- Periodic Table
- Developing the Periodic Table
- Metals, Non-metals and Outer Electrons

- Group 0 Elements

- Group 1 Elements
- Group 7 Elements
- Transition Metals

Lesson Objectives

- Identify the symbols of elements from the periodic table. Recognise the properties of elements and compounds. Identify the elements in a compound. Learn the symbols of the first 20 elements. Use symbols to describe elements and compounds. Use formulae to write equations.
- Recognise that all substances are chemicals. Understand that mixtures can be separated into their components. Suggest suitable separation and purification techniques for mixtures.
- Describe the process of diffusion using examples. Explain that diffusion is a random process, but particles will diffuse down a concentration gradient.
- Learn how models of the atom changed as scientists gathered more data. Consider the data Rutherford and Marsden collected and link their data to our model of the atom.
- Explore the structure of atoms. Consider the sizes of atoms. Explore the way the atomic radius of atoms changes with position in the periodic table. Compare protons, neutrons and electrons. Find out why atoms are neutral. Relate the number of charged particles in an atom to its position in the periodic table. Learn what isotopes are. Use symbols to represent isotopes.
- Use diagrams and symbols to show which energy levels electrons occupy. Relate the electronic configuration of each element to its position in the periodic table.
- Explain how the electronic structure of different atoms follows a pattern. Use the periodic table to make predictions.
- Find out how the periodic table has changed over the years, and explore Mendeleev's role in its development. Consider the accuracy of Mendeleev's predictions.
- Review the physical properties of metals and non-metals. Compare oxides of metals and non-metals. Make predictions about unknown metals and non-metals. Explore the links between electron configurations of elements and their properties. Find out what happens to outer electrons when metals react. Draw diagrams to show how ions form.
- Explore the properties of noble gases. Find out how the mass of the atoms in group 0 elements affects their boiling points. Relate the chemical properties of group 0 elements to their electronic structures.
- Explore the properties of group 1 metals and compare their reactivity. Relate the reactivity of group 1 elements to their electronic structures.
- Explain why group 7 non-metals are known as halogens and compare their reactivity. Relate the reactivity of group 7 elements to their electronic structures.
- Compare the properties of transition metals with those of group 1 metals. Explore the uses of transition metals. Find out why transition metals can form compounds with different colours.

Structure Bonding / Properties of Matter

Lesson Set Objectives To learn about the different types of chemical bonds, the states of matter, polymers, allotropes, metals and alloys, small molecules and nanoparticles.

Previous skills, themes or concepts	Builds on knowledge from the KS3 topic of 'The Particle Model of Matter'.	Assessment used within this topic	The KS4 science diagnostic assessment incorporates questions on the topic of 'Structure Bonding / Properties of Matter' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Structure Bonding / Properties of Matter' topic.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Structure Bonding / Properties of Matter' topic. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Structure Bonding / Properties of Matter'.
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This lesson set includes the following lessons:

- Chemical Bonds
- Ionic Bonding / Properties of Ionic Compounds
- Covalent Bonding 1 (Introduction)
- Covalent Bonding 2
- Metallic Bonding
- Three States of Matter
- Properties of Small Molecules
- Polymer Structures
- Giant Covalent Structures
- Properties of Metals and Alloys
- Diamond, Graphite, Graphene and Fullerenes
- Nanoparticles

Lesson Objectives

- Describe the three main types of bonding. Explain how electrons are used in the three main types of bonding. Explain how bonding and properties are linked.
- Represent an ionic bond with a diagram. Draw dot and cross diagrams for ionic compounds. Work out the charge on the ions of metals from the group number of the element.
- State what a covalent bond is. Identify where covalent bonds occur. Describe the types of materials with covalent bonds in them.
- List some properties of covalent compounds. Explain what a covalent bond is, using electron diagrams. Explain the relative strength of covalent bonds.
- Describe how metals form giant structures. Explain how metal ions are held together. Explain the delocalisation of electrons. Relate metallic bonding to the properties of metals.
- Use data to predict the states of substances. Explain the changes of state. Use state symbols in chemical equations.
- Identify small molecules from formulae. Explain the strength of covalent bonds. Relate the intermolecular forces to the bulk properties of a substance.
- Recognise polymers from their unit formulae. Explain why some polymers can stretch. Explain why some plastics do not soften on heating.
- Recognise giant covalent structures from diagrams. Explain the properties of giant covalent structures. Recognise the differences in the different forms of carbon.
- Identify the properties of metal elements and metal alloys. Describe the purpose of a tin-lead alloy. Explain why alloys have different properties to those of elements.
- Identify why diamonds are so hard and explain how their properties relate to the bonding in diamond. Describe the structure and bonding of graphite and explain how this relates to its properties. Describe the structure of graphene. Describe the structure and uses of fullerenes.
- Relate the sizes of nanoparticles to atoms and molecules. Explain that there may be risks associated with nanoparticles. Evaluate the use of nanoparticles for a specific purpose.

Chemical Quantities and Calculations

Lesson Set Objectives To learn about conservation of mass in chemical reactions, balancing equations, relative formula mass and relative atomic mass, concentrations of solutions, moles, amounts of substances, volumes of gases, percentage yield, atom economy and titrations.

Previous skills, themes or concepts	Builds on knowledge from the KS3 topics of 'Pure and Impure Substances' and 'Chemical Energetics'.	Assessment used within this topic	The KS4 science diagnostic assessment incorporates questions on the topic of 'Chemical Quantities and Calculations' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Chemical Quantities and Calculations' topic.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Chemical Quantities and Calculations' topic. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Chemical Quantities and Calculations'.
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This lesson set includes the following lessons:

- Conservation of Mass and Balanced Equations
- Relative Formula Mass
- Mass Changes in Volumes of Gases
- Chemical Measurements and Uncertainty

Lesson Objectives

- Explore ideas about the conservation of mass. Consider what the numbers in equations stand for. Write balanced symbol equations.
- Review the differences between the isotopes of an element. Distinguish between the mass of an atom and the relative atomic mass of an element. Use relative atomic masses to calculate relative formula masses.
- Find out how mass can be gained or lost during a reaction. Find the mass of carbon dioxide released per gram of copper carbonate decomposed. Assess the accuracy of measurements.
- Explore ideas about the accuracy of measurements. Consider how closely measurements reflect true values. Explore ways of estimating the uncertainty in a set of measurements.

- Amounts in Chemistry Moles
- Amount of Substances in Equations
- Using Moles to Balance Equations
- Concentration of Solutions
- Percentage Yield
- Atom Economy
- Using Concentrations of Solutions / Titration
- Amounts of Substances in Volumes of Gases
- Describe the measurements of amounts of substances in moles. Calculate the amount of moles in a given mass of a substance. Calculate the mass of a given number of moles of a substance.
- Calculate the masses of substances in a balanced symbol equation. Calculate the masses of reactants and products from balanced symbol equations. Calculate the mass of a given reactant or product.
- Convert masses in grams to amounts in moles. Balance an equation given the masses of reactants and products. Change the subject of a mathematical equation.
- Relate mass, volume and concentration. Calculate the mass of a solute in a solution. Relate concentration in mol/dm³ to mass and volume.
- Calculate the percentage yield from the actual yield. Identify the balanced equations needed for calculating yields. Calculate theoretical product amounts from reactant amounts.
- Identify the balanced equation of a reaction. Calculate the atom economy of a reaction to form a product. Explain why a particular reaction pathway is chosen.
- Describe how to carry out titrations. Calculate concentrations in titrations in mol/dm³ and in g/dm³. Explain how the concentration of a solution in mol/dm³ is related to the mass of the solute and the volume of the solution.
- Explain that the same amount of any gas occupies the same volume at room temperature and pressure (RTP). Calculate the volume of a gas at RTP from its mass and relative formula mass. Calculate the volumes of gases from a balanced equation and a given volume of a reactant or product.

Chemical Changes

Lesson Set Objectives

To learn about metal oxides, reactivity and extraction of metals, oxidation and reduction, reacting metals with acids, neutralisation reactions and pH, preparing salts, reacting volumes, electrolysis for metal extraction, and electron transfer.

Previous skills, themes or concepts

Builds on knowledge from the KS3 topics of 'Materials' and 'Chemical Reactions'.

Assessment used within this topic

The KS4 science diagnostic assessment incorporates questions on the topic of 'Chemical Changes' to test and evaluate a learner's prior learning and knowledge gaps.

Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Chemical Changes' topic.

Resilience

Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Chemical Changes' topic.

Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Chemical Changes'.

This lesson set includes the following lessons:

- Metal Oxides
- Reactivity Series
- Extraction of Metals
- Oxidation and Reduction in Terms of Electrons
- Reaction of Metals with Acids to Make Soluble Salts
- Neutralisation of Acids and Salt Production
- Prepare a Salt from a Metal Oxide or Carbonate (Practical Lesson)
- Neutralisation and pH
- Finding Reacting Volumes by Titration (Practical Lesson)
- Strong and Weak Acids
- Electrolysis Theory
- Electrolysis (Practical Lesson)
- Extracting Metals Using Electrolysis
- Electron Transfer Reduction and Oxidation

Lesson Objectives

- Explore what happens when metals burn or corrode. Classify chemical changes as oxidation or reduction. Review the properties of metal oxides.
- Compare the reactivity of metals. Observe some reactions between metal atoms and metal ions. Consider why some metals are more reactive than others.
- Find out where metals come from. Extract iron from its oxide using carbon. Consider how other metals are extracted from their ores.
- Observe some reactions between metal atoms and metal ions. Learn to write ionic equations and half equations. Classify half equations as oxidation or reduction.
- React an acid and a metal to make a salt. Predict the formula of a salt. Write balanced symbol equations and half equations.
- React an acid and an alkali to make a salt. Predict the formula of a salt. Write balanced symbol equations.
- React a carbonate with an acid to make a salt. Describe each step in the procedure.
- Estimate the pH of solutions. Identify weak and strong acids and alkalis. Investigate pH changes when a strong acid neutralises a strong alkali.
- Use an acid to neutralise a known volume of alkali. Use a burette to determine the volume of an acid needed. Use the results to determine the concentration of an alkali.
- Explore the factors that affect the pH of an acid. Find out how the pH changes when an acid is diluted. Find out how the concentrations of solutions are measured.
- Explore what happens when a current passes through a solution of ions. Find out what an electrolyte is and what happens when it conducts electricity. Find out how electricity decomposes compounds.
- Devise a hypothesis. Devise an investigation to test your hypothesis. Decide whether the evidence supports your hypothesis.
- Review the connection between the reactivity series and the way in which metals are extracted. Consider how aluminium is extracted from aluminium oxide. Learn the oxidation and reduction reactions involved in metal extraction.
- Review ion formation. Classify half equations as oxidation or reduction. Review patterns in reactivity.

Energy Changes

Lesson Set Objectives To learn about endothermic and exothermic reactions, measuring temperature changes during reactions, reaction profiles, cells, batteries and fuel cells.

Previous skills, themes or concepts	Builds on knowledge from the KS3 topic of 'Chemical Energetics'.	Assessment used within this topic	The KS4 science diagnostic assessment incorporates questions on the topic of 'Energy Changes' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Energy Changes' topic.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Energy Changes' topic. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Energy Changes'.
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This lesson set includes the following lessons:

- Endothermic and Exothermic Reactions
- Temperature Changes in Reactions (Practical Lesson)
- Reaction Profiles
- Energy Changes of Reactions
- Cells, Batteries and Fuel Cells

Lesson Objectives

- Explore the temperature changes produced by chemical reactions. Consider how reactions are used to heat or cool their surroundings. Investigate how these temperature changes can be controlled.
- Devise a hypothesis. Devise an investigation to test your hypothesis. Decide whether the evidence supports your hypothesis.
- Use diagrams to show the energy changes during reactions. Show the difference between exothermic and endothermic reactions using energy profiles.
- Identify the bonds broken and formed during a chemical reaction. Consider why some reactions are exothermic and others are endothermic. Use bond energies to calculate overall energy changes.
- Make simple cells and measure their voltages. Consider the importance of cells and batteries. Find out how larger voltages can be produced. Find out how fuel cells work. Compare and contrast the uses of hydrogen fuel cells, batteries and rechargeable cells. Learn what reactions take place inside hydrogen fuel cells.

Rate and Extent of Chemical Change

Lesson Set Objectives To learn about measuring rates, calculating rates, factors that affect the rate of reaction, limiting reactants, the effect of concentration on rates, collision theory, catalysts and reversible reactions, and equilibrium (including the Haber process).

Previous skills, themes or concepts	Builds on knowledge from the KS3 topic of 'Chemical Energetics'.	Assessment used within this topic	The KS4 science diagnostic assessment incorporates questions on the topic of 'Rate and Extent of Chemical Change' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Rate and Extent of Chemical Change' topic.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Rate and Extent of Chemical Change' topic. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Rate and Extent of Chemical Change'.
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This lesson set includes the following lessons:

- Measuring Rates
- Limiting Reactants and Molar Masses
- Calculating Rates
- Effect of Concentration on Rate of Reaction (Practical Lesson)
- Factors that Affect the Rate of a Reaction
- Collision Theory
- Catalysts
- Reversible Reactions and Equilibrium Reactions / Haber Process

Lesson Objectives

- Measure the volume of gas given off during a reaction and use the results to measure the reaction rate. Explore how the rate of reaction changes during a reaction.
- Recognise when one reactant is in excess and consider how this affects the amount of product made. Explore ways of increasing the amount of product.
- Find out how to calculate rates of reaction. Use graphs to compare reaction rates. Use tangents to measure rates that change.
- Measure the time taken to produce a specific amount of product and see how the temperature or concentration of the reactant can affect this time. Investigate the effect of breaking up a solid reactant into smaller pieces. Devise an investigation to test a hypothesis.
- Interpret graphs. Consider what determines the reaction rate. Explore the effect of changing the amounts of reactants used.
- Find out about the collision theory. Use the collision theory to make predictions about reaction rates. Relate activation energies to the collision theory.
- Investigate catalysts. Find out how catalysts work. Learn how catalysts affect activation energy.
- Explore the energy changes in a reversible reaction. Find out how reaction conditions affect reversible reactions. Find out what happens to the reactants and products at equilibrium. Use Le Chatelier's principle to make predictions. Explore how changing the concentration of reactants affects reversible reactions. Explore how changing the temperature affects reversible reactions. Explore how changing the pressure affects reversible reactions.

Hydrocarbons

Lesson Set Objectives To learn about alkanes, alkenes, alcohols, carboxylic acids, fractional distillation, cracking, combustion, polymerisation, man-made polymers, natural polymers, and the forces that hold small molecules together.

Previous skills, themes or concepts	Builds on knowledge from the KS3 topic of 'Chemical Reactions'.	Assessment used within this topic	The KS4 science diagnostic assessment incorporates questions on the topic of 'Hydrocarbons' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Hydrocarbons' topic.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Hydrocarbons' topic. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Hydrocarbons'.
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This lesson set includes the following lessons:

- Crude Oil Hydrocarbons and Alkanes
- Fractional Distillation and Petrochemicals
- Combustion and Properties of Hydrocarbons
- Cracking and Alkenes
- Structure and Formula of Alkanes
- Reactions of Alkenes
- Alcohols
- Carboxylic Acids
- Addition Polymerisation
- Condensation Polymerisation
- Amino Acids
- DNA and Other Natural Polymers
- Intermolecular Forces

Lesson Objectives

- Describe why crude oil is a finite resource. Identify the hydrocarbons in the series of alkanes. Explain the structure and formulae of the alkanes.
- Describe how crude oil is used to provide modern materials. Explain how crude oil is separated by fractional distillation. Explain why the boiling points of the fractions are different.
- Describe how different hydrocarbon fuels have different properties. Identify the properties that influence the use of fuels. Explain how the properties are related to the size of the molecules. Describe the process of complete combustion. Balance equations showing the combustion of hydrocarbons. Explain the consequences of incomplete combustion.
- Describe the usefulness of cracking. Balance chemical equations as examples of cracking. Explain why modern life depends on the uses of hydrocarbons.
- Describe the difference between an alkane and an alkene. Draw the displayed structural formulae for the first four members of the alkenes. Explain why alkenes are called unsaturated molecules.
- Describe the addition reactions of alkenes. Draw the full displayed structural formulae of the products alkenes make. Explain how alkenes react with hydrogen, water and the halogens.
- Recognise alcohols from their name or from given formulae. Describe the conditions used for the fermentation of sugar using yeast. Write balanced chemical equations for the combustion of alcohols.
- Describe the reactions of carboxylic acids. Recognise carboxylic acids from their formulae. Explain the reaction of ethanoic acid with an alcohol.
- Recognise addition polymers and monomers from diagrams. Draw diagrams of the formation of a polymer from an alkene. Relate the repeating unit of the polymer to the monomer.
- Explain the basic principles of condensation polymerisation. Explain the role of functional groups in producing a condensation polymer. Explain the structure of the repeating units in a condensation polymer.
- Describe the functional group of an amine. Identify the two functional groups of an amino acid. Explain how different amino acids build proteins.
- Describe the components of natural polymers. Explain the structure of proteins and carbohydrates. Explain how a molecule of DNA is constructed.
- Identify the bonds within a molecule and the forces between molecules. Explain changes of state. Explain how polymer structure determines its ability to stretch.

Chemical Analysis

Lesson Set Objectives To learn about identifying pure substances, chromatography, testing for gases, flame tests for metals, and using chemical tests to identify ions.

Previous skills, themes or concepts	Builds on knowledge from the KS3 topics of 'Pure and Impure Substances' and 'Chemical Reactions'.	Assessment used within this topic	The KS4 science diagnostic assessment incorporates questions on the topic of 'Chemical Analysis' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Chemical Analysis' topic.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Chemical Analysis' topic. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Chemical Analysis'.
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This lesson set includes the following lessons:

- Pure Substances
 - Formulations
- Lesson Objectives**
- Describe, explain and exemplify processes of separation. Suggest separation and purification techniques for mixtures. Distinguish pure and impure substances using melting point and boiling point data.
 - Identify formulations given appropriate information. Explain the particular purpose of each chemical in a mixture. Explain how quantities are carefully measured for formulation.

- Chromatography
- Use of Chromatography to Identify Inks (Practical Lesson)
- Tests for Gases
- Flame Tests
- Identifying Ions
- Use Chemical Tests to Identify Ions (Practical Lesson)
- Explain how to set up chromatography paper. Distinguish pure from impure substances. Interpret chromatograms and calculate Rf values.
- Describe the safe and correct manipulation of chromatography apparatus and describe how accurate measurements are achieved. Make and record measurements in paper chromatography. Calculate Rf values.
- Recall the tests for four common gases. Identify the four common gases using these tests. Explain why limewater can be used to detect carbon dioxide.
- Carry out flame test procedures. Identify the colours of the flames of ions. Identify species from the results of the tests.
- Identify species from the results of the tests. Explain how to use sodium hydroxide to test for metal ions. Write balanced equations for producing insoluble metal hydroxides. Identify the tests for carbonates. Explain the tests for halides and sulphates. Identify anions and cations from the results of tests. Describe some instrumental techniques.
- Describe how to carry out experiments safely using the correct manipulation of apparatus for the qualitative analysis of ions. Make and record observations using flame tests and precipitation methods. Identify unknown ions in chemical compounds.

The Atmosphere

Lesson Set Objectives To learn about the proportion of gases in the atmosphere, the composition of the early atmosphere, where oxygen came from, what happened to carbon dioxide, greenhouse gases and carbon footprint, and atmospheric pollution from fuel use.

Previous skills, themes or concepts	Builds on knowledge from the KS3 topic of 'Earth and Atmosphere'.	Assessment used within this topic	The KS4 science diagnostic assessment incorporates questions on the topic of 'The Atmosphere' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of 'The Atmosphere' topic.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of 'The Atmosphere' topic. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'The Atmosphere'.
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This lesson set includes the following lessons:

- Proportions of Gases in the Atmosphere
- Early Atmosphere and the Increase in Oxygen
- How Carbon Dioxide Decreased
- Greenhouse Gases
- Carbon Footprint
- Atmospheric Pollutants from Fuels

Lesson Objectives

- Review the composition of the atmosphere. Measure the percentage of oxygen in the atmosphere and consider why it stays the same.
- Explore the origins of the Earth's atmosphere. Consider the evidence that ideas about the early atmosphere are based on.
- Explore the processes that changed the amount of carbon dioxide in the atmosphere. Find out what ice cores tell us about the atmosphere. Explore how carbon dioxide levels have changed over time.
- Review the greenhouse effect. Explain how greenhouse gases trap heat. Consider the consequences of adding greenhouse gases to the atmosphere. Explore the consequences of climate change.
- Find out what a carbon footprint is. Consider factors that contribute to our carbon footprints. Explore ways of reducing our carbon footprints.
- Explore the products formed when fuels burn. Distinguish between complete and incomplete combustion. Write equations for complete and incomplete combustion.

Sustainable Development

Lesson Set Objectives To learn about the Earth's resources, potable water, water purification, life cycle assessments, recycling, alternative means of extracting metals, preventing corrosion, alloys, ceramics, polymers and composites, the Haber process and fertiliser production.

Previous skills, themes or concepts	Builds on knowledge from the KS3 topic of 'Earth and Atmosphere'.	Assessment used within this topic	The KS4 science diagnostic assessment incorporates questions on the topic of 'Sustainable Development' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Sustainable Development' topic.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Sustainable Development' topic. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Sustainable Development'.
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This lesson set includes the following lessons:

- Using the Earth's Resources
- Potable Water

Lesson Objectives

- Give examples of natural products replaced by synthetics. Give examples of products replaced by agricultural products. Distinguish between finite and renewable resources.
- Distinguish between potable water and pure water. Describe the differences in treatment of ground water and salt water. Explain what is needed to provide potable water for all.

- Purifying Water Samples (Practical Lesson)
 - Alternative Methods of Metal Extraction
 - Life Cycle Assessments and Recycling
 - Reducing the Use of Resources
 - Corrosion and Corrosion Prevention
 - Alloys as Useful Materials
 - Ceramics, Polymers and Composites
 - The Haber Process
 - Production of NPK Fertilisers
- Describe how safety is managed, apparatus is used and accurate measurements are made. Recognise when sampling techniques need to be used and made representative. Carry out a procedure to produce potable water from salt solution. Evaluate methods and suggest possible improvements and further investigations.
 - Describe the process of phytomining. Describe the process of bioleaching. Evaluate alternative biological methods of metal extraction.
 - Describe the components of a life cycle assessment (LCA). Interpret LCAs of materials or products from information. Carry out a simple comparative LCA for shopping bags.
 - Describe ways of recycling and reusing materials. Explain why recycling, reusing and reducing are needed. Evaluate ways of reducing the use of limited resources.
 - Show that air and water are needed for rusting. Describe experiments and interpret results on rusting. Explain methods for preventing corrosion.
 - Describe the composition of common alloys. Interpret the composition of other alloys from data. Evaluate the uses of other alloys.
 - Compare quantitatively properties of materials. Compare glass, ceramics, polymers, composites and metals. Select materials by relating their properties to uses.
 - Apply principles of dynamic equilibrium to the Haber process. Use graphs to explain the trade off with rate and equilibrium. Explain how commercially used conditions relate to cost.
 - Describe how to make a fertiliser in the laboratory. Explain how fertilisers are produced industrially. Compare the industrial production of fertilisers with the laboratory preparation of fertilisers.

KS3 Chemistry

Objectives	<p>Learners should gain an understanding of the science of matter:</p> <ul style="list-style-type: none"> That matter exists in different states and is composed of atoms, elements and compounds, which can be represented by symbols and by using the particle model. That mass is conserved during both chemical reactions and changes of state. The difference between mixtures and pure substances, a range of separation techniques, and how pure substances are identified. That chemical reactions such as: combustion, thermal decomposition, oxidation or displacement, are the rearrangement of atoms and can be represented by equations. That the pH scale is used to measure the strengths of acids and alkalis, that acids take part in a range of reactions, and how acids can be neutralised. That some chemical reactions are either exothermic or endothermic and that the rate of some chemical reactions can be increased by a catalyst. That the periodic table can be used to predict the properties of elements. That the order of metals and carbon in the reactivity series is used in the extraction of metals. The composition and structure of the Earth, and how the rock cycle leads to a range of rock types. The composition of the atmosphere and the impact of human activity upon it.
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The Particle Model of Matter

Lesson Set Objectives To learn how particles behave in solids, liquids and gases.

Previous skills, themes or concepts	Builds on knowledge from the KS2 topic of 'Properties and Changes of Materials'.	Assessment used within this topic	<p>The KS3 science diagnostic assessment incorporates questions on the topic of 'The Particle Model of Matter' to test and evaluate a learner's prior learning and knowledge gaps.</p> <p>Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of 'The Particle Model of Matter' topic.</p>	Resilience	<p>Support is provided throughout this lesson set to assist a learner's development in their knowledge of 'The Particle Model of Matter' topic.</p> <p>Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'The Particle Model of Matter'.</p>
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This lesson set includes the following lesson:

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| <ul style="list-style-type: none"> Solids, Liquids and Gases | <p>Lesson Objectives</p> <ul style="list-style-type: none"> Describe the properties of the different states of matter (solid, liquid and gas) in terms of the particle model, including pressure in gases. Explain changes of state in terms of the particle model. |
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Atoms, Elements and Compounds

Lesson Set Objectives To learn that elements are composed of specific types of atoms and that these can be arranged on the periodic table.

Previous skills, themes or concepts	Builds on knowledge from the KS2 topic of 'Properties and Changes of Materials'.	Assessment used within this topic	<p>The KS3 science diagnostic assessment incorporates questions on the topic of 'Atoms, Elements and Compounds' to test and evaluate a learner's prior learning and knowledge gaps.</p> <p>Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Atoms, Elements and Compounds' topic.</p>	Resilience	<p>Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Atoms, Elements and Compounds' topic.</p> <p>Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Atoms, Elements and Compounds'.</p>
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This lesson set includes the following lesson:

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| <ul style="list-style-type: none"> Atoms | <p>Lesson Objectives</p> <ul style="list-style-type: none"> Describe a simple (Dalton) atomic model of the atom. |
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Pure and Impure Substances

Lesson Set Objectives To learn how atoms form molecules, some chemical symbols, and how to identify a pure substance.

Previous skills, themes or concepts	Builds on knowledge from the KS2 topic of 'Properties and Changes of Materials'.	Assessment used within this topic	The KS3 science diagnostic assessment incorporates questions on the topic of 'Pure and Impure Substances' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Pure and Impure Substances' topic.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Pure and Impure Substances' topic. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Pure and Impure Substances'.
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This lesson set includes the following lessons:

Lesson Objectives

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| <ul style="list-style-type: none"> ■ Atoms and Molecules ■ Chemical Symbols ■ Where the Atoms Go ■ Pure Substances | <ul style="list-style-type: none"> ■ Explain the differences between atoms, elements and compounds. ■ Use chemical symbols for atoms, elements and compounds. ■ Explain how mass is conserved in changes of state and chemical reactions. ■ Describe the concept of a pure substance. Explain how to identify a pure substance. |
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Chemical Reactions

Lesson Set Objectives To learn about the different types of chemical reactions, acids and alkalis, and separating mixtures.

Previous skills, themes or concepts	Builds on knowledge from the KS2 topic of 'Properties and Changes of Materials'.	Assessment used within this topic	The KS3 science diagnostic assessment incorporates questions on the topic of 'Chemical Reactions' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Chemical Reactions' topic.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Chemical Reactions' topic. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Chemical Reactions'.
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This lesson set includes the following lessons:

Lesson Objectives

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| <ul style="list-style-type: none"> ■ Mixtures ■ Separating Mixtures ■ Chemical Reactions ■ Different Types of Reactions ■ Acids and Alkalis ■ Acids and Metals | <ul style="list-style-type: none"> ■ Explain mixtures, including dissolving and diffusion in terms of the particle model. ■ Explain simple techniques for separating mixtures, such as filtration, evaporation, distillation and chromatography. ■ Explain chemical reactions as the rearrangement of atoms. Represent chemical reactions using formulae and using equations. ■ Explain combustion, thermal decomposition, oxidation and displacement reactions. ■ Define acids and alkalis in terms of neutralisation reactions. Describe the reactions of acids with alkalis to produce a salt and water. Explain how the pH scale is used for measuring acidity and alkalinity and the use of indicators. ■ Describe the reactions of acids with metals to produce a salt and hydrogen. |
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Chemical Energetics

Lesson Set Objectives To learn about chemical reactions that produce or use up heat, and how a catalyst can be used to speed up a chemical reaction.

Previous skills, themes or concepts	Builds on knowledge from the KS2 topic of 'Properties and Changes of Materials'.	Assessment used within this topic	The KS3 science diagnostic assessment incorporates questions on the topic of 'Chemical Energetics' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Chemical Energetics' topic.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Chemical Energetics' topic. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Chemical Energetics'.
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This lesson set includes the following lessons:

Lesson Objectives

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| <ul style="list-style-type: none"> ■ What is a Catalyst? ■ Where is the Heat Going? ■ Hot and Cold Chemistry | <ul style="list-style-type: none"> ■ Explain what a catalyst is and what it does. ■ Explain the energy changes during changes of state (qualitative). ■ Explain exothermic and endothermic chemical reactions (qualitative). |
|---|---|

The Periodic Table

Lesson Set Objectives To learn the properties of metals and non-metals, and how we can use the periodic table to predict their properties.

Previous skills, themes or concepts	Builds on knowledge from the KS2 topic of 'Properties and Changes of Materials'.	Assessment used within this topic	The KS3 science diagnostic assessment incorporates questions on the topic of 'The Periodic Table' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of 'The Periodic Table' topic.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of 'The Periodic Table' topic. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'The Periodic Table'.
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This lesson set includes the following lessons:

Lesson Objectives

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| <ul style="list-style-type: none"> ■ Elements and Uses of the Periodic Table ■ Properties of Metals and Non-metals | <ul style="list-style-type: none"> ■ Outline the principles underpinning the Mendeleev periodic table. Describe the periodic table, including periods and groups, and metals and non-metals . Explain how patterns in reactions can be predicted with reference to the periodic table. ■ Describe the properties of metals and non-metals. Explain the chemical properties of metal and non-metal oxides with respect to acidity. |
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Materials

Lesson Set Objectives To learn how we use our knowledge of reactivity in the extraction of metals.

Previous skills, themes or concepts	Builds on knowledge from the KS2 topic of 'Properties and Changes of Materials'.	Assessment used within this topic	The KS3 science diagnostic assessment incorporates questions on the topic of 'Materials' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Materials' topic.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Materials' topic. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Materials'.
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This lesson set includes the following lessons:

Lesson Objectives

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| <ul style="list-style-type: none"> ■ Reactivity and Extraction of Metals | <ul style="list-style-type: none"> ■ Describe the order of metals and carbon in the reactivity series. Explain the use of carbon in obtaining metals from metal oxides. |
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Earth and Atmosphere

Lesson Set Objectives To learn about the structure of the Earth, the rock cycle, resources that the Earth provides and man-made substitutes of these resources, the carbon cycle, the atmosphere, and the impact of humans on the Earth's atmosphere.

<p>Previous skills, themes or concepts</p>	<p>Builds on knowledge from the KS2 topic of 'Properties and Changes of Materials'.</p>	<p>Assessment used within this topic</p>	<p>The KS3 science diagnostic assessment incorporates questions on the topic of 'Earth and Atmosphere' to test and evaluate a learner's prior learning and knowledge gaps.</p> <p>Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Earth and Atmosphere' topic.</p>	<p>Resilience</p>	<p>Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Earth and Atmosphere' topic.</p> <p>Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Earth and Atmosphere'.</p>
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This lesson set includes the following lessons:

- Man-made Materials
- Our Earth
- The Rock Cycle
- Resources from the Earth
- The Carbon Cycle
- The Atmosphere
- Our Impact on the Earth

Lesson Objectives

- Describe the properties of ceramics, polymers and composites (qualitative).
- Describe the composition of the Earth. Explain the structure of the Earth.
- Outline the rock cycle and the formation of igneous, sedimentary and metamorphic rocks.
- Discuss the earth as a source of limited resources and the efficacy of recycling.
- Outline the carbon cycle.
- Outline the composition of the atmosphere.
- Assess the production of carbon dioxide by human activity and the impact of this on the climate.

KS2 Chemistry

Objectives	<p>Learners should gain an understanding of the science of matter:</p> <ul style="list-style-type: none"> That matter exists in three different states, which each have different properties, as in the water cycle, where matter can change between these states. That materials that are dissolved can be separated. That unlike changes of state, chemical changes cannot be easily reversed. That soil is an example of a complex mixture.
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Properties and Changes of Materials

Lesson Set Objectives	To learn about the properties of materials, the three states of matter, the water cycle, that some materials dissolve in liquids to form solutions and how these can be separated, that soil is a complex mixture, and the difference between a chemical and a physical change.
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Previous skills, themes or concepts	Builds on knowledge from the KS1 topic of 'Uses of Everyday Materials'.	Assessment used within this topic	<p>The KS2 science diagnostic assessment incorporates questions on the topic of 'Properties and Changes of Materials' to test and evaluate a learner's prior learning and knowledge gaps.</p> <p>Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Properties and Changes of Materials' topic.</p>	Resilience	<p>Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Properties and Changes of Materials' topic.</p> <p>Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Properties and Changes of Materials'.</p>
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This lesson set includes the following lessons:

- Properties of Materials
- Solids, Liquids and Gases
- Changes of State
- Solutions
- Separating Mixtures
- The Water Cycle
- Soil
- Chemical Changes

Lesson Objectives

- Classify materials into categories such as solids, liquids and gases.
- Describe the three states of matter. Explain what water is called in the three states. Explain what happens when states change.
- Recognise that water can be a solid, a liquid or a gas.
- Explain that some materials will dissolve in liquids to form a solution. Describe how to recover a substance from a solution.
- Use knowledge of solids, liquids, gases and solutions to decide how mixtures might be separated through filtering, sieving or evaporating.
- Demonstrate that changes of state are reversible. Use the water cycle as an example of changes of state.
- Explain that soil is a complex mixture of substances.
- Explain that some changes result in new substances forming, and these changes cannot be reversed. Describe the changes associated with combustion and the neutralisation of acids.

Physics

The EDClass teaching staff will use a combination of professional judgement, diagnostic assessment, the information provided by school staff and SLT through the admissions process, and learner feedback to create a personalised, flexible and challenging learning pathway that offers eLearning, video clips, recorded sessions and live learning lessons for all learners on the subject of physics.

KS4 Physics

Energy	Electricity	The Particle Model of Matter	Atomic Structure	Forces
Waves	Electromagnetism	Space		

KS3 Physics

Forces and Motion	Energy	Waves	Electricity and Magnetism	Physical and Chemical Changes of Matter
The Particle Model	Energy in Matter	Space Physics		

KS2 Physics

Earth and Space	Forces and Magnetism	Light and Sound	Electricity
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KS4 Physics

Objectives	<p>Learners should gain an understanding of the fundamental concepts of the universe:</p> <p>The use of the particle model to explain the behaviour of matter, and the wave model to explain the behaviour of light and sound.</p> <p>The nature, properties, measurement and uses of energy.</p> <p>The use of cause and effect to explain the link between force and acceleration, and between changes in atomic nuclei and radioactive emissions.</p> <p>The concept of a field to explain the 'action at a distance' of electrical, magnetic and gravitational effects.</p> <p>The concept that the differences between pressure, temperature and electrical potential drive changes in systems.</p> <p>That the proportionality between the weight and mass of an object, or the force and extension of a spring is a fundamental component of many scientific models.</p> <p>That the structure of the universe is dependent on fundamental forces of nature.</p>
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Energy

Lesson Set Objectives To learn about the different forms of energy, the relationship between work, power and energy, specific heat capacity, energy transfers and efficiency, insulation and global energy supplies.

Previous skills, themes or concepts	Builds on knowledge from the KS3 topic of 'Energy'.	Assessment used within this topic	<p>The KS4 science diagnostic assessment incorporates questions on the topic of 'Energy' to test and evaluate a learner's prior learning and knowledge gaps.</p> <p>Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Energy' topic.</p>	Resilience	<p>Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Energy' topic.</p> <p>Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Energy'.</p>
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This lesson set includes the following lessons:

- Potential Energy
- Energy Transfers
- Work Done and Energy Transfer
- Power
- Investigate Specific Heat Capacity (Practical Lesson)
- Dissipation of Energy
- Energy Efficiency
- Reducing Energy Losses / Thermal Insulation
- Global Energy Supplies

Lesson Objectives

- Consider what happens when a spring is stretched. Describe what is meant by gravitational potential energy. Calculate the energy stored by an object raised above ground level.
- Define Joules (J) as the unit of energy. Describe the principle of 'the conservation of energy'. Draw diagrams to show energy transfers. Define power and use this to complete some simple calculations.
- Understand what is meant by work done. Explain the relationship between work done and force applied. Identify the transfers between energy stores when work is done against friction.
- Define power. Compare the rate of energy transfer by various machines and electrical appliances. Calculate power.
- Understand how things heat up. Find out about heating water. Find out about specific heat capacity. Use theories to develop a hypothesis. Evaluate a method and suggest improvements. Perform calculations to support conclusions.
- Explain ways of reducing unwanted energy transfer. Describe what affects the rate of cooling in a building. Understand that energy is dissipated.
- Explain what is meant by energy efficiency. Calculate the efficiency of energy transfers. Find out about the conservation of energy.
- Use scientific ideas to make predictions. Analyse data to identify trends. Evaluate an experimental procedure.
- Analyse global trends in energy use. Understand what the issues are when using energy resources.

Electricity

Lesson Set Objectives To learn about static electricity and electric fields, series and parallel circuits, voltage, current and resistance (Ohm's law), investigating resistance and the properties of components, transmitting electricity, power and energy transfers.

Previous skills, themes or concepts	Builds on knowledge from the KS3 topic of 'Electricity and Magnetism'.	Assessment used within this topic	<p>The KS4 science diagnostic assessment incorporates questions on the topic of 'Electricity' to test and evaluate a learner's prior learning and knowledge gaps.</p> <p>Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Electricity' topic.</p>	Resilience	<p>Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Electricity' topic.</p> <p>Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Electricity'.</p>
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This lesson set includes the following lessons:

- Static Electricity and Electric Fields
- Describe how insulating materials can become charged. Know that there are two kinds of electric charge. Explain these observations in terms of electron transfer. Explain what an electric field is. Draw an electric field pattern for a charged sphere. Use the idea of an electric field to explain electrostatic attraction and sparking.

- Electric Current, Series and Parallel Circuits
- Investigating Circuit Components
- Investigating IV Characteristics of Components (Practical Lesson)
- Investigating the Resistance in a Wire
- Control Circuits
- Electricity in the Home
- Transmitting Electricity
- Power and Energy Transfers
- Calculating Power
- The Difference Between Potential Difference and Current
- Recall that current is the rate at which electric charge flows. Recall that current (I) depends on resistance (R) and potential difference (V). Explain how an electric current passes through a circuit. Describe the changes in the current in series and parallel circuits. Describe the changes in the potential difference in series and parallel circuits.
- Classify materials as either conducting or insulating. Use series circuits to test components and make measurements. Carry out calculations on series circuits.
- Set up a circuit to investigate resistance. Investigate the changing resistance of a filament lamp. Compare the properties of a resistor and filament lamp. Evaluate how an experimental procedure can yield more accurate data. Interpret and explain graphs using scientific ideas.
- Use a circuit to determine resistance. Gather valid data to use in calculations. Apply the circuit to determine the resistance of combinations of components.
- Use a thermistor and light-dependent resistor (LDR). Investigate the properties of thermistors, LDRs and diodes.
- Recall that in the UK, mains electricity is an a.c. supply at 50 Hz and about 230 V. Describe the main features of live, neutral and earth wires.
- Describe how electricity is transmitted using the National Grid. Explain why electrical power is transmitted at high potential differences. Understand the role of transformers.
- Describe the energy transfers in different domestic appliances. Describe power as a rate of energy transfer. Calculate the energy transferred.
- Calculate power. Use power equations to solve problems. Consider power ratings and changes in stored energy.
- Explain the concepts of current and potential difference and use these concepts to explain various situations. Use current and potential difference to measure resistance in a circuit.

The Particle Model of Matter

Lesson Set Objectives						To learn about density, changes of state, internal energy, specific heat capacity, latent heat, particle motion in gases, pressure in gases, and relating changes of state to the particle model.					
Previous skills, themes or concepts		Builds on knowledge from the KS3 topics of 'Physical and Chemicals Changes of Matter' and 'The Particle Model'.		Assessment used within this topic		The KS4 science diagnostic assessment incorporates questions on the topic of 'The Particle Model of Matter' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of 'The Particle Model of Matter' topic.		Resilience		Support is provided throughout this lesson set to assist a learner's development in their knowledge of 'The Particle Model of Matter' topic. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'The Particle Model of Matter'.	

This lesson set includes the following lessons:

Lesson Objectives

- Density
- Investigating Density / Regular and Irregular Solids and Liquids (Practical Lesson)
- Changes of State
- Internal Energy
- Specific Heat Capacity
- Latent Heat
- Particle Motion in Gases
- Increasing the Pressure of a Gas
- The Particle Model and Changes of State
- Use the particle model to explain the different states of matter and differences in density. Describe differences in density for different states of matter. Calculate density.
- Interpret observations and data. Use spatial models to solve problems. Plan experiments and devise procedures. Use an appropriate number of significant figures in measurements and calculations.
- Describe how, when substances change state, mass is conserved. Describe energy transfer in changes of state. Explain changes of state in terms of particles.
- Describe the particle model of matter. Understand what is meant by the internal energy of a system. Describe the effect of heating on the energy stored within a system.
- Describe the effect of increasing the temperature of a system in terms of particles. State the factors that are affected by an increase in the temperature of a substance. Explain specific heat capacity.
- Explain what is meant by latent heat. State the factors that are affected by an increase in the temperature of a substance. Perform calculations involving specific latent heat.
- Relate the temperature of a gas to the average kinetic energy of the particles. Explain how a gas has a pressure. Explain that changing the temperature of a gas held at constant volume changes the pressure of that gas.
- Describe the relationship between the pressure and volume of a gas at constant temperature. Calculate the change in the pressure or volume of a gas held at constant temperature when either the pressure or volume is increased or decreased. Explain how doing work on a gas can increase its temperature.
- Use the particle model to explain states of matter. Use ideas about energy and bonds to explain changes of state. Explain the relationship between temperature and energy.

Atomic Structure

Lesson Set Objectives To learn about the structure of the atom, radioactive decay, background radiation, half-life, hazards and uses of radiation, fission and fusion, and the development of the nuclear model of the atom.

Previous skills, themes or concepts	Builds on knowledge from the KS3 topic of 'The Particle Model'.	Assessment used within this topic	The KS4 science diagnostic assessment incorporates questions on the topic of 'Atomic Structure' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Atomic Structure' topic.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Atomic Structure' topic. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Atomic Structure'.
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This lesson set includes the following lessons:

- Atomic Structure
- Radioactive Decay
- Background Radiation
- Nuclear Equations and Half-life
- Hazards and Uses of Radiation
- Nuclear Fission and Fusion
- Development of the Nuclear Model

Lesson Objectives

- Describe the structure of the atom. Use symbols to represent particles. Describe ionisation.
- Describe radioactive decay. Describe the types of nuclear radiation. Understand the processes of alpha decay and beta decay.
- Recall sources of background radiation. Describe how different types of radiation have different ionising power. Recall the different penetrating powers of alpha, beta and gamma radiation.
- Understand nuclear equations. Write balanced nuclear equations for alpha decay. Write balanced nuclear equations for beta decay. Explain what is meant by 'radioactive half-life'. Calculate half-life. Choose the best radioisotope for a task.
- Describe radioactive contamination. Give examples of how radioactive tracers can be used. Explain how contaminated waste is disposed of. Describe some uses of nuclear radiation for medical diagnosis and therapy. Describe how internal organs can be explored. Understand how nuclear radiation can control or destroy unwanted tissue.
- Describe nuclear fission. Describe the conditions needed for fusion. Describe how nuclear fusion may be an attractive energy source. Explain how a chain reaction occurs. Explain how fission is used. Explain nuclear fusion.
- Understand how ideas about the structure of the atom have changed. Understand how evidence is used to test and improve models.

Forces

Lesson Set Objectives To learn about speed and acceleration, velocity-time graphs, weight and mass, the relationship between force and motion, Newton's laws, moments, levers and gears, pressure and the behaviour of springs in relation to stored energy.

Previous skills, themes or concepts	Builds on knowledge from the KS3 topic of 'Forces and Motion'.	Assessment used within this topic	The KS4 science diagnostic assessment incorporates questions on the topic of 'Forces' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Forces' topic.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Forces' topic. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Forces'.
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This lesson set includes the following lessons:

- Forces
- Speed
- Acceleration
- Velocity-time Graphs
- Heavy or Massive?
- Forces and Motion
- Resultant Forces
- Investigating the Acceleration of an Object (Practical Lesson)

Lesson Objectives

- Describe a force. Recognise the difference between contact and non-contact forces. State examples of scalar and vector quantities.
- Calculate speed using distance travelled divided by time taken. Calculate speed from a distance–time graph. Measure the gradient of a distance–time graph at any point.
- Describe acceleration. Calculate acceleration. Explain motion in a circle.
- Draw velocity–time graphs. Calculate acceleration using a velocity–time graph. Calculate displacement using a velocity–time graph.
- Identify the correct units for mass and weight. Explain the difference between mass and weight. Understand how weight is an effect of gravitational fields.
- Understand what a force does. Explain what happens to an object if all the forces acting on it cancel each other out. Analyse how this applies to everyday situations.
- Calculate the resultant force from opposing forces. Draw free-body diagrams to find resultant forces. Understand that a force can be resolved into two components acting at right angles to each other.
- Explain what happens to the motion of an object when the resultant force is not zero. Analyse situations in which a non-zero resultant force is acting. Explain what inertia is. Plan an investigation to explore an idea. Analyse results to identify patterns and draw conclusions. Compare results with scientific theory.

- Newton's Third Law
- Momentum
- Keeping Safe on the Road
- Moments
- Levers and Gears
- Pressure in a Fluid
- Atmospheric Pressure
- Forces and Energy in Springs
- Hooke's Law - Force and Extension of a Spring (Practical Lesson)
- Identify force pairs. Understand and be able to apply Newton's third law.
- Explain what is meant by momentum. Apply ideas about rate of change of momentum to safety features in cars. Use momentum calculations to predict what happens in a collision.
- Explain the factors that affect stopping distance. Explain the dangers caused by large deceleration. Estimate the forces involved in the deceleration of a road vehicle. Apply the idea of the rate of change of momentum to explain safety features.
- Describe the turning effect of a force about a pivot. Explain and use the principle of moments. Explain what is meant by the centre of mass of an object.
- Describe how levers and gears can be used to transmit the rotational effect of a force. Explain how levers and gears transmit forces.
- Explain how pressure acts in a fluid. Calculate pressure at different depths in a fluid. Explain what causes upthrust.
- Show that the atmosphere exerts a high pressure. Explain variations in atmospheric pressure with height. Describe a simple model of the Earth's atmosphere and atmospheric pressure.
- Explain why you need two forces to stretch a spring. Describe the difference between elastic and inelastic deformation. Calculate extension, compression and elastic potential energy.
- Interpret readings to show patterns and trends. Apply the equation for a straight line to a graph.

Waves

Lesson Set Objectives To learn about the properties of waves, calculations involving waves, the wave equation, measuring the properties of waves, reflection and refraction, sound, seismic waves, electromagnetic waves, colour, lenses and magnification, and the emission and absorption of infra-red radiation.

Previous skills, themes or concepts

Builds on knowledge from the KS3 topic of 'Waves'.

Assessment used within this topic

The KS4 science diagnostic assessment incorporates questions on the topic of 'Waves' to test and evaluate a learner's prior learning and knowledge gaps.

Resilience

Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Waves' topic.

Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Waves' topic.

Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Waves'.

This lesson set includes the following lessons:

Lesson Objectives:

- Describing Waves
- Transverse and Longitudinal Waves
- Transferring Energy and Information by Waves
- Measuring Wave Speed
- Measure Wavelength, Frequency and Speed in Solids and Liquids (Practical Lesson)
- Reflection and Refraction
- Reflection and Refraction in Different Substances (Practical Lesson)
- Sound Waves and Ultrasound
- Seismic Waves
- The Electromagnetic Spectrum
- Reflection, Refraction and Wave Fronts
- Gamma Rays and X-rays
- UV and Infrared Radiation
- Investigating Infrared Absorption / Reflection (Practical Lesson)
- Describe wave motion. Define wavelength and frequency. Apply the relationship between wavelength, frequency and wave velocity.
- Compare the motion of transverse and longitudinal waves. Explain why water waves are transverse waves. Explain why sound waves are longitudinal waves.
- Explain that all waves have common properties. Explain how waves can be used to carry information. Explain various applications of energy transfer by different types of electromagnetic waves.
- Explain how the speed of sound in air can be measured. Explain how the speed of water ripples can be measured. Describe the use of echo sounding.
- Develop techniques for making observations of waves. Select suitable apparatus to measure frequency and wavelength. Use data to answer questions.
- Describe reflection, transmission and absorption of waves. Construct ray diagrams to illustrate reflection. Construct ray diagrams to illustrate refraction.
- Make and record observations of how light is reflected and transmitted at different surfaces. Measure angles and discuss the method, apparatus and uncertainty in measurements. Draw conclusions from experimental results.
- Describe how we hear sound and state the range of frequencies we can hear. Explain that sound travels faster in a denser medium. Explain about reflection, absorption and transmission of sound. Explain what ultrasound is. Describe how ultrasound is used in industry to investigate or detect hidden or buried objects. Explain how ultrasound is used in medicine.
- Describe how earthquakes are detected. Describe the properties of P waves and S waves. Explain how the properties of seismic waves allow us to investigate the inside of the Earth.
- Recall the similarities and differences between transverse and longitudinal waves. Recognise that electromagnetic waves are transverse waves. Describe the main groupings and wavelength ranges of the electromagnetic spectrum.
- Explain reflection and refraction and how these may vary with wavelength. Construct ray diagrams to illustrate refraction. Use wave front diagrams to explain refraction in terms of the difference in velocity of the waves in different substances.
- List the properties of gamma rays and X-rays. Compare gamma rays and X-rays.
- Describe the properties of ultraviolet and infrared radiation. Describe some uses and hazards of ultraviolet radiation. Describe some uses of infrared radiation.
- Explain reasons for the equipment used to carry out an investigation. Explain the rationale for carrying out an investigation. Apply ideas from an investigation to a range of practical contexts.

- Radio Waves and Microwaves
- Describe how radio waves are used for television and radio communications. List some properties of microwaves. Describe how microwaves are used in satellite communications. Describe the reflection and refraction of radio waves.
- Colour
- Describe what happens when light of different wavelengths lands on an object. Explain what determines the colour of an opaque object. Explain the effect of coloured filters.
- Lenses
- Describe what a lens does. Draw ray diagrams to show the formation of images by lenses. Describe the difference between a real and a virtual image.
- Images and Magnification
- Draw ray diagrams to show the formation of real and virtual images by lenses. Calculate the magnification of an image.
- Emission and Absorption of IR Radiation
- Realise that all bodies emit and absorb infrared radiation. Compare emission and absorption of radiation from different surfaces. Define a perfect black body. Explain that the intensity and distribution of wavelengths of any emission depend on the temperature of the body.

Electromagnetism

Lesson Set Objectives To learn about magnetism, magnetic fields, electromagnets, calculating magnetic force on a conductor, loudspeakers, the generator effects, and transformers and the national grid.

Previous skills, themes or concepts	Builds on knowledge from the KS3 topic of 'Electricity and Magnetism'.	Assessment used within this topic	The KS4 science diagnostic assessment incorporates questions on the topic of 'Electromagnetism' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Electromagnetism' topic.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Electromagnetism' topic. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Electromagnetism'.
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This lesson set includes the following lessons:

- Magnetism and Magnetic Forces
- Magnetic Fields / Electromagnets
- Calculating the Force on a Conductor
- Loudspeakers
- Generator Effect
- Transformers

Lesson Objectives:

- Explain what is meant by the poles of a magnet. Plot the magnetic field around a bar magnet. Describe magnetic materials and induced magnetism.
- Describe the Earth's magnetic field. Describe the magnetic effect of a current. Explain the link between current and magnetic field.
- Describe how motors work. Describe how to change the speed and the direction of the rotation of a motor. Explain the meaning of 'magnetic flux density'. Know the factors that make a more powerful motor.
- Describe how a moving-coil loudspeaker works. Link the vibration on a loudspeaker to the properties of the waves it produces. Compare loudspeakers and headphones.
- Describe how a current is induced in a wire when it moves in a magnetic field. Identify the factors that affect the size and direction of the induced current or induced potential difference.
- Explain how a transformer both uses and produces alternating current. Explain the relationship between the number of turns in the primary coil and the number in the secondary coil. Calculate the current that needs to be provided to produce a particular power output.

Space

Lesson Set Objectives To learn about the solar system, the orbits of planets, moons and artificial satellites, the force of gravity, the life cycle of stars, and red-shift.

Previous skills, themes or concepts	Builds on knowledge from the KS3 topic of 'Space Physics'.	Assessment used within this topic	The KS4 science diagnostic assessment incorporates questions on the topic of 'Space' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Space' topic.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Space' topic. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Space'.
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This lesson set includes the following lessons:

- The Solar System
- Orbits of Planets, Moons and Artificial Satellites
- Life Cycle of Stars
- Red-shift
- Gravity - the Force that Binds

Lesson Objectives:

- Describe the orbits of planets and moons in the solar system. Distinguish between planets, dwarf planets and moons.
- Compare the orbital motion of moons, artificial satellites and planets in the Solar System. Describe what keeps bodies in orbit around planets and stars. Explain how for circular orbits an object can have a changing velocity but unchanged speed. Explain why bodies must move at a particular speed to stay in orbit at a particular distance.
- Describe the life cycle of a star like the Sun and a massive star. Describe how the Sun and other stars formed. Describe the nuclear fusion reactions in the Sun. Describe the life cycle of a star. Identify the forces that are in equilibrium in a stable star. Understand how new elements are produced by nuclear fusion in stars. Recognise that the heavier elements are made in a supernova.
- Describe red-shift. Describe evidence for the expanding universe.
- Understand that gravity provides the force that keeps planets and satellites in orbits. Understand that gravity is necessary in the life cycle of a star, including the maintenance of equilibrium. Describe how the weight of an object depends on the gravitational field strength.

KS3 Physics

Objectives	<p>Learners should gain an understanding of the fundamental concepts of the universe:</p> <ul style="list-style-type: none"> That there are different forms of energy, which can be converted from one to another. That energy resources can be either renewable or non-renewable. That forces are measured in Newtons and can be either contact forces or non-contact forces. That unbalanced forces cause objects to move or change direction, and that there is a mathematical relationship between speed, distance and time. That both sound and light travel as waves, which have some common properties, such as reflection and refraction, but light travels much faster than sound. That current electricity travels in circuits, and can be quantified using a range of different units. The idea of a field to explain static electricity and magnetism. That during changes of state, mass is conserved, but density changes due to the rearrangement of particles, which can be represented using the particle model. The mathematical relationship between gravity and weight, and how this is dependent upon the location within the solar system. That the motion of the Earth in relation to the Sun, causes days and seasons. That other galaxies exist and distances within and between these galaxies are measured using light years.
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Forces and Motion

Lesson Set Objectives To learn about contact and non-contact forces and how they are measured, the relationship between forces and motion, and how to measure speed.

Previous skills, themes or concepts	Buils on knowledge from the KS2 topic of 'Forces and Magnetism'.	Assessment used within this topic	<p>The KS3 science diagnostic assessment incorporates questions on the topic of 'Forces and Motion' to test and evaluate a learner's prior learning and knowledge gaps.</p> <p>Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Forces and Motion' topic.</p>	Resilience	<p>Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Forces and Motion' topic.</p> <p>Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Forces and Motion'.</p>
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This lesson set includes the following lessons:

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| <ul style="list-style-type: none"> ■ Forces ■ Speed | <p>Lesson Objectives</p> <ul style="list-style-type: none"> ■ Describe the forces associated with deforming objects, friction and resistance to motion the of air and water. Explain that forces are measured in Newtons. ■ Explain the relationship between speed, distance and time ($\text{speed} = \text{distance} \div \text{time}$) . Represent a journey on a distance-time graph. Describe the relative motion of trains and cars passing each other. |
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Energy

Lesson Set Objectives To learn about the different forms of energy, energy transfers, and the sources of energy.

Previous skills, themes or concepts	Buils on knowledge from the KS2 topics of 'Living Things and Their Habitat' and 'Electricity'.	Assessment used within this topic	<p>The KS3 science diagnostic assessment incorporates questions on the topic of 'Energy' to test and evaluate a learner's prior learning and knowledge gaps.</p> <p>Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Energy' topic.</p>	Resilience	<p>Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Energy' topic.</p> <p>Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Energy'.</p>
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This lesson set includes the following lessons:

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| <ul style="list-style-type: none"> ■ Energy ■ Energy Transfers ■ Energy Sources | <p>Lesson Objectives</p> <ul style="list-style-type: none"> ■ Compare the energy values in kJ of different foods using labels. Compare power ratings of appliances in watts (W) and kilowatts (kW). ■ Compare amounts of energy transferred (J, kJ, kW / hour) domestic fuel bills, fuel use and costs. ■ Describe the uses of fuels and energy resources. |
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Waves

Lesson Set Objectives To learn about the properties of waves, sound, light reflection, and the spectrum.

Previous skills, themes or concepts	Builds on knowledge from the KS2 topic of 'Light and Sound'.	Assessment used within this topic	The KS3 science diagnostic assessment incorporates questions on the topic of 'Waves' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Waves' topic.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Waves' topic. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Waves'.
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This lesson set includes the following lessons:

- Sound
- Light
- Light Rays
- Light Energy
- The Spectrum

Lesson Objectives

- Recall the frequency of sound waves, measured in Hertz (Hz). Recall that the reflection of sound waves causes echoes, and that some surfaces lead to the absorption of sound. Explain that sound needs a medium to travel through. Explain the difference in the speed of sound in air, water, and solids. Explain that sound is produced by vibrations of objects, such as in loudspeakers. Sound waves are detected by their effects on a microphone diaphragm and the ear drum. Recall that sound waves are longitudinal. Recall the auditory range of humans and animals.
- Outline the similarities and differences between light waves and sound waves. Recall the speed of light. Explain how light waves travel through a vacuum. Explain the transmission of light through materials, including absorption, diffuse scattering and specular reflection at a surface.
- Use the ray model to explain imaging in mirrors, the pinhole camera, the refraction of light, and the action of convex lenses in focusing, using the human eye as an example.
- Explain how light transfers energy to absorbers, leading to chemical and electrical effects, using the example of photo-sensitive material in the retina and in cameras.
- Describe and explain the different colour frequencies of light, white light and prisms, using the example of differential colour effects in absorption and diffuse reflection.

Electricity and Magnetism

Previous skills, themes or concepts	Builds on knowledge from the KS2 topic of 'Electricity'.	Assessment used within this topic	The KS3 science diagnostic assessment incorporates questions on the topic of 'Electricity and Magnetism' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Electricity and Magnetism' topic.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Electricity and Magnetism' topic. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Electricity and Magnetism'.
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Lesson Set Objectives To learn the difference between current and voltage and how they are measured, Ohms law, and the relationship between magnetism and electricity.

This lesson set includes the following lessons:

- Volts, Amps and Ohms
- Static Electricity
- Magnets and Electricity

Lesson Objectives

- Explain that potential difference is measured in volts. Explain that current is measured in amps. Recall that resistance, measured in ohms, is the ratio of potential difference to current.
- Describe the separation of positive or negative charges when objects are rubbed together. Explain the idea of an electric field creating a force that acts across the space between objects.
- Describe magnetic poles, attraction and repulsion. Show the effect of a magnetic field by plotting using a compass. Describe the Earth's magnetic field and how compasses are used. Describe the magnetic effect of a current, and how electromagnets and electric motors work.

Physical and Chemical Changes of Matter

Lesson Set Objectives To learn about how temperature affects materials, the similarities and differences between solids, liquids and gases, how gases and liquids move, and the difference between chemical and physical changes.

Previous skills, themes or concepts	Builds on knowledge from the KS2 topic of 'Properties and Changes of Materials'.	Assessment used within this topic	The KS3 science diagnostic assessment incorporates questions on the topic of 'Physical and Chemical Changes of Matter' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Physical and Chemical Changes of Matter' topic.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Physical and Chemical Changes of Matter' topic. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Physical and Chemical Changes of Matter'.
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This lesson set includes the following lessons:

Lesson Objectives

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| <ul style="list-style-type: none"> ■ How Temperature Changes Things ■ Solids, Liquids and Gases ■ Moving Particles ■ Chemical and Physical Changes | <ul style="list-style-type: none"> ■ Explain the conservation of material and of mass. Describe the reversibility of melting, freezing, evaporation, sublimation, condensation and dissolving. ■ Describe the similarities and differences, including density differences, between solids, liquids and gases. ■ Describe how diffusion in liquids and gases is driven by differences in concentration. Explain Brownian motion in gases. ■ Explain the difference between chemical and physical changes. |
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The Particle Model

Lesson Set Objectives To learn about the changes in the arrangements of particles as they change state, and the difference between atoms and molecules.

Previous skills, themes or concepts	Builds on knowledge from the KS2 topic of 'Properties and Changes of Materials'.	Assessment used within this topic	The KS3 science diagnostic assessment incorporates questions on the topic of 'The Particle Model' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of 'The Particle Model'.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of 'The Particle Model'. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'The Particle Model'.
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This lesson set includes the following lessons:

Lesson Objectives

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| <ul style="list-style-type: none"> ■ Changes of State and Particles ■ Atoms and Molecules | <ul style="list-style-type: none"> ■ Explain the differences in the arrangement and motion of particles in relation to changes of state, shape and density. Explain the anomaly of the ice to water transition. ■ Explain the difference between atoms and molecules as particles. |
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Energy in Matter

Lesson Set Objectives To learn about the effect of temperature on particles and how energy is stored in materials.

Previous skills, themes or concepts	Builds on knowledge from the KS2 topics of 'Properties and Changes of Materials' and 'Living Things and Their Habitats'.	Assessment used within this topic	The KS3 science diagnostic assessment incorporates questions on the topic of 'Energy in Matter' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Energy in Matter' topic.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Energy in Matter' topic. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Energy in Matter'.
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This lesson set includes the following lessons:

Lesson Objectives

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| <ul style="list-style-type: none"> ■ Effect of Temperature on Particles ■ Storing Heat in Particles | <ul style="list-style-type: none"> ■ Explain how changes in temperature affect the motion and spacing of particles. ■ Explain the internal energy stored in materials. |
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Space Physics

Lesson Set Objectives To learn about the effect of gravity on the Earth and other planets (using calculations), the solar system, and why we have days, nights and seasons.

<p>Previous skills, themes or concepts</p>	<p>Builds on knowledge from the KS2 topic of 'Earth and Space'.</p>	<p>Assessment used within this topic</p>	<p>The KS3 science diagnostic assessment incorporates questions on the topic of 'Space Physics' to test and evaluate a learner's prior learning and knowledge gaps.</p> <p>Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Space Physics' topic.</p>	<p>Resilience</p>	<p>Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Space Physics' topic.</p> <p>Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Space Physics'.</p>
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This lesson set includes the following lessons:

Lesson Objectives

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| <ul style="list-style-type: none"> ■ Gravity and Weight ■ Sun and Stars ■ Days and Seasons ■ Astronomical Distances | <ul style="list-style-type: none"> ■ Describe gravity as a force. Calculate weight using the equation: $\text{weight} = \text{mass} \times \text{gravitational field strength}$. Describe how gravitational field strength is different on different planets. Describe how gravity holds the Earth and the moon in their orbits. ■ Describe our Sun as a star. Describe other stars in our galaxy and other galaxies. ■ Explain the relationship between the seasons and the Earth's tilt. Describe the changes in day length at different times of year and in different hemispheres. ■ Describe a light year as a unit of astronomical distance. |
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KS2 Physics

Objectives

Learners should gain an understanding of the fundamental concepts of the universe:
 That the solar system consists of the sun and all of the objects that orbit around it.
 That the motion of the Earth causes days and seasons.
 That forces exist in contact and non-contact forms, including gravity and magnetism.
 That vibrating objects produce sound, and that shadows are evidence of light travelling in straight lines.
 That symbols are used to represent electrical circuits and how circuits are required for energy to flow.

Earth and Space

This lesson set includes the following lessons:

Lesson Objectives

Previous skills, themes or concepts	Builds on knowledge from the KS1 topic of 'Seasonal Changes'.	Assessment used within this topic	The KS2 science diagnostic assessment incorporates questions on the topic of 'Earth and Space' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Earth and Space' topic.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Earth and Space' topic. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Earth and Space'.
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Lesson Set Objectives To learn how the planets of the solar system orbit the Sun, how the Earth's orbit and rotation give us days and seasons, and why the moon has phases and how it affects the Earth.

- Days, Nights and Seasons
- The Earth and the Moon
- The Solar System
- Explain how the Earth's rotation and orbit give us days, years and seasons.
- Explain why the moon shows phases, and how it influences the earth.
- Describe the planets of the solar system, including the differences and similarities between them.

Forces and Magnetism

Lesson Set Objectives To learn how unsupported objects are acted upon by gravity, the effects of resistance and friction, the difference between contact and non-contact forces, how levers and pulleys work, and that magnetic materials interact due to a force acting between them.

Previous skills, themes or concepts	Builds on the skill 'using observations and ideas to suggest answers to questions' developed in KS1.	Assessment used within this topic	The KS2 science diagnostic assessment incorporates questions on the topic of 'Forces and Magnetism' to test and evaluate a learner's prior learning and knowledge gaps. Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Forces and Magnetism' topic.	Resilience	Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Forces and Magnetism' topic. Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Forces and Magnetism'.
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This lesson set includes the following lessons:

Lesson Objectives

- Force of Gravity
- Resistance
- Simple Machines
- Forces and Friction
- Magnetic Materials
- Magnetism
- Explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object.
- Identify the effects of forces that act between moving surfaces, such as air resistance, water resistance and friction.
- Explain how levers work. Explain how gears work. Explain how pulleys work.
- Describe the difference between contact and non-contact forces. Explain that friction is a force that resists movement.
- Explain that some materials are affected by magnets.
- Explain how magnets interact by means of a force between them.

Light and Sound

Lesson Set Objectives To learn about the difference between light and dark, how we see things due to the reflection of light, and that sound is produced by objects that vibrate.

<p>Previous skills, themes or concepts</p>	<p>Builds on the skill 'using observations and ideas to suggest answers to questions' developed in KS1.</p>	<p>Assessment used within this topic</p>	<p>The KS2 science diagnostic assessment incorporates questions on the topic of 'Light and Sound' to test and evaluate a learner's prior learning and knowledge gaps.</p> <p>Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Light and Sound' topic.</p>	<p>Resilience</p>	<p>Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Light and Sound' topic.</p> <p>Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Light and Sound'.</p>
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This lesson set includes the following lessons:

- Light and Dark
- Traveling Light - Shadows and Reflection
- Making and Understanding Sound

Lesson Objectives

- Describe light and dark. Explain how shadows are formed.
- Explain how we see things that are light sources, or reflect light. Describe reflection.
- Explain that sound is produced by objects that vibrate. Describe sound waves as vibrations passing through the air.

Electricity

Lesson Set Objectives To learn how to identify circuit symbols, that electricity needs a complete circuit, the test for conductors, and how components change when voltage and current change.

<p>Previous skills, themes or concepts</p>	<p>Builds on the KS1 topic of 'Uses of Everyday Materials' and the skill 'using observations and ideas to suggest answers to questions' developed in KS1.</p>	<p>Assessment used within this topic</p>	<p>The KS2 science diagnostic assessment incorporates questions on the topic of 'Electricity' to test and evaluate a learner's prior learning and knowledge gaps.</p> <p>Questions, tasks and a one-to-one assessment take place within this lesson set, to assess a learner's knowledge and understanding of the 'Electricity' topic.</p>	<p>Resilience</p>	<p>Support is provided throughout this lesson set to assist a learner's development in their knowledge of the 'Electricity' topic.</p> <p>Resilience is developed through independent practice, assessment, one-to-one support sessions and live lessons covering the lesson set objectives for the topic of 'Electricity'.</p>
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This lesson set includes the following lessons:

- Circuit Symbols
- Electrical Circuits
- Testing Conductors
- Changing How Components Function

Lesson Objectives

- Identify, name and draw circuit symbols.
- Explain how electricity needs a circuit to be useful.
- Explain the nature of, and test for conductors and insulators.
- Compare and explain the variations in how components function, including the brightness of bulbs and the loudness of buzzers. Associate the brightness of a bulb and the loudness of a buzzer with the number of cells and the voltage of the cells in the circuit.