Programme of study for Year 9 Science

Autumn (1st half term)	Autumn (2nd half term)	Spring (1st half term)	Spring (2nd half term)	Summer (1st half term)	Summer (2nd half term)
Topics: • Cells • Energy • Electricity, current and charge	Topics: • Cell transport • Cell division • Atomic structure	Topics: • The periodic table • Energy resources	Topics: • Organisation • Digestion • Particles	Topics: • Chemical changes • Animals and plants including organ systems	Topics: • Energy changes • Electricity for the home

Skills (students should be able to do):

Emerging skills:

- Students are able to **plan most of an experiment**. Students are able to **identify most risks** in an experiment.
- Students are able to **identify most of the variables** in an investigation.
- Students are able to **record data in appropriate formats** with support.
- Students are able to **identify most patterns** in data presented in various formats, including line graphs.
- Students are able **to draw conclusions** which are based on more than one piece of supporting evidence with support.
- Students are able to **draw conclusions from data collected**, although this may not always be in detail.
- Students are able to **describe ways of modifying** the method to improve reliability and validity of the investigation, although this may not always be in detail.
- Students' answers **mostly demonstrate a good knowledge and clear understanding**, with occasional errors.
- Students' answers **mostly demonstrate structure and organisation** and use of **specialist terms have been used,** although this may not always be in detail.
- Most specialist terms are used in order to **describe and explain** processes in science, with occasional errors.

Developing skills:

- Students are able to **plan**, with very few errors an experiment to investigate a hypothesis.
- Students are able to **identify a range of relevant risks** in an experiment and **describe** how to minimise these.
- Students are able to **identify the different variables** in an investigation.
- Students are able to **record data in appropriate formats**.
- Students are able to **identify patterns in data** presented in a range of formats, including line graphs.
- Students are able to **explain in detail** conclusions using scientific understanding and knowledge with support and very few errors.
- Students are able to **explain** ways of modifying the method to improve reliability and validity of the investigation.
- Students' answers show a **detailed level of knowledge and clear understanding**, with very few errors.
- Students' show a **detailed understanding**, which may contain supporting evidence and examples, and may consist of very few errors.
- Students are able to, with very few errors, **link scientific ideas, models and theories** from different topics when **applying knowledge** to familiar situations.

- Students are able to **use specialist terms** with very few errors to **describe and explain** processes in science.

Secure skills:

- Students are able to **plan an experiment** to investigate a hypothesis to obtain valid results with minor errors.
- Students are able to **identify a range of relevant risks** in an experiment and **provide an assessment of each risk**.
- Students are able to **accurately identify the variables in an investigation** and begin to **justify the control variables**, with minor errors.
- Students are able to **record data clearly** in appropriate formats, although this may not be consistent throughout.
- Students are able to **identify patterns** in data presented in a range of formats, including line graphs and are **beginning to spot anomalies**.
- Students are able to **explain conclusions** using **scientific understanding and knowledge** with minor errors.
- Students are able to **explain** ways of modifying the method to improve reliability and validity of the investigation, although this may not be consistent throughout.
- Students' answers show an **in-depth knowledge**, which is **appropriately contextualised** with minor errors.
- Students' show an **in-depth understanding**, supported by **relevant evidence and examples** with minor errors.
- Students are able to, with minor errors, **link scientific ideas, models and theories from different topics** when applying knowledge to unfamiliar situations.
- Students' answers are **coherent** and in an **organised, logical sequence**, containing a **range of appropriate or relevant specialist terms**, with minor errors.

Advanced skills:

- Students are able to **plan an experiment** to investigate a hypothesis and **obtain valid results**. Students are able to **identify a range of relevant risks** in an experiment and provide **thorough assessment of each risk**.
- Students are **confidently able to identify the variables** in an investigation and **begin to provide in-depth justifications** for the control variables with minor errors.
- Students are able to **record data clearly and accurately** in appropriate formats.
- Students are able to **identify patterns** in data presented in a range of formats, including line graphs, and are beginning to spot anomalies, with an **attempt to provide reasoning** for such results, although this may not be consistent throughout.
- Students are able to **explain and analyse a conclusion** using **scientific understanding and knowledge**.
- Students are able to **explain** ways of modifying the method to improve reliability and validity of the investigation, with minor errors.
- Students' answers show an **in-depth knowledge**, which is **appropriately contextualised** with minor errors.
- Students' show an **in-depth** understanding, supported by **accurate evidence and examples** with minor errors. Students are able to, with minor errors, **link scientific idea, models and theories** from different topics when **applying knowledge** to unfamiliar situations.
- Students' answers are **in-depth**, **coherent** and in an orga**nised, logical sequence**, containing a **range of appropriate or relevant specialist terms**, with minor errors.

Mastery skills:

- Unaided, students are able to **plan an experiment** to investigate a hypothesis to **obtain valid results**.
- Students are able to **identify a range of relevant risks** in an experiment and provide **thorough assessment of each risk**.
- Students are able to **decide on the observations and measurements that need to be taken and the degree of accuracy that is required**.
- Students are able to **set up and use a range of scientific apparatus with precision and skill** with minor errors.
- Students are **confidently able to identify the variables** in an investigation and provide **in-depth justifications** for the control variables.
- Students are able to **record data clearly and accurately** choosing appropriate formats, with minor errors.
- Students are able to **identify patterns** in data presented in a range of formats, including line graphs and is beginning to spot anomalies **with reasoning** for such results.
- Students are able to **explain, analyse and provide an in-depth** conclusion **using scientific understanding and knowledge**.
- Students are able to **explain** ways of modifying the method to improve reliability and validity of the investigation.
- Students' answers show an **in-depth knowledge**, which is **appropriately contextualised.**
- Students' show an **in-depth understanding**, supported by **relevant evidence and examples** with minor errors.
- Students are able to **confidently link scientific idea, models and theories from different topics** when **applying knowledge** to unfamiliar situations.
- Students' answers are **in-depth**, **coherent** and in an **organised, logical sequence**, containing a **confident range of appropriate or relevant specialist terms.**

Key Learning Outcomes (students should know):	Key Learning Outcomes (students should know):	Key Learning Outcomes (students should know):	Key Learning Outcomes (students should know):	Key Learning Outcomes (students should know):	Key Learning Outcomes (students should know):
• Understanding the structure and function of cells, including the differences between plant and animal cells • Knowing the different types of human cells and their functions • Understanding adaptations of specialised cells and linking them to their roles	• Understand the structure and function of cell membranes and how they control movement in and out of the cell understanding the processes of diffusion osmosis and active transport and how they contribute to cell transport • Carry out experiments to	• Related equations and calculations • How to build a circuits and work with electricity safely • Understand the use of electrical circuits in everyday devices • Understand the principles of static electricity • Understand the advantages and disadvantages of different sources of energy such as fossil	• Understand the structure and function of the human digestive system • How to investigate enzymes involved in digestion • The enzymes involved in digestion and their role in breaking down biological molecules • The concept of matter and how matter is made-up of particles • The differences between solids liquids	• The types of chemical reactions • Recognising and interpreting chemical equations And balancing chemical equations • Knowledge An application of the reactivity series of metals • Understanding the differences between acids, bases, and salts	• Understand the different types of energy changes that occur during chemical reactions • Recognise and interpret energy level diagrams • Electrical safety measures and the potential dangers of electric shocks and current • The functions of Components in electrical systems

• Exploring how enzymes function and their importance in biological processes • Understanding the concept of energy and its different forms eg Kinetic, potential, thermal, gravitational, etc • Recognising that energy can be transferred from one form to another • Understanding the principle of conservation of energy and applying it • Understanding and interpreting energy transfer diagrams • Understand and use related energy equations and calculations • The concept of current and how it is measured • The relationship between voltage	investigate the effects of different factors of cell transport • Understand the importance of cell division for growth, repair and reproduction • Understanding the process of mitosis and meiosis • Describe and explain the cell cycle • Link meiosis to reproduction and the role of production of gametes • Understand the basic structure of the atom including subatomic particles • Know how to use the periodic table to determine the number of protons neutrons and electrons in an atom • Calculate relative atomic mass and relative formula mass • Explore the concept of isotopes and	fuels, nuclear power, and renewable resources • Understand the structure of the periodic table and explain how the periodic table is organised • Identify elements and interpret information from the periodic table • Trends in atomic structure and patterns in the periodic table • Understand periodic trends in reactivity • Use the periodic table to predict chemical properties	and gases in terms of arrangement and movement of particles • Understand the relationship between temperature and particle movement • The properties of solids liquids and gases • The behaviour of gases • Further methods of energy transfer with regards to particles such as convection conduction and radiation • How to calculate specific heat capacity • The characteristics and classification of organisms • Classify organisms based on their characteristics? • Knowledge of animal and plant cells and identifying the structures of animal and plant cells • Understanding the level of organisation in humans from cells to the whole organism	• Be able to make salts • Applying knowledge of chemical changes to real life applications such as the production of fuels and fertilisers and considering wider implications • Understanding the structure and function of the human circulatory system, including the heart, blood, vessels • Knowledge of how substances are transported In the blood • Link the circulatory system to regulating the body • Explain the process of gas exchange • Explain the processes of evaporation and transpiration in plants	• How to reduce energy and electricity consumption and improve energy efficiency in the home • Using equations relating to electrical power • How electrical appliances work • How plugs work and their components • The role of AC and DC electricity

current and resistance • The difference between series and parallel circuits and how current and resistance are affected • The role of potential difference and power in circuits • Factors affecting resistance •	relative atomic masses • Understand how electrons are arranged around an atom • Understand the concept of ions		• Knowledge of reproductive systems in plants and animals and compare and contrast them		

Assessments:
Half term 1: Practical – Microscopy. Energy end of chapter quiz.
Half term 2: Linear assessment focussing on topics from half term 1.
Half term 3: Electricity quiz. Atoms, elements and compounds home learning assessment project.
Half term 4: The periodic table home learning. Energy home learning project.
Half term 5: Linear assessment
Half term 6: Home learning projects.

Building understanding: Rationale / breakdown for your sequence of lessons:
The rationale for the topic sequence is to guide the learners through a logical progression of concepts related to cell biology, atomic structure, and energy. This sequence is designed to build a foundation of understanding in cellular processes and then expand to explore the fundamental concepts related to energy, atoms, electricity, and energy resources.

Starting with the topic of cells is essential as they are the basic building blocks of all living organisms. By studying cells, learners can gain an understanding of their structure, function, and various processes that occur within them. This knowledge is crucial for comprehending subsequent topics, as many of the concepts covered in energy, cell transport, and cell division are directly applicable to cellular processes.

We then rotate to physics. By rotating between biology, chemistry and physics topics, students will develop a holistic understanding of the natural world, gaining insights into the fundamental principles underlying the sciences and their connections. Therefore we move from cells to energy. By studying energy, learners can gain knowledge about its various forms, including potential and kinetic energy, chemical energy, and the conversion of energy in biological systems. This topic serves as an important bridge between the cell biology concepts and the upcoming topics related to atomic structure and electricity.

After acquiring a foundational understanding of cells and energy, the next set of topics focuses on cell transport and cell division. Cell transport introduces learners to the mechanisms by which cells transfer materials across their membrane. Cell division explores the processes of cellular replication and reproduction, which are fundamental to growth and development. These topics further enhance the understanding of cell biology while providing a segue to the study of atoms and electricity.

Transitioning from cell division, learners can delve into the concept of atomic structure, which forms the basis for understanding the behaviour of matter. By studying atomic structure, including atoms, subatomic particles, and electron configuration, learners can begin to grasp the principles that underpin the interactions between atoms and the formation of compounds.

The topic of electricity builds upon the knowledge of atomic structure and helps learners understand how electrons are involved in the flow of charge. It introduces fundamental concepts like conductors, insulators, circuit components, and the principles of electric current and electromagnetic induction. This topic is significant both as a practical application of atomic structure and as a precursor for exploring energy resources.

Finally, the sequence concludes with the study of energy resources. Understanding different sources of energy, their generation, and their impact on the environment is crucial for responsible decision-making and sustainable development. By contextualising energy resources within the broader topics of cells, energy, atomic structure, and electricity, learners can develop a comprehensive understanding of the interconnections and implications of energy usage.

In summation, the proposed topic sequence follows a logical progression that enables learners to build a foundation of knowledge and understand the interconnectedness between various scientific concepts. This sequence ensures a coherent learning experience as learners explore the fundamental principles governing life processes, atomic interactions, and energy dynamics It provides an ambitious and broad learning field which can expand on their prior knowledge and build them towards further learning.

Home – Learning:
Teachers will set home learning using lesson materials. Some of these will be assessed. This will be indicated.

Reading / literacy:
Students are encouraged to prior reading on topics. In lessons students are taught how to construct answers through use of writing frames and exemplar answers where extended writing is required and command words and keywords that are relevant to the topic are consistently assessed in lessons through questioning and written question practice.

Numeracy:

- Recognise and use expressions in decimal form: Recognise and use expressions in standard form; Use ratios, fractions and percentages; Make estimates of the results of simple calculations
- Handling data: Use an appropriate number of significant figures; Find arithmetic means; Construct and interpret frequency tables and diagrams, bar charts and histograms; Make order of magnitude calculations

- Algebra: Understand and use the symbols: =, <>, >, ∝ , ~ ;Change the subject of an equation; Substitute numerical values into algebraic equations using appropriate units for physical quantities
- Graphs: Translate information between graphical and numeric form; Understand that y = mx + c represents a linear relationship; Plot two variables from experimental or other data; Determine the slope and intercept of a linear graph; Draw and use the slope of a tangent to a curve as a measure of rate of change
- Geometry and trigonometry: Visualise and represent 2D and 3D forms including two dimensional representations of 3D objects; Calculate areas of triangles and rectangles, surface areas and volumes of cubes

Enrichment / opportunities to develop cultural capital (including careers, WRL and SMSC):

- Trips during science week
- Science week
- Science club
- STEM club