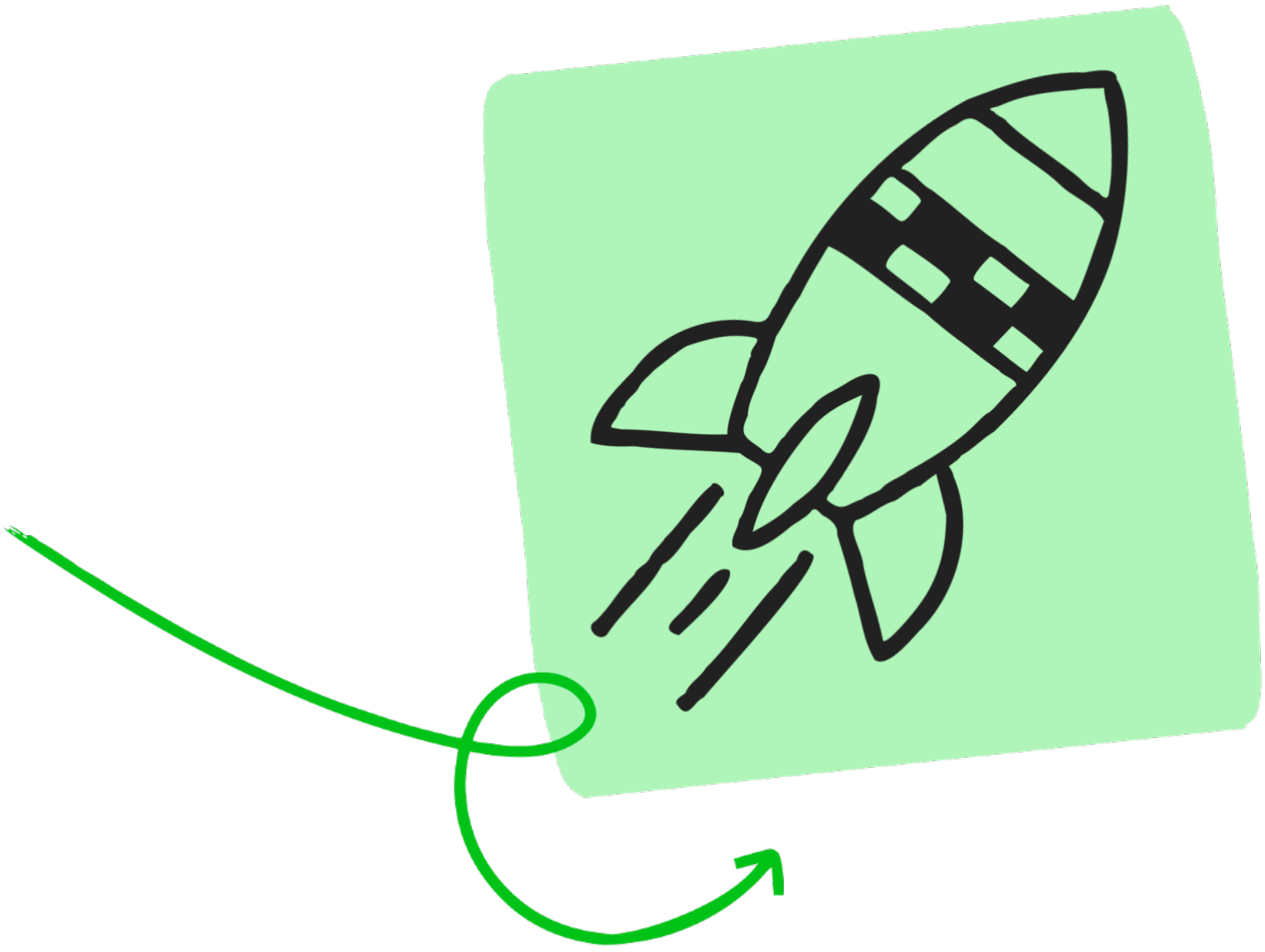
Oak National Academy

KS3 & KS4 Science curriculum plan

AQA, Biology, Foundation (KS4)



Contents

Our curriculum

All of our curricula share the same set of principles that guide our curriculum design to ensure our curricula are high-quality. They are:

Knowledge and vocabulary rich

Lessons and units are knowledge and vocabulary rich. Pupils will build on what they already know to develop deep knowledge and apply this knowledge in the form of skills.

Sequenced and coherent

Careful sequencing and attention to building coherence via vertical threads so that pupils build on prior knowledge and make meaningful connections.

Flexible

Our flexible curriculum enables schools to tailor our content to their curriculum and context.

Accessible

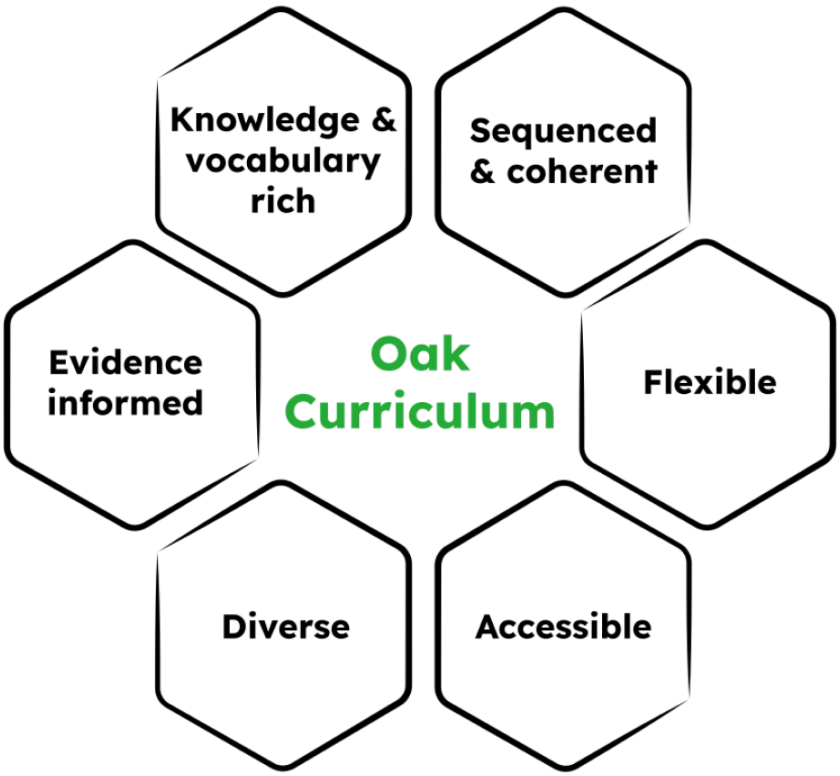
Creating an accessible curriculum that addresses the needs of all pupils and meets accessibility guidelines and requirements.

Diverse

We prioritise creating a diverse curriculum by committing to diversity in teaching and teachers, and the language, texts and media we use, so all pupils feel positively represented.

Evidence-informed

We take an evidence-informed approach applying the science of learning and subject-specific research.



Threads

What are threads?

We use threads to signpost groups of units that link to one another, that together build a common body of knowledge over time. We use the term thread, rather than vertical concepts, themes or big ideas, because it helps us bring to mind the visual concept of a thread weaving through the curriculum.

How to use threads

1. Familiarise yourself with all of the threads relating to the subject
2. Identify the unit you will be delivering
3. Review the threads associated with the unit
4. Audit where pupils have and will learn about these threads in your existing curriculum sequence.
5. Ensure you understand how the thread relating to your new unit has been framed in prior and future units
6. Review how the thread works within the unit you will be delivering
7. Teach and iterate your framing of the thread within the unit and across your curriculum sequence

Threads in subject

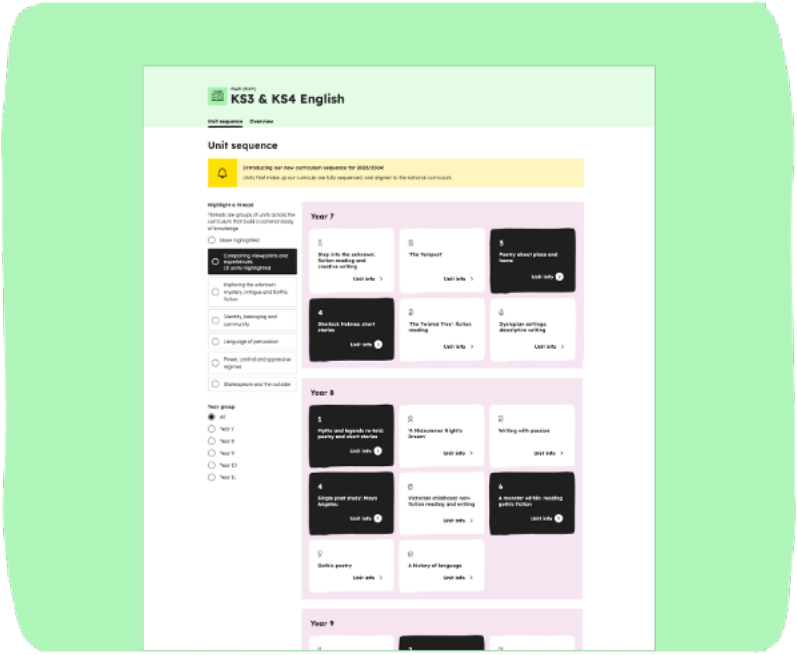
- BQ01 Biology: What are living things and what are they made of?
- BQ02 Biology: How do living things grow and reproduce?
- BQ03 Biology: How do living things live together in their environments?
- BQ04 Biology: Why are there similarities and differences between living things?
- BQ05 Biology: How do living things stay healthy?
- BQ06 Chemistry: How do we explain how substances behave?
- BQ07 Chemistry: What are things made of?
- BQ08 Chemistry: How can substances be made and changed?
- BQ09 Chemistry: How can we explain changes in the air, land and oceans?
- BQ11 Physics: How do forces make things happen?
- BQ12 Physics: How do we see, hear and communicate?
- BQ13 Physics: How do electricity and magnetism work?
- BQ14 Physics: How does the Earth fit into the Universe?
- BQ15 How can we live sustainably to protect Earth for a better future?
- BQ10 Physics: Why do materials have different properties?

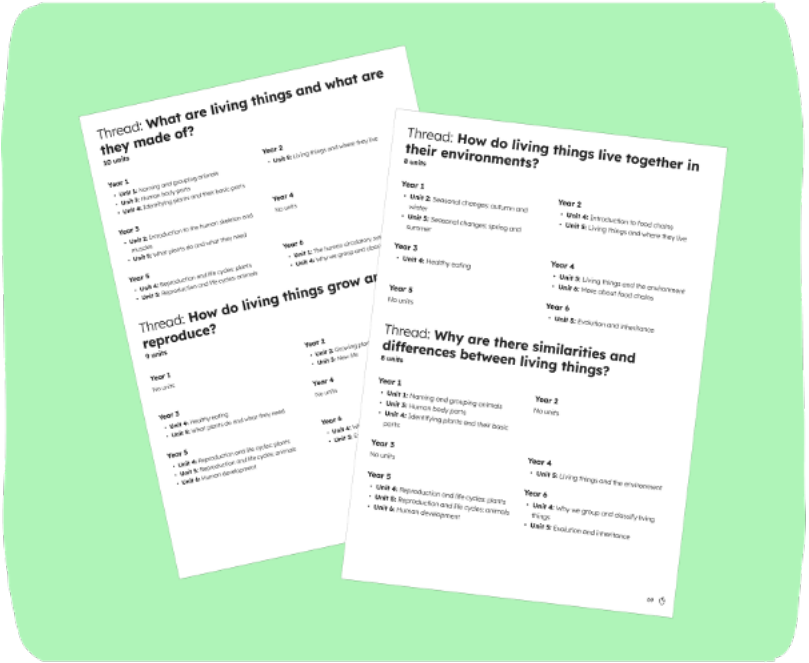
Tools for using threads

Online curriculum

Our interactive tool enables you to visualise how threads are sequenced across our curriculum plans.

Go to online curriculum





Threads in this document

The appendix displays the threads and their related units.

Go to threads appendix ↓

Science curriculum explainer

Aims and purpose

What are the aims and purpose of our curriculum?

With this curriculum, we aim to develop an interest in passion for science by exploring answers to big questions like '"How do forces make things happen?"' We combine substantive and disciplinary knowledge to make practical skills, mathematical proficiency, and scientific practices meaningful.

Oak curriculum principles

What overarching curriculum principles inform the design of our curriculum?

Knowledge and vocabulary rich

This principle recognises the important role that knowledge, and vocabulary as a particularly important type of knowledge, plays in learning. We identify and map vocabulary across the curriculum, both the introduction of new vocabulary and the necessary repetition of vocabulary that has gone before. New vocabulary, called keywords, are signalled in bold in our lesson materials to indicate their importance. Our curriculum develops pupils' knowledge and understanding of scientific concepts over time. As concepts evolve, so do their definitions, for example, 'group' becomes 'classify' as pupils move through the key stages.

Sequenced and coherent

The sequencing of our curriculum content underpins its design so that pupils build on and make links with existing knowledge. At its simplest, this means ensuring, for example, that pupils will learn about a living thing (organism) using common processes such as criteria for life before being introduced to cells and cell structures. Curriculum threads, which provide coherence by mapping vertical concepts across the curriculum, mirror the 'big questions' in science. For example, 'How do we explain how substances behave?' is first addressed in key stage 1 by identifying everyday materials and their properties. This foundational knowledge is built upon in key stage 2 with reversible and irreversible changes. By key stage 3, pupils delve into more complex topics like solutions and separation techniques, preparing them for advanced concepts in key stage 4 like rates of reaction and industrial chemistry.

Evidence-informed

Our evidence-informed approach enables the rigorous application of research outcomes, the science of learning and impactful best practices both in education in general and at a subject-specific level. For example, the design of our resources reflects findings from Sweller's cognitive load theory and Mayer's principles of multimedia learning whilst our lesson design draws on Rosenshine's principles of instruction. We also draw on findings from research organisations such as the Education Endowment Foundation (EEF). At the subject level, our curriculum is inspired by the Best Evidence Science Teaching (BEST) research-informed curriculum development project and is structured to incorporate the outcomes of this research, including

appropriately sequenced steps for learning progression and diagnostic questions that provide evidence of learning and common misconceptions, with response activities to challenge misconceptions.

Flexible

Our flexible approach enables schools to use our resources in a way that fits their content and meets the varying needs of teachers and their pupils. Our curriculum can be used in its entirety or units can be selected to complement existing curricula. Our resources are adaptable so that, for example, teachers can easily add in more or different examples to explanations, can edit or add checks for understanding, or adapt practice tasks to better reflect the prior knowledge of their pupils. At key stage 4 teachers and pupils can select a pathway aligned to the most frequently used exam board specifications for GCSE Science: AQA, Edexcel or OCR.

Diverse

Our commitment to breadth and diversity in content, language, texts, and media can be seen throughout the curriculum, for example, in the diverse school-age characters featured in our resources. Our curriculum highlights the achievements of scientists from different genders, ethnicities, and nationalities to ensure a diversity of perspectives and experiences. This approach ensures that our science curriculum is inclusive and reflective of the global scientific community.

Accessible

Our curriculum is intentionally designed to facilitate high-quality teaching as a powerful lever to support pupils with SEND. Aligned with EEF guidance, our resources have a focus on clear explanations with scientific diagrams, modelling and frequent checks for understanding, with guided and independent practice. Lessons are chunked into learning cycles and redundant images and information are minimised to manage cognitive load. We have removed reference to year groups in our resources so that they can be used when pupils are ready, regardless of their age. Our resources are purposefully created to be accessible, for example by using accessible fonts, colours with good contrast, and captions in our videos.

Oak subject principles

What subject specific principles inform the design of our curriculum?

Building knowledge of key concepts in a way that reflects how knowledge is organised in the three scientific disciplines

Our science curriculum structures knowledge to reflect the organisation of biology, chemistry, and physics, introducing concepts in a logical sequence from basic to advanced topics. Fundamental ideas are taught with consistent language and models across disciplines. For example, students begin with basic material properties and advance to complex topics like chemical reactions.

Pairing substantive and disciplinary knowledge, particularly around practical work

Our curriculum combines substantive knowledge (concepts) with disciplinary knowledge (scientific methods) to enhance practical work. For instance, in studying chemical reactions, students learn core concepts like reactants and products while also developing skills in

measurement and data analysis through experiments. This approach ensures that practical activities are purposeful and clearly linked to theoretical concepts.

A ‘big ideas’ approach to developing subject concepts

We use a ‘big ideas’ approach to create ‘big questions’ in science that link concepts across the curriculum. For example, with the question “Why are there similarities and differences between living things?” we start with identifying plants and animals in key stage 1, study habitats and basic biology in key stage 2, delve into cellular biology and genetics in key stage 3, and cover evolution and biotechnology in key stage 4. This ‘big question’ helps students from key stage 1 to key stage 4 connect new knowledge with prior learning.

Where there is a practical focus, it builds knowledge through the use of carefully planned and purposeful practical activities

Practical work is carefully planned; a physics experiment on forces is carefully designed to connect substantive knowledge of force interactions with the disciplinary skills of measuring and analysing data. Each activity is sequenced to build on previous knowledge, ensuring students engage deeply with the material. Additional materials outline the purpose of each practical task and assist teachers and pupils in carrying it out safely.

Where mathematics is taught or used in science, alignment with the sequence, language and approach used in the mathematics curriculum is considered

The mathematical skills used in science align with the Oak mathematics curriculum. When teaching data analysis, we use the same methods and language as in mathematics lessons, helping students to apply their mathematical knowledge effectively in scientific contexts. Where there are differences between the approaches in mathematics and science they are explicitly shared with pupils so that they can make connections between the two subjects.

National curriculum

How does our curriculum reflect the aims & purpose of the national curriculum?

There are 3 aims of the national curriculum. First, is that all ‘pupils develop scientific knowledge and conceptual understanding through the specific disciplines of biology, chemistry and physics’. Each of our curriculum threads is explicitly signposted as sitting within biology, chemistry or physics. For example, ‘Biology: What are living things and what are they made of?’ or ‘Chemistry: What are things made of?’. This means that pupils are taught knowledge from within each discipline, building from fundamentals such as grouping animals and plants to the more complex elements such as genetic engineering.

The next aim is to ‘develop understanding of the nature, processes and methods of science through different types of science enquiries that help them to answer scientific questions about the world around them’. Our curriculum incorporates a diverse range of scientific enquiries, such as investigating the effect of light on the rate of photosynthesis and exploring how different materials conduct heat, which places emphasis on the scientific method. These activities encourage critical thinking, provide hands-on activities, use models such as the solar system to explain abstract concepts, and foster reflection and discussion.

The last aim is that pupils ‘are equipped with the scientific knowledge required to understand the uses and implications of science, today and for the future’. Our curriculum links scientific concepts to real-world applications, fosters discussions on the ethical and societal impacts of scientific developments, and encourages pupils to think critically about how science influences the future in fields like sustainability and health. For example in the year 11 "Biology: Gene Technology" unit, pupils explore how advances in understanding the human genome, such as gene therapy, impact medicine, and assess the benefits, risks, and ethics of genetic engineering in agriculture and healthcare.

Curriculum delivery

What teaching time does our curriculum require?

Our curricula for key stages 1-3 are designed for 36 weeks of curriculum time across the school year, which leaves time for other activities both within and beyond the curriculum, such as assessments or school trips. At key stage 4, year 10 also has 36 weeks of curriculum time, but year 11 has only 24 weeks (approximately 2 terms) to recognise that schools will not be teaching new content in the run-up to the GCSE exams.

At key stage 1, our curriculum has been designed to teach one weekly lesson, approximately 40 minutes long. In key stage 2 there are two lessons per week lasting 50 minutes to an hour each. At key stage 3, there are three lessons per week and three or four lessons at key stage 4, depending on whether pupils are following a combined science or separate science pathway. Key stage 3 and 4 lessons are designed to last one hour.

We understand that the exact time dedicated to science can vary greatly between schools due to differences in curriculum planning, resource allocation, and school-specific priorities. Therefore, we fully expect and encourage teachers to adapt our curriculum and resources to best suit their needs and available curriculum time. This is particularly important in key stage 4, where classes may be streamed and pupils may be following different exam pathways or studying for different tiered papers at a range of levels.

Curriculum coherence

What are 'threads'?

We use threads to signpost groups of units that link to one another and build a common body of knowledge over time. Our science threads are ‘big questions’ driven by the big ideas in science. We use the term thread rather than vertical concepts, themes, or big ideas because it helps to bring to mind the visual concept of a thread weaving through the curriculum.

Our science threads that weave through both our primary and secondary curricula reflect the three science disciplines plus one ‘big question’ that sits across all three:

Biology

- What are living things and what are they made of?
- How do living things grow and reproduce?
- How do living things live together in their environments?

- Why are there similarities and differences between living things?
- How do living things stay healthy?

Chemistry

- How do we explain how substances behave?
- What are things made of?
- How can substances be made and changed?
- How can we explain changes in the air, land, and oceans?

Physics

- Why do materials have different properties?
- How do forces make things happen?
- How do we see, hear, and communicate?
- How do electricity and magnetism work?
- How does the Earth fit into the Universe?

Cross-disciplinary

- How can we live sustainably to protect Earth for a better future?

The threads revisit and develop scientific knowledge and understanding with increasing complexity over time. For example, pupils develop their understanding of living things via the ‘Why are there similarities and differences between living things?’ thread. They are first taught about ‘Naming and Grouping Animals’ in key stage 1, before building on this in key stage 2 by learning about ‘Living Things and the Environment’. In key stage 3 pupils learn about ‘Species and Classification’ and in key stage 4 ‘Variation and Natural Selection’. Consistent threads across our primary and secondary curricula can enable a more effective transition, helping pupils to bridge their knowledge and understanding from primary to secondary.

We have recently added a new cross-disciplinary thread: ‘How can we live sustainably to protect Earth for a better future?’ This thread connects scientific knowledge from biology, chemistry, and physics, helping pupils understand human impact on the Earth and explore science-based solutions for a sustainable future.

Recommendations from subject specific reports

How does our curriculum address and enact recommendations from subject specific reports (e.g. EEF guidance reports & Ofsted Research Review)?

Our science curriculum incorporates EEF recommendations from 2018 and 2023, emphasising the importance of building on pupils’ prior knowledge, addressing misconceptions, and providing meaningful feedback. Classroom dialogue from primary is further developed in secondary education with advanced scientific reading and writing knowledge and skills. Scientific vocabulary is explicitly taught, with increasing complexity and connections to word origins. For example, in key stage 4, when studying genetics, vocabulary such as "homozygous" and "heterozygous" is explicitly taught, highlighting the etymology. This reinforces connections between words, deepening pupils' understanding of complex biological concepts.

The recent Ofsted subject report for science highlights the need for high-quality, purposefully planned practical work. For example, in key stage 4, a practical experiment investigating the effect of light intensity on the rate of photosynthesis allows students to observe how varying light levels impact oxygen production in pondweed. Links between substantive knowledge (photosynthesis and light as a limiting factor) and disciplinary knowledge (conducting controlled experiments and analysing data) enhance pupils' retention and application of what they've learned and there is sufficient time for pupils to interpret and explain the observations and measurements made.

Subject-specific needs

How does our curriculum deal with elements that arise from the specific needs of the subject?

How are practicals featured in the curriculum?

Practical work is purposeful and clearly linked to curriculum content. Video clips and GIFs help pupils visualise techniques before they engage in the activities, ensuring they understand the procedures. If hands-on practicals aren't possible, lessons include videos that demonstrate equipment use. For example, if a microscope is not available for a biology lesson on microscopy, pupils can instead watch a video showing how to prepare and view a slide under the microscope.

How does the science curriculum link to our curricula in other subjects?

The curriculum is planned to align with other subjects, such as mathematics. In science lessons, students apply mathematical skills to tasks like calculating means and plotting graphs when analysing experimental data. Graphing techniques and statistical methods are consistent with those taught in mathematics to maintain continuity between subjects, while also addressing subject-specific differences. These differences are explicitly highlighted; for example, in science, the line of best fit may be curved to show a general trend, whereas in mathematics, it is usually a straight line.

Our curriculum partner

We are delighted to be collaborating with The University of York Science Education Group (UYSEG) on our secondary science curriculum package. UYSEG are well known for their Best Evidence Science Teaching (BEST) curriculum package. BEST is designed to help teachers to develop evidence-informed practice and provide high-quality resources for effective teaching of difficult ideas, increased student engagement, effective practical work and embedded formative assessment.

Year 7 units

View interactive sequence online

1 **Forces**	**2** **Solid, liquid, gas states and changes of state**	**3** **Cells**
4 **Our solar system and beyond**	**5** **Solutions**	**6** **Ecosystems**
7 **Sound, light and vision**	**8** **Heredity and DNA**	**9** **Separation techniques**
10 **Human skeleton and muscles**	**11** **Heating and cooling**	**12** **Diffusion**
13 **Climate change and living sustainably**		

1. Forces

Year 7: Physics

Go to unit resources

Threads

- BQ11 Physics: How do forces make things happen?

Unit description

This unit focuses on quantifying and comparing energy transfers in different processes, such as motion changes, electrical circuits, and fuel burning. It examines forces as interactions between objects, using diagrams and measurements, including contact and non-contact forces.

Why this, why now?

Building on pupils' prior knowledge of forces, including simple machines, where they explored resistance forces such as air and water resistance and friction, this unit deepens their understanding by introducing forces as interactions between objects, including contact and non-contact forces, using diagrams and measurements. This ensures that pupils can contextualise how forces affect motion before they progress to the next unit, Hidden forces, where they will explore more complex concepts like turning forces, forces that hold objects on surfaces, and buoyancy.

Lessons in unit

1. What forces do
2. The different kinds of force
3. Measuring forces
4. Using force arrows
5. Balanced and unbalanced forces
6. Friction
7. Reducing friction: practical
8. Reducing friction: analysis
9. Energy
10. Transferring energy

Prior knowledge requirements

- Forces are pushes or pulls.
- Some forces need contact to push or pull.
- Magnetic forces can push or pull at a distance.
- Gravity is a force that pulls objects towards the Earth.
- Air resistance, water resistance and friction push back against moving objects.
- Friction is a force that acts between moving surfaces.

2. Solid, liquid, gas states and changes of state

Year 7: Chemistry

Go to unit resources

Threads

- BQ06 Chemistry: How do we explain how substances behave?
- BQ08 Chemistry: How can substances be made and changed?

Unit description

This unit covers the properties of solids, liquids, and gases using the particle model, including gas pressure. It explains changes of state in terms of the particle model while developing skills in using appropriate techniques, apparatus, and materials in lab work.

Why this, why now?

This unit builds on pupils' prior learning from Introduction to states of matter and changing states, where they explored how solids, liquids, and gases change when heated or cooled. It develops their understanding of the particle model, focusing on how particles behave and interact during changes of state, including gas pressure and motion. This positions pupils to deepen their knowledge in the next unit, Solutions, where they will apply these concepts to understand the behaviour of mixtures and how they can be separated, further reinforcing the thread of substance interactions.

Lessons in unit

1. Solid and liquid states
2. Melting: particle model
3. Bunsen burners
4. Melting: melting points and freezing points
5. Particle model of substances in the gas state
6. Boiling and condensing
7. Changes of state: energy and evaporation

Prior knowledge requirements

- Materials can be grouped as solids, liquids or gases.
- Solids hold their shape.
- Liquids form a pool not a pile.
- Gases can escape from an unsealed container.
- Some materials change state when they are heated or cooled.
- Water can evaporate into a gas.
- Water evaporates more quickly when the temperature is higher.
- Water vapour can condense into water.

3. Cells

Year 7: Biology

Go to unit resources

Threads

- BQ01 Biology: What are living things and what are they made of?

Unit description

This unit explores cell structures, their functions, and differences between plant and animal cells. It includes adaptations of unicellular organisms and the organisation of multicellular organisms. Skills in using safe techniques, recording data, and evaluating methods in lab work are developed.

Why this, why now?

This unit builds on pupils' prior learning from Living things and where they live, where they explored basic biological structures and how organisms are adapted to their environments. It develops their understanding by focusing on the structure and function of cells, the building blocks of all living things, including specialised cell functions. This prepares pupils for the next unit, Human skeleton and muscles, where they will apply their knowledge of cells to understand the organisation of tissues, organs, and systems, highlighting how cellular structures contribute to movement and support.

Lessons in unit

1. The common processes of all living organisms
2. Observing cells with a light microscope
3. Preparing and observing a microscope slide
4. Animal cell structures and their functions
5. Plant cell structures and their functions
6. Multicellular and unicellular organisms
7. Specialised cells are adapted for their functions

Prior knowledge requirements

- [Y2] Some processes happen in all living things (and do not happen in things that are dead or have never been alive).
- [Y5] All living things have a life cycle.
- [Y3] Flowering plants are made up of different parts with different functions, including roots, stem/trunk, leaves and flowers.
- [Y4, Y6] Humans are made up of different parts with different functions, including organ systems such as the digestive system and circulatory system.

4. Our solar system and beyond

Year 7: Physics

Go to unit resources

Threads

- BQ14 Physics: How does the Earth fit into the Universe?

Unit description

This unit explores gravity as the force between masses, including weight calculation using gravitational field strength. It covers the relationship between Earth, the Moon, and the Sun, the concept of light years, and seasonal changes due to Earth's tilt.

Why this, why now?

This unit builds on pupils' prior learning from Earth, Sun and Moon, where they explored the movement and interactions of these celestial bodies. It expands their understanding by examining the solar system, including the concept of gravity as a force between masses and the role of gravity in maintaining orbital paths. This prepares pupils for the next unit, Gravity in space, where they will delve deeper into the effects of gravity on orbits, the formation of celestial bodies, and evidence supporting theories about the universe's expansion.

Lessons in unit

1. The spinning Earth
2. Our solar system
3. Gravity
4. Stars, galaxies and the universe
5. Heating by the Sun
6. Earth's tilt
7. Seasons on Earth
8. Changing ideas about Earth

Prior knowledge requirements

- The Sun is a huge, hot star.
- Other stars are much further away than the Sun.
- Earth is a spherical rocky planet.
- The Sun appears to move in an arc across the sky because Earth spins round once every 24 hours.
- The spin of Earth causes day and night.
- Earth is one of eight planets that orbit the Sun.
- A year is the time it takes Earth to orbit the Sun.
- The Moon is a spherical and rocky moon.
- The Moon orbits Earth about once every month.

5. Solutions

Year 7: Chemistry

Go to unit resources

Threads

- BQ06 Chemistry: How do we explain how substances behave?
- BQ08 Chemistry: How can substances be made and changed?

Unit description

This unit explores the concepts of pure substances, mixtures, and diffusion in liquids and gases. It emphasises accuracy, precision, and the use of appropriate techniques during investigations. The focus is on making predictions and recording reliable observations.

Why this, why now?

This unit builds on pupils' prior learning from Solid, liquid, gas states and changes of state, where they explored how particles behave in different states and change under various conditions. It advances their knowledge by investigating how substances mix to form solutions and the factors that affect solubility. This prepares pupils for the next unit, Separation techniques, where they will apply their understanding of mixtures and solutions to learn how substances can be separated, deepening their grasp of the interactions and properties of materials.

Lessons in unit

1. Pure substances
2. Mixtures: choosing equipment
3. Mixtures: equipment diagrams
4. Mixtures and solutions
5. Diffusion
6. Dissolving
7. Variables
8. Dissolving: scientific methods
9. Solubility: practical
10. Solubility: analysis
11. Saturated solutions

Prior knowledge requirements

- Some materials will dissolve in a liquid to form a solution.
- Dissolving is a reversible change.
- Changes of state are reversible.
- Some changes result in the formation of a new substance.

6. Ecosystems

Year 7: Biology

Go to unit resources

Threads

- BQ03 Biology: How do living things live together in their environments?

Unit description

This unit explores the interdependence of organisms in ecosystems, including food webs and insect-pollinated crops. It examines how organisms interact with their environment and the impact of toxic materials. It also highlights the importance of biodiversity and preserving genetic material.

Why this, why now?

This unit builds on pupils' prior learning from More about food chains, where they explored the flow of energy through organisms as they interact in ecosystems. It deepens their understanding by examining the complex interdependence of organisms, the impact of environmental changes, and the importance of biodiversity. This prepares pupils for the next unit, Biodiversity, where they will further explore how species interactions and environmental factors influence the survival and adaptation of organisms, reinforcing the thread of ecosystem dynamics and conservation.

Lessons in unit

1. Food chains
2. Predator-prey relationships
3. Adaptations of predators and prey
4. Food webs
5. Ecosystems and habitats
6. Pollination and human food security
7. Using chemicals in farming
8. Bioaccumulation
9. The importance of biodiversity

Prior knowledge requirements

- Recognise that environments can change and that this can sometimes pose dangers to living things.
- Be able to identify how a habitat changes throughout the year
- Be able to construct and interpret a variety of food chains, identifying producers, predators and prey.

7. Sound, light and vision

Year 7: Physics

Go to unit resources

Threads

- BQ12 Physics: How do we see, hear and communicate?

Unit description

This unit explores sound and light waves, including frequencies, echoes, reflection, absorption, and the need for a medium for sound to travel. It also compares light and matter waves, investigates light transmission and colour, and examines wave properties and effects.

Why this, why now?

This unit builds on pupils' prior learning from Light and how it travels, where they explored the basic properties of light, including how it moves in straight lines and forms shadows. It extends this knowledge by examining the nature of sound and light waves, their interactions, and how they are perceived by the human senses. This prepares pupils for the next unit, Making images, where they will apply their understanding of wave properties to explore how light is used to create images, further enhancing their grasp of the role of waves in communication and perception.

Lessons in unit

1. Sound vibrations
2. Travelling vibrations
3. Travelling sound
4. Reflecting and absorbing sound
5. Shadows
6. Reflecting light from mirrors
7. How we see things
8. Reflections in mirrors

Prior knowledge requirements

- Sounds are made by something that is vibrating.
- Vibrations from sounds are heard because they move through the air to the ear.
- Bigger vibrations make louder sounds.
- Shorter or tighter strings vibrate to make sounds with a higher pitch.
- Sounds get fainter as distance from the sound increases.
- Light travels in straight lines.
- Objects are seen because they shine light or reflect light into the eye.
- Light forms shadows in the shape of objects that block it.

8. Heredity and DNA

Year 7: Biology

Go to unit resources

Threads

- BQ02 Biology: How do living things grow and reproduce?

Unit description

This unit examines the transmission of genetic information through heredity, how scientific methods evolve with new evidence, the importance of publishing and peer review, and the Study of DNA, chromosomes, and genes while developing lab skills focusing on safety.

Why this, why now?

This unit builds on pupils' prior learning from Evolution and inheritance, where they examined how genetic traits are passed through generations and how species adapt over time. It deepens their understanding by exploring the detailed mechanisms of heredity, including DNA, chromosomes, and genes, and how genetic information is transmitted. This prepares pupils for the next unit, Reproduction in humans, where they will apply their knowledge of genetic inheritance to understand human reproductive processes, focusing on the roles of genetic material in development and variation.

Lessons in unit

1. Heredity
2. Heredity and genetic material
3. Genetic material and DNA
4. A model of the structure of DNA
5. DNA from fruit
6. The discovery of the structure of DNA
7. DNA, chromosomes, genes and the genome

Prior knowledge requirements

- [Y5] Reproduction is part of the life cycle of all living things.
- [Y6] Living things, including animals and plants, produce offspring of the same kind.
- [Y6] Characteristics are passed from parents to their offspring.
- [Y6] Offspring are similar to their parents, but normally offspring vary and are not identical to their parents.
- All organisms are made up of cells.
- The cells of animals and plants have a nucleus that stores genetic material.
- The genetic material provides instructions for growth and other life processes.

9. Separation techniques

Year 7: Chemistry

Go to unit resources

Threads

- BQ06 Chemistry: How do we explain how substances behave?
- BQ08 Chemistry: How can substances be made and changed?

Unit description

This unit covers techniques for separating mixtures, including filtration, evaporation, distillation, and chromatography, as well as identifying pure substances. Conduct experiments safely, record observations, evaluate methods, and suggest improvements.

Why this, why now?

This unit builds on pupils' prior learning from Properties, changes and separating materials, where they explored material properties and methods of separation. It focuses on techniques like filtration, evaporation, and distillation to separate mixtures based on their properties. This prepares pupils for the next unit, Understanding chemical reactions, where they will apply this knowledge to explore how substances interact and change during chemical reactions, deepening their understanding of material behaviour.

Lessons in unit

1. Separating an insoluble solid from a liquid
2. Separating a soluble solid from a liquid
3. Separating pure salt from dirty rock salt
4. Separating liquids
5. Simple distillation
6. Distillation: practical
7. Chromatography

Prior knowledge requirements

- Some materials change state when they are heated or cooled.
- Some materials will dissolve in liquids to form a solution, and how to recover a substance from a solution.
- Dissolving is a reversible state.
- Use knowledge of solids, liquids and gases to decide how mixtures might be separated.

10. Human skeleton and muscles

Year 7: Biology

Go to unit resources

Threads

- BQ01 Biology: What are living things and what are they made of?

Unit description

This unit investigates the structure and functions of the human skeleton, including support, protection, movement, and blood cell production. Explore biomechanics, the interaction of muscles and the skeleton, and antagonistic muscles while measuring muscle force.

Why this, why now?

This unit builds on pupils' prior learning from Cells, where they explored cell structures and functions as the basic units of life. It extends their understanding by examining how the human skeleton and muscles work together for support, protection, and movement. This prepares pupils for the next unit, Diffusion, where they will apply their knowledge of cellular functions to understand how substances move in and out of cells, highlighting the importance of these processes in body systems.

Lessons in unit

1. The human skeleton
2. Muscles
3. Movement
4. Biomechanics

Prior knowledge requirements

- [Y5] Humans have a skeleton and muscles for support, protection and movement.
- All organisms, living and dead, are made up of cells.
- In multicellular organisms, all the tissues and organs are made of cells.
- Specialised cells in animals and plants have shapes, sizes and structures that are adapted for the jobs the cells do.

11. Heating and cooling

Year 7: Physics

Go to unit resources

Threads

- BQ10 Physics: Why do materials have different properties?

Unit description

This unit explains energy transfer between objects due to temperature differences, through conduction or radiation, the role of insulators, and thermal equilibrium. It covers particle arrangements and motions in solids, liquids, and gases and Brownian motion.

Why this, why now?

This unit builds on pupils' prior learning from Solid, liquid, and gas states and changes of state, where they explored how particles behave in different states and respond to heating and cooling. It deepens their understanding by examining energy transfer, thermal equilibrium, and the role of insulators. This prepares pupils for the next unit, Particle explanations of density and pressure, where they will apply their knowledge of particle behaviour to explore how density and pressure are influenced by particle arrangement and movement.

Lessons in unit

1. Measuring temperature
2. Changing temperature
3. Mixing substances of different temperatures
4. Cooling
5. Thermal conductors
6. Thermal insulators
7. Energy and temperature
8. Energy and substance

Prior knowledge requirements

- Almost everything is made of particles.
- Solids have a fixed shape, cannot usually be squashed and do not flow.
- Liquids usually cannot be squashed, they flow and will take the shape of the container they are in.
- Gases can be squashed, they flow and will fill the container they are in.
- In a solid, particles are very close together, have a regular arrangement, are vibrating and are bonded together.
- In a liquid, particles are close together, they do not have a regular arrangement and can move over each other, they are loosely bonded together.
- In a gas, particles are spaced apart and move quickly in straight lines, bouncing off other particles or the walls of their container.
- Between particles there is empty space.

12. Diffusion

Year 7: Biology

Go to unit resources

Threads

- BQ01 Biology: What are living things and what are they made of?

Unit description

This unit explores diffusion's role in material movement in and between cells and involves making predictions, observations and measurements with various methods.

Why this, why now?

This unit builds on pupils' prior learning from Human skeleton and muscles, where they explored the structure and function of body systems. It deepens their understanding by examining diffusion as a key process for transporting substances in and between cells. This prepares pupils for the next unit, Human digestive system, where they will apply their knowledge of diffusion to understand how nutrients are absorbed into the bloodstream, highlighting the importance of these processes in digestion and overall body function.

Lessons in unit

1. Diffusion: moving particles
2. Diffusion through a permeable material: practical
3. Diffusion through the cell membrane
4. Diffusion through a selectively-permeable membrane: practical

Prior knowledge requirements

- All living organisms are made up of cells.
- All cells are surrounded by a cell membrane, which controls which substances can move into and out of the cell.
- The particle model of matter.
- The properties of the different states of matter (solid, liquid and gas) in terms of the particle model.

13. Climate change and living sustainably

Year 7: Biology, Chemistry, Physics

Go to unit resources

Threads

- BQ15 How can we live sustainably to protect Earth for a better future?

Unit description

This unit introduces the greenhouse effect, global warming and the impact of climate change on weather events. It explores some actions that can be taken to use resources, and to live, in a sustainable way.

Why this, why now?

The purpose of this unit is to give a brief introduction to the greenhouse effect, global warming and climate change using concrete ideas from topics covered through Y7 science lessons. It introduces pupils to evidence from climate science, to start addressing their questions about climate change in a clear, positive and relevant way. The key message is that climate change 'is real, it's us, it's bad, there's hope'. In the next climate change unit, the local actions considered here are used as stepping stones to understand how larger scale actions for tackling climate change can be delivered.

Lessons in unit

1. The greenhouse effect
2. Global warming
3. Climate change and human activities
4. Sustainable use of resources
5. Eating sustainably
6. Heating and cooling our school sustainably
7. Waste and recycling

Prior knowledge requirements

- Organisms interact with the environment in which they live.
- Changes to the environment may make it harder for organisms to survive in a particular habitat.
- Each element has particular chemical properties.
- A compound may have different properties to each of the elements that it is made from.
- Heating a solid makes its particles vibrate more quickly.
- In thermal conductors, vibrating particles quickly cause the particles near to them to vibrate as well.
- In thermal insulators, it is hard for vibrating particles to cause the particles near to them to vibrate as well.
- Air is a good thermal insulator because it is a gas.
- Thermal insulators often contain trapped air.

Year 8 units

View interactive sequence online

1 Human digestive system	**2** Atoms, elements and compounds	**3** Biodiversity
4 Understanding chemical reactions	**5** Moving by force	**6** Species and classification (differences between species)
7 Variation (differences within species)	**8** Earth's resources	**9** Series circuits
10 Reproduction in humans	**11** Fuels and energetics	**12** Making images
13 Diet and exercise	**14** Climate change and greenhouse gases	

1. Human digestive system

Year 8: Biology

Go to unit resources

Threads

- BQ01 Biology: What are living things and what are they made of?

Unit description

This unit examines the human digestive system, including the roles of tissues, organs, enzymes, and beneficial bacteria. It also focuses on evaluating risks, interpreting data, identifying patterns, and suggesting improvements to enhance the reliability of investigations.

Why this, why now?

This unit builds on pupils' prior learning from Diffusion, where they explored how substances move in and out of cells. It deepens their understanding by examining the human digestive system, focusing on how nutrients are broken down and absorbed through diffusion into the bloodstream. This prepares pupils for the next unit, Breathing and respiration, where they will apply their understanding of diffusion to explore gas exchange in the lungs, further connecting the role of diffusion in vital body processes.

Lessons in unit

1. The parts of the human digestive system
2. Digestion and enzymes
3. Food tests: practical
4. Bacteria in the human digestive system
5. Absorption and transport of nutrients in humans

Prior knowledge requirements

- [Y2] Animals, including humans, need water and food for survival.
- [Y4, Y6] Humans are made up of different parts with different functions, including organ systems such as the digestive system and circulatory system.
- [Y4] Basic parts of the human digestive system and their simple functions.
- [Y6] The main parts of the human circulatory system, including the blood vessels and blood.
- Specialised cells in animals and plants have shapes, sizes and structures that are adapted for the jobs the cells do.
- Muscles have important roles in organ systems.

2. Atoms, elements and compounds

Year 8: Chemistry

Go to unit resources

Threads

- BQ06 Chemistry: How do we explain how substances behave?
- BQ07 Chemistry: What are things made of?

Unit description

This unit explores the basic atomic model, the differences between atoms, elements, and compounds, and the varying physical and chemical properties of elements. It covers chemical symbols, formulae, SI units, and IUPAC nomenclature, emphasising their use in describing elements and compounds.

Why this, why now?

This unit builds on pupils' prior learning from Solid, liquid, gas states and changes of state, where they explored particle behaviour in different states and how materials change under various conditions. It enhances their understanding by focusing on the structure of atoms, elements, and compounds, and how these fundamental particles combine. This prepares pupils for the next unit, Understanding chemical reactions, where they will apply this knowledge to explore how atoms rearrange during chemical reactions, reinforcing the principles of matter and its transformations.

Lessons in unit

1. Atoms and elements
2. Properties of elements
3. Metallic elements
4. Molecular elements
5. Common elements
6. Compounds and their formation
7. Chemical formulae
8. Naming compounds
9. A particle model of chemical reactions

Prior knowledge requirements

- A pure substance is made of only one type of particle.
- A pure substance has a fixed melting point and boiling point.
- Impurities change the melting and boiling point of a substance.
- Mass of substances that are mixed adds to give the total mass of the mixture (mass is conserved).
- Mass is measured with a balance in grams.

3. Biodiversity

Year 8: Biology

Go to unit resources

Threads

- BQ03 Biology: How do living things live together in their environments?

Unit description

This unit examines environmental changes and their impact on species' survival and adaptation, potentially leading to extinction. It also develops skills for interpreting data and observations, evaluating errors, and using SI units and IUPAC chemical nomenclature in scientific contexts.

Why this, why now?

This unit builds on pupils' prior learning from Ecosystems, where they examined the interdependence of organisms and the impact of environmental changes. It deepens their understanding by focusing on biodiversity, exploring the variety of life forms and their roles within ecosystems. This prepares pupils for the next unit, Living organisms and their environments, where they will apply this knowledge to study how biotic and abiotic factors influence the distribution and survival of species, reinforcing the importance of maintaining biodiversity.

Lessons in unit

1. Interdependence within ecosystems
2. Pyramids of number
3. Pyramids of biomass
4. Plants are adapted for their environment
5. Animals are adapted for their environment
6. Ecological sampling of living organisms
7. Ecological sampling using a quadrat
8. Conserving biodiversity

Prior knowledge requirements

- Food chains show the transfer of biomass
- Food web diagrams represent several interconnected food chains within a community of organisms
- A change in the size of a population will affect other populations in the same community
- Habitats are where plants and animals live and they contain living (biotic) and non-living (abiotic) parts
- Organisms interact with the environment in which they live
- All species have features which make them suited to their environment
- Changes to the environment may make it harder for organisms to survive in a particular habitat
- Biodiversity is a measure of the range of living organisms
- It is important to preserve biodiversity to maintain a healthy environment

4. Understanding chemical reactions

Year 8: Chemistry

Go to unit resources

Threads

- BQ06 Chemistry: How do we explain how substances behave?
- BQ08 Chemistry: How can substances be made and changed?

Unit description

This unit covers the conservation of mass in changes of state and chemical reactions, including atom rearrangement. It also focuses on representing reactions with formulae and equations, exploring combustion, decomposition, and displacement, and distinguishing chemical from physical changes.

Why this, why now?

This unit builds on pupils' prior learning from Atoms, elements and compounds, where they explored the basic building blocks of matter and how elements combine. It deepens their understanding by examining chemical reactions, focusing on how atoms rearrange to form new substances. This prepares pupils for the next unit, Acids and bases, where they will apply this knowledge to explore specific reactions, such as neutralisation, reinforcing their understanding of how substances interact chemically.

Lessons in unit

1. Characteristics of chemical reactions
2. Conservation of mass and balanced symbol equations
3. Chemical reactions: oxidation
4. Chemical reactions: combustion
5. Chemical reactions: decomposition
6. Chemical reactions: precipitation

Prior knowledge requirements

- Some substances simply form mixtures when they are put together.
- Mixtures contain substances which are not chemically combined.
- The substances in a mixture can usually be separated out again.
- Some substances will dissolve in liquids to form a solution.
- Dissolving is a reversible state.

5. Moving by force

Year 8: Physics

Go to unit resources

Threads

- BQ11 Physics: How do forces make things happen?

Unit description

This unit explores speed, forces, and motion, including effects on objects. It covers deriving equations, calculations, and distance-time graphs. Learn to use force arrows, identify balanced and unbalanced forces, and understand their impact on movement.

Why this, why now?

This unit builds on pupils' prior learning from Forces, where they explored different types of forces and how they affect motion. It deepens their understanding by examining how forces cause objects to move, stop, and change direction, using force diagrams and calculations. This prepares pupils for the next unit, Measuring and calculating motion, where they will apply their knowledge of forces to quantify motion through speed, velocity, and acceleration, enhancing their grasp of the principles governing movement.

Lessons in unit

1. Calculating speed
2. Measuring speed: practical
3. Measuring speed accurately
4. Reading distance-time graphs
5. Interpreting distance-time graphs
6. Changing speed
7. Newton's First Law
8. Streamlining
9. Comparing the speeds of different parachutes
10. Changing the speed of a parachute

Prior knowledge requirements

- Increasing the mass and/or speed of objects makes their movement harder to change.
- Forces make things changes and bigger forces cause greater change.
- Newton meters are used to measure force.
- Force arrows show the direction and size of a force.
- The resultant force is the difference in size of two forces acting in opposite directions.
- A gravitational force pulls objects towards Earth.
- Air resistance, water resistance and friction push back against moving objects.
- Friction prevents or slows down movement between surfaces.
- Friction is caused by the roughness of surfaces.
- Forces can transfer energy.

6. Species and classification (differences between species)

Year 8: Biology

Go to unit resources

Threads

- BQ04 Biology: Why are there similarities and differences between living things?

Unit description

This unit explores the differences between species and how to interpret observations and data to identify patterns and draw conclusions. It also focuses on making and recording observations using various methods, evaluating their reliability, and suggesting improvements for investigations.

Why this, why now?

This unit builds on pupils' prior learning from Why we group and classify living things, where they explored the principles of classification and the characteristics that distinguish different groups. It deepens their understanding by examining the differences between species and how these distinctions inform classification. This prepares pupils for the next unit, Variation (differences within species), where they will explore how differences within a species contribute to diversity and adaptation, reinforcing the importance of classification in understanding biological variation.

Lessons in unit

1. Classification and species
2. Classifying organisms using a classification key
3. Identification and classification in the field
4. Classification at the cellular level

Prior knowledge requirements

- [Y4] A classification key can be used to identify living things, including animals and plants.
- [Y6] Living things can be classified into groups based on similarities and differences in their observable characteristics.

7. Variation (differences within species)

Year 8: Biology

Go to unit resources

Threads

- BQ04 Biology: Why are there similarities and differences between living things?

Unit description

This unit examines variation within species, both continuous and discontinuous, using measurements and graphical representations. It also emphasises objectivity, accuracy, precision, and repeatability in investigations, the use of appropriate techniques, and the effective presentation of data.

Why this, why now?

This unit builds on pupils' prior learning from Species and classification (differences between species), where they examined how species differ and the role of classification. It deepens their understanding by exploring variations within species, highlighting how individual differences contribute to diversity. This prepares pupils for the next unit, Adaptations, competition, natural selection and evolution, where they will apply their knowledge to understand how variation drives adaptation and evolution, shaping how species survive and thrive in their environments.

Lessons in unit

1. Reproduction and variation
2. Variation within species
3. Continuous and discontinuous variation: practical
4. Discontinuous variation: data handling and analysis
5. Continuous variation: data handling and analysis

Prior knowledge requirements

- [Y6] Living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents.
- Impacts of diet, exercise and lifestyle on the body.
- Heredity as the process by which genetic information is transmitted from one generation to the next.
- A simple model of chromosomes, genes and DNA in heredity.

8. Earth's resources

Year 8: Chemistry

Go to unit resources

Threads

- BQ07 Chemistry: What are things made of?
- BQ09 Chemistry: How can we explain changes in the air, land and oceans?

Unit description

This unit explores Earth's composition, structure, and rock cycle, including the formation of igneous, sedimentary, and metamorphic rocks. It also examines Earth as a source of limited resources and the importance of recycling, alongside skills in making and evaluating observations and measurements.

Why this, why now?

This unit builds on pupils' prior learning from Rocks and soils, where they explored the formation and classification of rocks and the composition of soils. It deepens their understanding by examining Earth's resources, including how these materials are used and the importance of sustainable management. This prepares pupils for the next unit, Carbon cycle and climate change, where they will apply their knowledge to understand the role of Earth's resources in global cycles and the impact of human activity on climate, reinforcing the need for responsible resource use.

Lessons in unit

1. Inside rock
2. Rocks and minerals
3. Types of rocks
4. Structure of Earth
5. Tectonic plates
6. Igneous rock
7. Metamorphic rock

Prior knowledge requirements

- There are different types of rock that have different properties.
- Some types of rock are harder than other types and scratch them.
- Some types of rock contain fossils and other types do not.
- Soil is made of tiny pieces of rock and organic matter, such as rotting leaves.
- Earth is a rocky planet.
- Earth is shaped as a sphere.

9. Series circuits

Year 8: Physics

Go to unit resources

Threads

- BQ13 Physics: How do electricity and magnetism work?

Unit description

This unit covers electric current, potential difference, and resistance in series and parallel circuits. It also explores charge separation, electron transfer, and electric fields. The unit focuses on interpreting data, identifying patterns, and drawing conclusions using scientific knowledge.

Why this, why now?

This unit builds on pupils' prior learning from Changing circuits, where they explored the components and variations of electrical circuits and how changes affect circuit behaviour. It deepens their understanding by focusing on series circuits, exploring current, voltage, and resistance in a simple loop. This prepares pupils for the next unit, Magnets and electromagnets, where they will apply their knowledge of electric circuits to understand how electricity and magnetism interact, further enhancing their understanding of electromagnetic systems.

Lessons in unit

1. Making a series circuit
2. Fixing faulty circuits
3. Electric current
4. Measuring electric current
5. Measuring voltage
6. Changing voltage
7. Static electricity
8. Static electricity: charge

Prior knowledge requirements

- The names of basic components of an electric circuit.
- The circuit symbols of basic components of an electric circuit.
- A complete circuit is needed for a circuit to work.
- A switch opens and closes to break and complete a circuit.
- Metals are good conductors of electricity.
- Having more cells in a simple (series) circuit makes a bulb brighter or a buzzer louder.
- In a simple circuit, a battery with a higher voltage makes a bulb brighter or a buzzer louder.

10. Reproduction in humans

Year 8: Biology

Go to unit resources

Threads

- BQ02 Biology: How do living things grow and reproduce?

Unit description

This unit explores human reproduction, covering the structure and function of male and female reproductive systems, the menstrual cycle, gametes, fertilisation, gestation, and birth. It also examines how maternal lifestyle impacts the foetus through the placenta.

Why this, why now?

This unit builds on pupils' prior learning from Heredity and DNA, where they explored genetic transmission and how DNA controls traits in living organisms. It deepens their understanding by examining human reproduction, focusing on the structure and function of reproductive systems and the role of genetics in inheritance. This prepares pupils for the next unit, Reproduction in plants, where they will apply their understanding of genetic principles to explore plant reproductive processes, reinforcing the continuity of life across different species.

Lessons in unit

1. Reproduction and inheritance
2. Life cycles and reproduction
3. Puberty in humans and sexual maturity
4. Gametes and fertilisation in sexual reproduction
5. Human reproductive organs
6. The human menstrual cycle
7. Gestation and birth in humans
8. Healthy pregnancy

Prior knowledge requirements

- The changes experienced during puberty.
- The gestation period of a human.
- The nucleus of a cell contains DNA.
- Organisms grow by cell division.

11. Fuels and energetics

Year 8: Chemistry

Go to unit resources

Threads

- BQ08 Chemistry: How can substances be made and changed?
- BQ09 Chemistry: How can we explain changes in the air, land and oceans?

Unit description

This unit examines energy changes in state, exothermic and endothermic reactions, and energy transfers in various processes. It emphasises objectivity, accuracy, and precision in scientific enquiries, data interpretation, and the use of tables, graphs, and reliable methods.

Why this, why now?

This unit builds on pupils' prior learning from Understanding chemical reactions, where they explored how substances interact and transform during reactions. It deepens their understanding by examining fuels and energetics, focusing on energy changes in chemical reactions and the impact of energy resources. This prepares pupils for the next unit, Carbon cycle and climate change, where they will apply their knowledge of fuels and energy transfers to explore the environmental impact of carbon emissions, linking chemical processes to global climate issues.

Lessons in unit

1. Heating and cooling
2. Cooling curve: practical
3. Exothermic and endothermic chemical reactions
4. Comparing fuels
5. Power stations
6. Using renewable energy resources

Prior knowledge requirements

- In a chemical reaction, atoms rearrange themselves to form new substances
- Chemical reactions cannot usually be reversed easily
- Combustion is the reaction of substances with oxygen
- Burning is also used to describe the reaction of substances with oxygen, but is most often used when flames are seen
- Combustion requires three things: fuel, heat and oxygen

12. Making images

Year 8: Physics

Go to unit resources

Threads

- BQ12 Physics: How do we see, hear and communicate?

Unit description

This unit explores the transmission of light, including absorption, scattering, and reflection, and the use of the ray model in imaging, refraction, and lenses. It also covers energy transfer in various processes, using safe techniques, making accurate observations, and improving reliability.

Why this, why now?

This unit builds on pupils' prior learning from Sound, light and vision, where they explored the properties of sound and light waves and how they interact with different materials. It deepens their understanding by examining how light is used to form images through reflection, refraction, and lenses. This prepares pupils for the next unit, Waves, where they will apply their knowledge of wave properties to explore the broader concepts of wave behaviour, including superposition and wave interactions, reinforcing their understanding of how waves function in various contexts.

Lessons in unit

1. Seeing in colour
2. The visible spectrum
3. Reflecting colour
4. A pinhole camera
5. Reflected images
6. Refracting light
7. Focusing light

Prior knowledge requirements

- Light moves in straight lines to form a shadow in the same shape as an opaque object.
- A light ray is just a line that shows the direction light travels in.
- A light source is seen when light from it travels into the eye.
- Objects are seen when light reflects off them into the eye.
- Light enters the eye through a hole called a pupil.
- Light is detected by special cells in the retina, on the back of the eye.
- Light reflects off rough surfaces in many different directions.
- An eye detects light reflecting off an object in the direction of the eye and enters it through the pupil.

13. Diet and exercise

Year 8: Biology

Go to unit resources

Threads

- BQ05 Biology: How do living things stay healthy?

Unit description

This unit covers the components of a healthy diet, energy requirements, and the effects of imbalances, exercise, asthma, and smoking on the body. It also focuses on planning scientific enquiries, applying mathematical concepts, performing calculations, and basic data analysis techniques.

Why this, why now?

This unit builds on pupils' prior learning from Keeping healthy, where they explored the importance of a balanced diet, exercise, and lifestyle choices for overall health. It deepens their understanding by examining the specific impacts of diet and exercise on body systems, including effects of physical activity. This prepares pupils for the next unit, Disease and drugs, where they will apply their knowledge to explore how lifestyle factors contribute to disease risk and the role of drugs in managing health conditions, reinforcing the link between daily choices and long-term health.

Lessons in unit

1. Good and ill health
2. Balanced diet
3. Food is a source of building materials and energy
4. Energy provided by food: practical
5. Imbalanced diet: starvation and deficiency diseases
6. Imbalanced diet: obesity
7. The effects of exercise on the human body
8. The effects of exercise on breathing and heart rate
9. Recovery time after exercise

Prior knowledge requirements

- [Y6] The impacts of lifestyle, including diet and exercise, on the way the human body functions.

14. Climate change and greenhouse gases

Year 8: Chemistry, Physics

Go to unit resources

Threads

- BQ15 How can we live sustainably to protect Earth for a better future?

Unit description

In this unit pupils learn about greenhouse gas emissions from transport and industry, and the use of renewable energy resources and changes to transport infrastructure that could reduce emissions.

Why this, why now?

This unit adds to pupils' knowledge of the greenhouse effect, global warming and climate change. It uses the contexts of transport and industry to explore some medium- and large-scale actions that lead to reductions in greenhouse gas emissions and how they can be delivered. Importantly, it develops understanding of why increasing the use of electric vehicles and electric heat pumps must be combined with an increased use of renewable energy resources for the generation of electricity, to reduce greenhouse gas emissions from transport and buildings.

Lessons in unit

1. Greenhouse gases and global warming
2. Evidence for global warming
3. Impact of climate change on sea levels
4. Impacts of transport on the greenhouse effect
5. Reducing emissions from transport
6. Reducing emissions from industry
7. Using renewable energy resources

Prior knowledge requirements

- Greenhouse gases in Earth's atmosphere cause the natural greenhouse effect.
- Human activities are increasing the amount of greenhouse gases in the atmosphere, increasing the greenhouse effect.
- Emissions of greenhouse gases from human activities are causing global warming and climate change.
- Temperature data show an unusual, rapid increase in the Earth's average surface temperature over the last century or so.
- The recent increase in average surface temperature is called global warming.
- There is a correlation between data showing increasing temperature and data showing increasing greenhouse gas emissions.
- Most scientists agree that emissions from human activities are increasing the greenhouse effect, causing global warming.

- Renewable resources do not run out because they are replenished faster than they are used up.
- A resource is sustainable it is maintained a certain level for as long as it is needed.
- Some resources, such as wood, are only renewable if they are used sustainably.

Year 9 units

View interactive sequence online

1 **Breathing and respiration**	**2** **Acids and bases**	**3** **Magnets and electromagnets**
4 **Plant nutrition and photosynthesis**	**5** **Materials**	**6** **Hidden forces**
7 **Adaptations, competition, natural selection and evolution**	**8** **Carbon cycle and climate change**	**9** **Waves**
10 **Disease and drugs**	**11** **Patterns in the periodic table**	**12** **Resistance and parallel circuits**
13 **Reproduction in plants**	**14** **Climate change and biodiversity**	

1. Breathing and respiration

Year 9: Biology

Go to unit resources

Threads

- BQ01 Biology: What are living things and what are they made of?

Unit description

This unit explores the human gas exchange system, breathing mechanisms, and adaptations for function. It covers aerobic and anaerobic respiration, including fermentation, and compares their processes and implications. Focus is on accuracy, reliable measurements, and SI units.

Why this, why now?

This unit builds on pupils' prior learning from the Human digestive system, where they examined how nutrients are broken down and absorbed to support bodily functions. It deepens their understanding by exploring breathing and respiration, focusing on gas exchange and how oxygen is used to release energy from food. This prepares pupils for the next unit, Plant nutrition and photosynthesis, where they will apply their knowledge of respiration to understand the interdependence of respiration and photosynthesis in living organisms.

Lessons in unit

1. Breathing, respiration and gas exchange
2. The human gas exchange system and breathing
3. Estimating lung volume
4. Adaptations of the human lungs for gas exchange
5. Cellular respiration
6. Aerobic cellular respiration
7. Anaerobic cellular respiration in humans
8. Anaerobic cellular respiration and fermentation in microorganisms

Prior knowledge requirements

- [Y2] Animals, including humans, need air for survival.
- [Y4, Y6] Humans are made up of different parts with different functions, including organ systems such as the digestive system and circulatory system.
- Living organisms are made up of one or more cells.
- Specialised cells in animals and plants have shapes, sizes and structures that are adapted for the jobs the cells do.
- Muscles have important roles in organ systems.
- Cells contain mitochondria that use food as a fuel to provide energy for life processes.

2. Acids and bases

Year 9: Chemistry

Go to unit resources

Threads

- BQ06 Chemistry: How do we explain how substances behave?
- BQ08 Chemistry: How can substances be made and changed?

Unit description

This unit covers acids, alkalis, and their neutralisation reactions, the pH scale, and the reactions of acids with metals and alkalis. It also examines the chemical properties of metal and non-metal oxides. Emphasis is on evaluating risks, using appropriate techniques, and making observations.

Why this, why now?

This unit builds on pupils' prior learning from Understanding chemical reactions, where they explored how substances interact and transform during chemical processes. It deepens their understanding by examining the properties of acids and bases, their reactions, and the concept of pH. This prepares pupils for the next unit, Making salts, where they will apply their knowledge of acid-base reactions to create different salts, reinforcing the practical application of chemical reactions and enhancing their understanding of chemical processes.

Lessons in unit

1. Acids and bases
2. pH scale and universal indicator solution
3. Practical: red cabbage indicator solution
4. Chemical reactions: acid and metal
5. Metal oxides and non-metal oxides
6. Chemical reactions: neutralisation
7. Chemical reactions: acid and metal carbonate

Prior knowledge requirements

- Some solids can dissolve to form solutions.
- New materials are formed as a result of a chemical reaction.
- One group (or class) of chemical substances is called acids.
- In a chemical reaction, atoms rearrange themselves to form new substances
- Word equations are a simple way of describing chemical reactions

3. Magnets and electromagnets

Year 9: Physics

Go to unit resources

Threads

- BQ13 Physics: How do electricity and magnetism work?

Unit description

This unit explores magnetism, including magnetic poles, fields, and Earth's magnetism, along with the principles of electromagnets and DC motors. It focuses on conducting precise scientific enquiries and identifying variables and emphasises accuracy, repeatability, and reproducibility.

Why this, why now?

This unit builds on pupils' prior learning from Series circuits, where they explored electrical components and how current flows in a simple loop. It deepens their understanding by examining the properties of magnets and electromagnets, focusing on magnetic fields and the interaction between electricity and magnetism. This prepares pupils for the next unit, Electromagnetism, where they will apply their knowledge to understand the principles behind electric motors and other electromagnetic devices, enhancing their grasp of how electricity and magnetism work together in practical applications.

Lessons in unit

1. Magnetic poles
2. The magnetic field of a bar magnet
3. Electromagnets
4. Current through an electromagnet
5. Using electromagets

Prior knowledge requirements

- Magnets attract or repel each other and attract some materials and not others.
- Magnets have two poles and two magnets will attract or repel each other, depending on which poles are facing.
- A battery pushes electric charge (electrons) one way round a complete circuit.
- An ammeter is used to measure the size of an electric current.
- Electric current is measured in amps (A), which is short for ampere.
- The current in a series circuit is the same everywhere.

4. Plant nutrition and photosynthesis

Year 9: Biology

Go to unit resources

Threads

- BQ01 Biology: What are living things and what are they made of?

Unit description

This unit covers photosynthesis, including how plants produce carbohydrates, absorb water and minerals, and the role of leaf stomata in gas exchange. It highlights the importance of photosynthesis in sustaining life on Earth and explores the adaptations of leaves for photosynthesis.

Why this, why now?

This unit builds on pupils' prior learning from Breathing and respiration, where they explored how organisms use oxygen to release energy from food. It deepens their understanding by examining plant nutrition and photosynthesis, focusing on how plants produce their own food using light, carbon dioxide, and water. This prepares pupils for the next unit, Eukaryotic and prokaryotic cells, where they will apply their knowledge of energy processes to understand cellular structures and functions, highlighting the differences in how cells support life across various organisms.

Lessons in unit

1. Plant nutrition
2. Photosynthesis
3. Adaptations of plants for photosynthesis: absorbing light
4. Adaptations of plants for photosynthesis: gas exchange and stomata

Prior knowledge requirements

- [Y2] Plants need light and water to grow.
- [Y3] Plants need air and nutrients from soil to grow.
- [Y3 & Y4] Plants are producers because they make their own food in their leaves.
- Cellular respiration is a chemical process that uses glucose from food as a fuel to provide energy for life processes.

5. Materials

Year 9: Chemistry

Go to unit resources

Threads

- BQ06 Chemistry: How do we explain how substances behave?
- BQ07 Chemistry: What are things made of?
- BQ08 Chemistry: How can substances be made and changed?

Unit description

This unit examines the varying properties of elements, the reactivity series, and the role of carbon in metal extraction. It also explores catalysts and the properties of ceramics, polymers, and composites. Emphasis is placed on evaluating risks, using appropriate techniques, and interpreting data.

Why this, why now?

This unit builds on pupils' prior learning from Acids and bases, where they explored chemical properties and reactions of substances. It deepens their understanding by examining different materials, including metals, polymers, and ceramics, and their properties and uses. This prepares pupils for the next unit, Using Earth's resources, where they will apply their knowledge to explore the sustainable use of natural resources, material extraction, and the environmental impact of human activity, reinforcing the link between chemistry and real-world applications.

Lessons in unit

1. Materials and composites: including metals, ceramics and polymers
2. Structure of polymers
3. The reactivity series for metals
4. Chemical reactions: displacement of metals
5. Catalysts

Prior knowledge requirements

- Metals are good conductors of heat and electricity, they are strong, shiny, malleable and ductile.
- Non-metals are normally poor conductors of heat and electricity, they are not strong, and are dull and brittle.
- Graphite is a non-metal that is an electrical conductor.
- When a metal reacts with acid bubbles may form, the temperature rises and the metal reduces in size or disappears.
- Not all metals react with an acid.
- The word equation for a metal and acid reaction is: metal + acid → salt + hydrogen.

6. Hidden forces

Year 9: Physics

Go to unit resources

Threads

- BQ11 Physics: How do forces make things happen?

Unit description

This unit explores forces, deformation, Hooke's Law, moments, and work done. It covers pressure in liquids, atmospheric pressure, upthrust, and equilibrium, as well as simple machines and force-extension relationships, highlighting how forces affect motion, friction, and object deformation.

Why this, why now?

This unit builds on pupils' prior learning from Forces, where they explored the basics of contact and non-contact forces and how they affect motion. It deepens their understanding by examining hidden forces, such as turning forces, forces that hold objects on surfaces, and buoyancy, highlighting how these forces interact in everyday situations. This prepares pupils for the next unit, Particle explanations of density and pressure, where they will apply their knowledge to understand how particle behaviour influences density, pressure, and the forces exerted by fluids.

Lessons in unit

1. Gravitational force and weight
2. Stretching springs
3. Hooke's law
4. Stretching rubber
5. The force of a floor
6. Levers
7. Turning forces
8. Floating, mass and shape
9. Pressure
10. Pressure at different depths and heights

Prior knowledge requirements

- Forces are pushes or pulls.
- Gravity is a force that pulls objects towards the Earth.
- The bigger the force, the greater the change.
- Forces are measure in newtons (N).
- Force arrows show the direction of a force.
- The length of a force arrow shows the size of a force.
- Force arrows are best labelled as the force acting on (object A) by (object b).
- When forces are balanced there is no resultant force.

7. Adaptations, competition, natural selection and evolution

Year 9: Biology

Go to unit resources

Threads

- BQ04 Biology: Why are there similarities and differences between living things?

Unit description

This unit explores variation within and between species, competition, and natural selection. It focuses on asking questions, making predictions, planning scientific enquiries, and testing hypotheses. It also covers analysing results, explaining findings, and identifying new questions that arise.

Why this, why now?

This unit builds on pupils' prior learning from of carbonVariation (differences within species), where they explored how genetic differences contribute to diversity within a species. It deepens their understanding by examining adaptations, competition, and natural selection, highlighting how these processes drive evolution. This prepares pupils for the next unit, Fossil evidence, selective breeding and explaining evolution, where they will apply their knowledge to study evidence for evolution, the impact of human intervention through selective breeding, and evolutionary changes.

Lessons in unit

1. Fossils show that species change over time
2. Understanding time scales
3. Adaptations
4. Competition
5. Heritable variation
6. Natural selection
7. A model of natural selection
8. Evolution

Prior knowledge requirements

- All species have features which make them suited to their environment.
- Changes to the environment may make it harder for organisms to survive in a particular habitat.
- There are differences in the features of individuals of the same species, and this is called variation.
- Variation can be caused by environmental and genetic factors.

8. Carbon cycle and climate change

Year 9: Chemistry

Go to unit resources

Threads

- BQ08 Chemistry: How can substances be made and changed?
- BQ09 Chemistry: How can we explain changes in the air, land and oceans?
- BQ15 How can we live sustainably to protect Earth for a better future?

Unit description

This unit explores the rock cycle and the formation of igneous, sedimentary, and metamorphic rocks. It also examines the atmosphere's composition, human-induced carbon dioxide production, and its impact on climate. Focus is on interpreting data, identifying patterns, and presenting explanations.

Why this, why now?

This unit builds on pupils' prior learning from Earth's resources, where they explored how natural resources are utilised and the importance of sustainable management. It deepens their understanding by examining the carbon cycle and its role in climate change, focusing on human impacts such as carbon emissions. This prepares pupils for the next unit, Atmosphere and changing climate, where they will apply their knowledge to explore the composition and evolution of Earth's atmosphere and the ongoing impacts of climate change.

Lessons in unit

1. Physical weathering and erosion
2. Formation of sedimentary rock
3. Fossils and the rock cycle
4. Formation of fossil fuels
5. Gases in the atmosphere
6. Atmospheric carbon
7. The carbon cycle

Prior knowledge requirements

- Rocks may contain sand, grit, bits of seashell, fossils or crystals.
- Sedimentary rocks contain distinct grains that are stuck together.
- Sedimentary rocks may contain fragments of shell or fossils, or larger pieces of grit or pebbles cemented together.
- Igneous rocks contain crystals that point in many directions.
- Metamorphic rocks contain large crystals that all line up.
- Most rocks are a mixture of one or more types of mineral, or of fragments of other rocks and fossils.
- Burning coal, oil or gas in power stations makes carbon dioxide gas and other pollutants.

9. Waves

Year 9: Physics

Go to unit resources

Threads

- BQ12 Physics: How do we see, hear and communicate?

Unit description

This unit explores the nature of sound and water waves, including transverse and longitudinal motion, wave reflection, superposition, and the speed of sound in various media. It covers sound production, detection, and auditory ranges, emphasising data interpretation, and basic calculations.

Why this, why now?

This unit builds on pupils' prior learning from Making images, where they explored how light interacts with materials through reflection, refraction, and the use of lenses to form images. It deepens their understanding by examining the broader properties of waves, including sound and light, and their behaviours. This prepares pupils for the next unit, Measuring waves, where they will apply their knowledge to quantify wave properties such as amplitude, wavelength, and frequency, enhancing their understanding of wave dynamics in various contexts.

Lessons in unit

1. Water waves
2. Sound waves
3. Speed of sound
4. Hearing sound
5. Ultrasound

Prior knowledge requirements

- Hard surfaces reflect sound because air particles bounce off them.
- Soft surfaces absorb a lot of sound because sound waves transfer energy by making the particles in them vibrate.
- A light source can emit light in every direction.
- Light moves in straight lines.
- A light ray is just a line that shows the direction light travels in.
- The angle of incidence is the angle at which light hits a mirror.
- The angle of reflection is the angle at which light is reflected off a mirror.
- For mirrors, the angle of reflection is the same size as the angle of incidence.

10. Disease and drugs

Year 9: Biology

Go to unit resources

Threads

- BQ05 Biology: How do living things stay healthy?

Unit description

This unit explores the human gas exchange system, focusing on the impact of exercise, asthma, smoking, recreational drugs, and the differences between infectious and non-infectious diseases. It emphasises understanding scientific methods, evidence, risk evaluation, and peer review importance.

Why this, why now?

This unit builds on pupils' prior learning from Diet and exercise, where they explored how lifestyle choices impact overall health and body systems. It deepens their understanding by examining the role of disease and drugs, focusing on how different conditions affect the body and the use of medications. This prepares pupils for the next unit, Health and disease, where they will apply their knowledge to explore the interactions between communicable and non-communicable diseases, lifestyle factors, and prevention strategies, reinforcing the link between health management and disease prevention.

Lessons in unit

1. Differences between infectious and non-infectious disease
2. The gas exchange system in healthy humans
3. Lifestyle diseases
4. Asthma
5. Smoking
6. Vaping
7. Recreational drug use: depressants
8. Recreational drug use: stimulants
9. Solvent abuse

Prior knowledge requirements

- [Y6] The main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood.
- [Y6] The impacts of lifestyle, including drugs, on the way the human body functions.
- Cellular respiration requires oxygen which is obtained by gas exchange in the lungs.
- The structure of the lungs, including bronchi, bronchioles and alveoli.
- The function of the heart.

11. Patterns in the periodic table

Year 9: Chemistry

Go to unit resources

Threads

- BQ06 Chemistry: How do we explain how substances behave?
- BQ07 Chemistry: What are things made of?

Unit description

This unit explores the periodic table, including the principles behind Mendeleev's design, the arrangement of elements into periods and groups, and the classification of metals and non-metals. It examines how the physical and chemical properties of elements predict reaction patterns.

Why this, why now?

This unit builds on pupils' prior learning from Atoms, elements and compounds, where they explored the basic structure of matter and how elements combine to form compounds. It deepens their understanding by examining the patterns in the periodic table, highlighting how element properties are organised based on atomic structure. This prepares pupils for the next unit, Atomic structure and the periodic table, where they will further explore how atomic configuration influences element positioning, reactivity, and trends, solidifying their grasp of chemical organisation and behaviour.

Lessons in unit

1. Groups of elements in the periodic table
2. Group 1 and 2 metals
3. Group 7 (halogens)
4. Group 0 (Noble Gases)

Prior knowledge requirements

- All matter is made up of atoms.
- Each element is made up of just one sort of atom.
- Each element is made of a different type of atom.
- Each element has particular physical properties.
- Each element has particular chemical properties.
- Metals are good thermal and electrical conductors, they are strong, shiny, malleable and ductile.
- Non-metals are normally poor thermal and electrical conductors, they are not strong, and are dull and brittle.
- Metals are found on the left side and in the middle of the periodic table, non-metals on the right side.
- Each element has a chemical symbol of which the first letter is always a capital.

12. Resistance and parallel circuits

Year 9: Physics

Go to unit resources

Threads

- BQ13 Physics: How do electricity and magnetism work?

Unit description

This unit covers electrical circuits, compares appliance power ratings, and understands domestic fuel use and costs. It explores electric current, potential difference, resistance, and the differences between conductors and insulators, focusing on calculations and applications in circuits.

Why this, why now?

This unit builds on pupils' prior learning from Series circuits, where they explored current, voltage, and resistance in simple electrical loops. It deepens their understanding by examining resistance and parallel circuits, focusing on how electrical components behave differently when arranged in parallel. This prepares pupils for the next unit, Electric fields and circuit calculations, where they will apply their knowledge to explore electric fields, complex circuit behaviours, and the calculations needed to predict circuit performance, enhancing their understanding of electrical systems.

Lessons in unit

1. Electrical resistance
2. Thickness of a wire
3. Length of a wire
4. Making parallel circuits
5. Voltage in parallel circuits
6. Loops of a parallel circuit
7. Measuring current in a parallel circuit
8. Comparing series and parallel circuits
9. Mains electricity

Prior knowledge requirements

- An ammeter measures the size of current flowing through it without affecting the current in the circuit it is connected into.
- Electric current is measured in amps (A), which is short for ampere.
- The current in a series circuit is the same everywhere.
- Adding a component to a series circuit changes the current everywhere, on both sides of the component.
- A voltmeter is used to measure the voltage of a battery or the voltage across a component in an electric circuit.
- A voltmeter is connected to each side of a battery or component.
- Voltage (or potential difference) is measured in volts (V).
- The voltage of a battery measures the strength with which it can 'push' current around a circuit.
- The voltage of a component in an electric circuit measures the size of 'push' that is moving current through it.

- The voltage across each component in a series electric circuit adds up to the voltage of the battery.

13. Reproduction in plants

Year 9: Biology

Go to unit resources

Threads

- BQ02 Biology: How do living things grow and reproduce?

Unit description

This unit explores plant reproduction, including flower structure, pollination, fertilisation, seed formation, and dispersal mechanisms. It highlights the role of insect pollination in food security. Focus is on planning and conducting enquiries, and ensuring reliable observations.

Why this, why now?

This unit builds on pupils' prior learning from Reproduction in humans, where they explored the reproductive systems and genetic inheritance in humans. It deepens their understanding by examining reproduction in plants, focusing on pollination, fertilisation, and seed formation, highlighting similarities and differences across species. This prepares pupils for the next unit, DNA and the genome, where they will apply their knowledge of reproduction to understand the molecular basis of inheritance, exploring how genetic information is stored, expressed, and passed on in all living organisms.

Lessons in unit

1. Flower structure
2. Pollination and fertilisation
3. Insects and food security
4. Fruit and seeds
5. Factors affecting seed germination: practical
6. Factors affecting seed germination: data analysis
7. Seed dispersal: practical
8. Seed dispersal: data analysis

Prior knowledge requirements

- Fertilisation is the fusion of gametes.
- Sexual reproduction involves the nuclei of two gametes fusing together.
- The nucleus of a cell contains DNA.
- Plants are producers and form the base of food chains and as such are important to food production.

14. Climate change and biodiversity

Year 9: Biology, Chemistry

Go to unit resources

Threads

- BQ15 How can we live sustainably to protect Earth for a better future?

Unit description

In this unit pupils learn about the impact of agriculture and deforestation on biodiversity, and to more thoroughly consider the effects of climate change on biodiversity and food production.

Why this, why now?

The thread through this unit is agriculture, including deforestation, and its impact on biodiversity. The examples used draw on pupils' knowledge of greenhouse gases and global warming and explore some effects of climate change in a range of contexts and in particular their impact on biodiversity and on food production. This prepares pupils for thinking about strategies to maintain biodiversity and achieve food security.

Lessons in unit

1. Agriculture and habitat loss
2. Deforestation affects the carbon and water cycles
3. Impacts of climate change on biodiversity
4. Climate change and food production
5. Advantages and disadvantages of plastic food packaging

Prior knowledge requirements

- Increasing levels of greenhouse gases in the atmosphere is leading to global warming and climate change.
- Carbon dioxide is a greenhouse gas, released by living organisms and produced when burning fuels.
- Methane is a greenhouse gas, released by living organisms and from the ground.
- Methane is a more potent greenhouse gas than carbon dioxide.
- Reducing greenhouse gas emissions can reduce the rate of global warming and may even help to reverse it.
- Since the industrial revolution, in the 1850s, overall global surface temperatures have been increasing.
- Scientists can explain how increased levels of greenhouse gases contribute to global warming.
- Burning fuels produces greenhouse gases, other pollutant gases, and particulates.
- Greenhouse gas emissions can be reduced by using less energy and switching to renewable energy sources.

- Renewable energy resources will not run out because they are replenished more quickly than we use them up.

Biology, Foundation

Year 10 units

View interactive sequence online

1 **Eukaryotic and prokaryotic cells**	**2** **DNA and the genome**	**3** **Health and disease**
4 **Biological molecules and enzymes**	**5** **Transport and exchange surfaces in humans**	**6** **Coordination and control: the human nervous system**
7 **Coordination and control: hormones and the human endocrine system**	**8** **Photosynthesis: requirements and products**	**9** **Inheritance, genotype and phenotype**
10 **Cell division: mitosis and meiosis**	**11** **Stem cells and differentiation**	**12** **Fossil evidence, selective breeding and explaining evolution**
13 **Living organisms and their environments**		

1. Eukaryotic and prokaryotic cells

Year 10: Biology

Go to unit resources

Threads

- BQ01 Biology: What are living things and what are they made of?

Unit description

This unit covers the structure and function of sub-cellular components in eukaryotic and prokaryotic cells and explores DNA as the genetic material of organisms. It explains genetic terms, protein synthesis, and how genetic variants influence phenotypes.

Why this, why now?

This unit builds on pupils' prior learning from Plant nutrition and photosynthesis, where they explored how plants produce glucose. It deepens their understanding by examining the structures and functions of eukaryotic and prokaryotic cells, highlighting the cellular basis of these processes. This prepares pupils for the next unit, Biological molecules and enzymes, where they will apply their knowledge to understand the molecular components of cells and the role of enzymes in biochemical reactions, reinforcing the link between cell structure and function.

Lessons in unit

1. Cells
2. Light microscopy: observing and drawing cells
3. Animal cells: common structures and specialised cells
4. Plant cells: common structures and specialised cells
5. Eukaryotic and prokaryotic organisms
6. Common structures of prokaryotic cells
7. The size and scale of cells: the basics

Prior knowledge requirements

- All organisms are made up of one or more cells.
- Organisms can be unicellular or multicellular.
- The hierarchical organisation of multicellular organisms from cells to tissues to organs to systems to organisms.
- Similarities and differences between plant and animal cells.
- The functions of the cell wall, cell membrane, cytoplasm, nucleus, vacuole, mitochondria and chloroplasts.

2. DNA and the genome

Year 10: Biology

Go to unit resources

Threads

- BQ02 Biology: How do living things grow and reproduce?

Unit description

This unit covers the structure and function of eukaryotic and prokaryotic cells, DNA as the genetic material, and key genetic terms. It also explains protein synthesis, genetic variants, and how DNA structure affects proteins. The emphasis is on using models to explain scientific concepts.

Why this, why now?

This unit builds on pupils' prior learning from Reproduction in plants, where they explored how genetic information is passed from one generation to the next through reproductive processes. It deepens their understanding by examining the structure and function of DNA and the genome, focusing on how genetic information is stored and expressed. This prepares pupils for the next unit, Inheritance, genotype and phenotype, where they will apply their knowledge to explore how genetic variations influence traits, reinforcing the principles of heredity and genetic inheritance.

Lessons in unit

1. The genome
2. The chemical structure of DNA
3. The genome, the environment and phenotype

Prior knowledge requirements

- All organisms are made up of one or more cells.
- Genetic material stored in cells provides instructions for growth and other life processes.
- The genetic material of all organisms is made of a chemical substance called DNA.

3. Health and disease

Year 10: Biology

Go to unit resources

Threads

- BQ05 Biology: How do living things stay healthy?

Unit description

This unit explores health and disease, including communicable and non-communicable types and their interactions. It examines lifestyle impacts, disease spread, evaluates cardiovascular treatments, and highlights the importance of risk evaluation, peer review, and effective communication of results.

Why this, why now?

This unit builds on pupils' prior learning from Disease and drugs, where they explored how different conditions affect the body and the use of medications for treatment. It deepens their understanding by examining the relationship between health, disease, and lifestyle factors, including prevention strategies. This prepares pupils for the next unit, Defences against pathogens, the human immune system and vaccination, where they will apply this knowledge to explore the body's defences, immune responses, and the role of vaccines in disease prevention.

Lessons in unit

1. Diseases
2. Cardiovascular disease
3. Risk factors for non-communicable diseases
4. Cancer
5. Bacterial and viral diseases in humans: Salmonella and measles
6. Fungal and protist diseases in humans
7. Sexually transmitted infections
8. Plant diseases: TMV and rose black spot

Prior knowledge requirements

- The structure of the human heart.
- The role of arteries in transporting oxygenated blood around the human body.
- Disease is a cause of ill health.
- Diseases can be caused by pathogens and lifestyle factors.

4. Biological molecules and enzymes

Year 10: Biology

Go to unit resources

Threads

- BQ01 Biology: What are living things and what are they made of?

Unit description

This unit explores the roles of sugars, amino acids, and fatty acids in the synthesis and breakdown of biological molecules. It covers enzyme action, transport in organisms, hypothesis development, and data interpretation. Emphasis is on planning experiments and presenting explanations.

Why this, why now?

This unit builds on pupils' prior learning from Eukaryotic and prokaryotic cells, where they explored cell structures and functions. It deepens their understanding by examining biological molecules and enzymes, focusing on their roles in cellular processes and metabolism. This prepares pupils for the next unit, Transport and exchange surfaces in humans, where they will apply their knowledge of enzymes and molecules to understand how substances are transported across cell membranes, highlighting the importance of cellular function in human physiology.

Lessons in unit

1. Biological molecules
2. Tests for biological molecules
3. Obtaining the elements needed to make biological molecules
4. Enzymes: function, structure and specificity
5. Effects of substrate concentration and temperature on rate of enzyme activity
6. The effect of pH on the rate of an enzyme reaction: plan
7. The effect of pH on the rate of an enzyme reaction: practical
8. The effect of pH on the rate of an enzyme reaction: data analysis

Prior knowledge requirements

- Carbohydrates (including sugars), proteins and lipids/fats are the major food groups.
- Photosynthesis in producers makes glucose, a type of carbohydrate.
- Producers use the glucose made by photosynthesis to make biomass for growth and repair, and as a fuel for cellular respiration to provide energy for life processes.
- Consumers depend upon producers to make biomass, which consumers eat as food.
- Consumers use the food they eat to make biomass for growth and repair, and as a fuel for cellular respiration to provide energy for life processes.

5. Transport and exchange surfaces in humans

Year 10: Biology

Go to unit resources

Threads

- BQ01 Biology: What are living things and what are they made of?

Unit description

This unit covers the human circulatory system, its link to the gas exchange system, and the adaptations of the heart, blood vessels, and blood components. It explains transport mechanisms like diffusion, osmosis, and active transport, and the need for exchange surfaces in multicellular organisms.

Why this, why now?

This unit builds on pupils' prior learning from Biological molecules and enzymes, where they explored the roles of molecules in cellular processes. It deepens their understanding by examining how the human body transports substances like gases and nutrients through specialised exchange surfaces, such as the lungs and intestines. This prepares pupils for the next unit, Coordination and control: the human nervous system, where they will apply their knowledge to explore how the body regulates these processes, emphasising the integration of transport and control mechanisms.

Lessons in unit

1. The human circulatory system
2. The human heart and double circulatory system
3. Human blood cells and blood vessels
4. Microscopy of human blood cells and blood vessels
5. Moving into and out of the blood: diffusion, osmosis and active transport
6. Diffusion and surface area to volume ratio
7. The importance of exchange surfaces and transport systems in humans

Prior knowledge requirements

- [Y6] The basic functions of the heart, blood vessels and blood of the human circulatory system.
- Humans are multicellular organisms – they are made up of millions of living cells.
- Cells need to be supplied with nutrients including carbohydrates, proteins, lipids and water for growth and repair.
- Cells need to be supplied with oxygen and glucose for cellular respiration to provide energy for life processes.
- Nutrients, glucose and water are absorbed from the digestive system.
- Oxygen is absorbed from air in the lungs, which are part of the gas exchange system.
- Particles of substances move by diffusion into and out of cells through selectively-permeable cell membranes.

6. Coordination and control: the human nervous system

Year 10: Biology

Go to unit resources

Threads

- BQ01 Biology: What are living things and what are they made of?

Unit description

This unit explores the structure and function of the nervous system, including the CNS, reflex arcs, and the eye. It covers brain structure, common eye defects, and the challenges in treating nervous system damage. It also addresses ethical considerations.

Why this, why now?

This unit builds on pupils' prior learning from Transport and exchange surfaces in humans, where they explored how substances like oxygen and nutrients are transported and exchanged in the body. It deepens their understanding by examining the nervous system's role in controlling and coordinating body functions, including reflex actions and responses to stimuli. This prepares pupils for the next unit, Coordination and control: hormones and the human endocrine system, where they will explore hormonal regulation, further enhancing their understanding of the body's control systems.

Lessons in unit

1. The human nervous system
2. Neurones and synapses
3. Human reaction time: practical
4. The structure and function of a reflex arc
5. The human eye
6. Common defects of the human eye
7. The human brain

Prior knowledge requirements

- [Y1] The basic parts of the human body and which part of the body is associated with each sense.
- Humans are multicellular organisms – they are made up of millions of living cells.
- Specialised cells in animals have shapes, sizes and structures that are adapted for the jobs the cells do.

7. Coordination and control: hormones and the human endocrine system

Year 10: Biology

Go to unit resources

Threads

- BQ01 Biology: What are living things and what are they made of?

Unit description

This unit explores hormonal control by the endocrine system, including blood sugar regulation by insulin and glucagon, and the roles of thyroxine and adrenaline. It covers the importance of maintaining a stable internal environment and compares types 1 and 2 diabetes and their treatments.

Why this, why now?

This unit builds on pupils' prior learning from Coordination and control: the human nervous system, where they explored how the body uses electrical signals to respond to stimuli. It deepens their understanding by examining the endocrine system, focusing on how hormones regulate body functions and maintain homeostasis. This prepares pupils for Photosynthesis: requirements and products, where they will explore how plants use environmental signals to regulate growth, linking control across organisms.

Lessons in unit

1. The human endocrine system
2. Insulin and the control of blood sugar level
3. Type 1 and type 2 diabetes

Prior knowledge requirements

- Humans are multicellular organisms – they are made up of millions of living cells.
- Specialised cells in animals have shapes, sizes and structures that are adapted for the jobs the cells do.
- The circulatory system transports substances around the body in the blood.
- The human body has a nervous system that enables us to sense and respond quickly to changes outside and inside the body.
- Receptors detect stimuli.
- Sensory neurons transmit nerve impulses from receptors to processing centres such as the brain in the CNS.
- Motor neurons transmit nerve impulses from the CNS to effectors that carry out responses.

8. Photosynthesis: requirements and products

Year 10: Biology

Go to unit resources

Threads

- BQ01 Biology: What are living things and what are they made of?

Unit description

This unit explores photosynthesis as the basis for food and biomass, examines cell structure and adaptations in eukaryotic and prokaryotic cells, and covers the photosynthesis process. It focuses on using models and theories to develop hypotheses, interpret data, and present reasoned explanations.

Why this, why now?

This unit helps answer the big question, What are living things and what are they made of?, by examining photosynthesis, a key process where plants convert light, water, and carbon dioxide into glucose and oxygen, storing energy in chemical bonds. This understanding prepares pupils for the next unit, Aerobic and anaerobic cellular respiration, where they will explore how living organisms release energy from glucose, reinforcing the interconnected roles of photosynthesis and respiration in sustaining life.

Lessons in unit

1. Producers, photosynthesis and consumers
2. The requirements and products of photosynthesis: practical

Prior knowledge requirements

- Plants are multicellular organisms – they are made up of millions of living cells.
- Plants do not take in food; they are producers that make their own food in the form of carbohydrate by photosynthesis.
- The chemical reactants of photosynthesis are water and carbon dioxide.
- Photosynthesis can only happen in the light.
- The chemical products of photosynthesis are oxygen and glucose (a type of carbohydrate).
- Photosynthesis involves many chemical reactions; a word summary of the reactants and products is a model of the process.
- Plant leaves are adapted for photosynthesis; they have stomata for gas exchange, to absorb carbon dioxide and release waste oxygen; and they have a large surface area to absorb light.
- The cells that make up leaves have chloroplasts that contain chlorophyll, where photosynthesis takes place.

9. Inheritance, genotype and phenotype

Year 10: Biology

Go to unit resources

Threads

- BQ02 Biology: How do living things grow and reproduce?

Unit description

This unit covers key genetic terms, single-gene inheritance, and genetic crosses, including probability and ratios. It explores how most traits result from multiple genes and sex determination in humans. The unit also includes interpreting data and using models to solve problems.

Why this, why now?

This unit builds on pupils' prior learning from DNA and the genome, where they explored the structure and function of DNA in carrying genetic information. It deepens their understanding by examining how inheritance, genotype, and phenotype influence traits, and how genetic information is passed from parents to offspring. This prepares pupils for the next unit, Cell division: mitosis and meiosis, where they will apply their knowledge of inheritance to understand how cells divide and how genetic variation arises, further reinforcing the principles of heredity and variation.

Lessons in unit

1. Alleles, genotype, and phenotype
2. Models of single-gene inheritance: Punnett squares
3. Models of single-gene inheritance: family tree diagrams
4. Explaining inheritance: Mendel and beyond
5. The inheritance of biological sex in humans

Prior knowledge requirements

- Genetic material stored in cells provides instructions for growth and other life processes.
- The genetic material of all organisms is made of a chemical substance called DNA.
- Some of an organism's characteristics are determined only by instructions in its genome (e.g. eye colour).
- Most of an organism's characteristics are influenced by the organisms' genome and interaction with its environment.
- Humans and plants can reproduce sexually to have offspring that inherit some, but not all, of the characteristics of the parents.
- During sexual reproduction, male and female gametes fuse in process called fertilisation.

10. Cell division: mitosis and meiosis

Year 10: Biology

Go to unit resources

Threads

- BQ02 Biology: How do living things grow and reproduce?

Unit description

This unit covers mitosis and the cell cycle in growth, cancer as uncontrolled cell division, and the role of mutations in genetic variation. It explains meiosis in gamete formation and chromosome reduction. The emphasis is on recording observations and interpreting patterns to draw conclusions.

Why this, why now?

This unit builds on pupils' prior learning from Inheritance, genotype and phenotype, where they explored how genetic traits are passed down and expressed in organisms. It deepens their understanding by examining cell division through mitosis and meiosis, focusing on how these processes contribute to growth, reproduction, and genetic variation. This prepares pupils for the next unit, Stem cells and differentiation, where they will apply their knowledge to understand how cells develop into specialised types, further reinforcing concepts of cellular development and genetic expression.

Lessons in unit

1. Growth in multicellular organisms
2. The cell cycle and cell division: mitosis
3. The structure of DNA: including nucleotides
4. Errors in cell division and cancer: basics
5. Making gametes: meiosis

Prior knowledge requirements

- [Y5] Growth and reproduction are part of the life cycle of all living organisms.
- All organisms are made up of one or more cells.
- Chromosomes stored in cells provide instructions for growth and other life processes.
- Humans and plants can reproduce sexually to have offspring that inherit some, but not all, of the characteristics of the parents.
- During sexual reproduction, male and female gametes fuse in process called fertilisation.

11. Stem cells and differentiation

Year 10: Biology

Go to unit resources

Threads

- BQ02 Biology: How do living things grow and reproduce?

Unit description

This unit explores the function of stem cells and the importance of cell differentiation. It discusses the benefits and risks of stem cell use in medicine, evaluates applications of science, and considers the personal, social, economic, and environmental implications of scientific decisions.

Why this, why now?

This unit builds on pupils' prior learning from Cell division: mitosis and meiosis, where they explored how cells divide and genetic variation occurs. It deepens their understanding by focusing on stem cells and differentiation, examining how unspecialised cells become specialised and their potential medical uses. This prepares pupils for the next unit, Hormones and human reproduction, where they will apply this knowledge to understand how hormones regulate reproductive processes and cell development.

Lessons in unit

1. Specialised cells, unspecialised cells and differentiation
2. Stem cells in animals
3. Meristem cells in plants
4. Using stem cells in medicine: potential benefits, risks and ethical issues

Prior knowledge requirements

- All organisms are made up of one or more cells.
- Multicellular organisms grow by making new cells.
- New cells are made when existing cells divide by mitosis.
- Specialised cells in multicellular organisms (including humans and plants) have shapes, sizes and structures that are adapted for the jobs the cells do.
- The genetic material of all organisms is made of DNA, wound up into structures called chromosomes.
- Sections of chromosomes are called genes, which store instructions for making proteins (including enzymes).
- The proteins that are made are used to build other structures and control chemical reactions.

12. Fossil evidence, selective breeding and explaining evolution

Year 10: Biology

Go to unit resources

Threads

- BQ04 Biology: Why are there similarities and differences between living things?

Unit description

This unit explores evidence for evolution, including fossils and antibiotic resistance. It covers selective breeding, Darwin and Wallace's contributions to natural selection, and evolution as changes in inherited traits over time. It also examines how scientific theories evolve over time.

Why this, why now?

This unit builds on pupils' prior learning from Adaptations, competition, natural selection and evolution, where they explored how organisms adapt and evolve based on environmental pressures. It deepens their understanding by focusing on fossil evidence and selective breeding, illustrating how these processes provide insight into evolutionary change over time. This prepares pupils for the next unit, Variation and natural selection at the genetic level, where they will explore the genetic mechanisms driving evolution, reinforcing their understanding of evolutionary biology.

Lessons in unit

1. The fossil record provides evidence for evolution
2. Common ancestors and transitional species
3. Selective breeding and human food security
4. Darwin, Wallace and the theory of evolution by natural selection
5. The evolution of new species
6. Climate change and evolution

Prior knowledge requirements

- Fossils provide evidence about organisms that lived and died from 10,000 to billions of years ago and their habitats.
- Fossils show that the features of some species have changed over time.
- Species have adaptations which make them well suited to survive in their environment.
- Due to variation, some individuals within a species have features that make them better adapted to complete and survive in their environment.
- Better adapted individuals are more likely to reproduce and pass heritable adaptations (caused by genetic variation) on to the next generation.
- This 'natural selection' of better adapted individuals causes advantageous features to become more common in each generation of offspring.

- Natural selection can cause the common features of a species to change (evolve) over generations.

13. Living organisms and their environments

Year 10: Biology

Go to unit resources

Threads

- BQ03 Biology: How do living things live together in their environments?

Unit description

This unit explores ecosystem organisation, biotic and abiotic factors, material cycling, and the role of decomposers. It covers methods for identifying species and measuring their distribution. Emphasis is on selecting appropriate techniques, accurate measurements, sampling, and fieldwork practices.

Why this, why now?

This unit builds on pupils' prior learning from Biodiversity, where they explored the variety of life forms and their roles in ecosystems. It deepens their understanding by examining how living organisms interact with their environments, focusing on biotic and abiotic factors that influence species distribution and survival. This prepares pupils for the next unit, Maintaining biodiversity and human impacts, where they will apply their knowledge to explore the effects of human activity on biodiversity and the importance of conservation efforts.

Lessons in unit

1. Components of an ecosystem
2. Measuring the size and distribution of populations of organisms
3. Estimating population size using quadrats: practical
4. Estimating population size and distribution using transects: practical
5. Competition and adaptations in ecosystems
6. The role of microorganisms in decomposition
7. Factors affecting the rate of decomposition
8. The effect of temperature on the rate of decomposition by an enzyme: practical
9. The effect of temperature on the rate of decomposition by an enzyme: data analysis and evaluation
10. Material cycles: the carbon cycle
11. Material cycles: the water cycle

Prior knowledge requirements

- Food chains show the transfer of biomass from producers to consumers, and from prey to predators.
- Food web diagrams represent several interconnected food chains within a community of organisms.
- A change in the size of a population will affect other populations in the same community.
- Habitats are where plants and animals live and they contain living (biotic) and non-living (abiotic) parts.
- Organisms interact with the environment in which they live.

- All species have features which make them suited to their environment.
- Changes to the environment may make it harder for organisms to survive in a particular habitat.
- Plants undergo both photosynthesis and respiration.
- Carbon is stored in fossil fuels such as coal, oil and peat.
- The size of populations of organisms can be estimated using sampling techniques.

Biology, Foundation

Year 11 units

View interactive sequence online

1 Defences against pathogens, the human immune system and vaccination	**2** Aerobic and anaerobic cellular respiration	**3** Maintaining biodiversity and human impacts
4 Transport and exchange surfaces in plants	**5** Hormones and human reproduction	**6** Plant growth and development
7 Coordination and control: maintaining a constant internal environment	**8** Photosynthesis: factors affecting the rate	**9** Medicines and new treatments for disease
10 Variation and natural selection at the genetic level	**11** Classification in modern biology	**12** Gene technology

1. Defences against pathogens, the human immune system and vaccination

Year 11: Biology

Go to unit resources

Threads

- BQ05 Biology: How do living things stay healthy?

Unit description

This unit explores the body's defences and immune response against pathogens, disease prevention, and vaccines. It covers plant defence responses, and disease detection, and evaluates scientific applications, considering personal, social, economic, and environmental implications.

Why this, why now?

This unit builds on pupils' prior learning from Health and disease, where they explored the relationship between lifestyle factors and disease. It deepens their understanding by examining the body's defences against pathogens, focusing on the immune system and how vaccines help prevent diseases. This prepares pupils for the next unit, Medicines and new treatments for disease, where they will apply their knowledge to explore how modern medicines, such as antibiotics and monoclonal antibodies, are used to treat diseases, reinforcing their understanding of disease prevention and treatment.

Lessons in unit

1. Non-specific defences of the human body against pathogens
2. Immunity and vaccination
3. Evaluating the global use of vaccination
4. Plant defences against disease

Prior knowledge requirements

- Disease is a cause of ill health.
- Lifestyle factors can cause or increase the risk of disease.
- Communicable diseases are caused by pathogens including viruses, bacteria, protists and fungi.
- Ways in which pathogens can be spread.
- Some common communicable diseases caused by viruses, bacteria, protists and fungi.

2. Aerobic and anaerobic cellular respiration

Year 11: Biology

Go to unit resources

Threads

- BQ01 Biology: What are living things and what are they made of?

Unit description

This unit covers cellular respiration as an exothermic reaction in all cells, comparing aerobic and anaerobic processes. It explores cell structures and functions, enhanced by electron microscopy. Emphasis is on conducting experiments, analysing data, and interpreting results.

Why this, why now?

This unit builds on pupils' prior learning from Photosynthesis: requirements and products, where they learned how plants produce glucose using light, water, and carbon dioxide. It deepens their understanding by focusing on aerobic and anaerobic respiration, showing how organisms release energy from glucose for life processes. This prepares pupils for the next unit, Transport and exchange surfaces in plants, where they will explore how plants transport water, minerals, and gases, reinforcing the connection between energy and nutrient transport.

Lessons in unit

1. Aerobic cellular respiration in humans and other organisms
2. Anaerobic cellular respiration in humans and other organisms
3. The effect of different substrates on cellular respiration in yeast: practical
4. Explaining the effect of different substrates on the rate of cellular respiration

Prior knowledge requirements

- Living organisms are made up of one or more cells.
- Animal, plant and other eukaryotic cells contain mitochondria that use food as a fuel for cellular respiration to provide energy for life processes.
- Differences between breathing and cellular respiration.
- In humans, the circulatory system transports substances from the gas exchange and digestive systems to cells for cellular respiration, and transports the waste products away.
- Word equations for aerobic and anaerobic cellular respiration in humans.
- Word equations for anaerobic cellular respiration in humans and in microorganisms.
- Humans use anaerobic cellular respiration (fermentation) in microorganisms to make useful products such as bread, yogurt and alcoholic drinks.

3. Maintaining biodiversity and human impacts

Year 11: Biology

Go to unit resources

Threads

- BQ03 Biology: How do living things live together in their environments?
- BQ15 How can we live sustainably to protect Earth for a better future?

Unit description

This unit explores trophic levels, biomass pyramids, and the efficiency of biomass transfers in ecosystems. It examines human impacts on biodiversity, factors affecting food security, and biotechnological solutions. Emphasis is on evaluating environmental changes and ethical considerations.

Why this, why now?

This unit builds on pupils' prior learning from Living organisms and their environments, where they explored how biotic and abiotic factors affect species survival. It deepens their understanding by examining the importance of maintaining biodiversity and the impact of human activities on ecosystems. As the final unit in the big question How do living things live together in their environments?, it reinforces the need for conservation and sustainable practices to preserve ecosystems and the complex relationships that support life.

Lessons in unit

1. Transfers of biomass between trophic levels
2. Negative human interactions with ecosystems and impacts on biodiversity
3. Examples of human interactions with ecosystems, including use of peat
4. Benefits and challenges of maintaining biodiversity
5. Factors affecting human food security, and possible solutions

Prior knowledge requirements

- Food chain diagrams show transfers of biomass.
- Food web diagrams represent several interconnected food chains within a community of organisms.
- Trophic levels are the stages in a food chain.
- Biomass is the amount of living or recently living matter.
- Biodiversity is a measure of the range of living organisms.
- It is important to preserve biodiversity to maintain a healthy environment.
- Pollinating insects are important in producing crops.
- The relationship between genes, chromosomes and DNA.
- The products of combustion.
- Which fuels are fossil fuels.

4. Transport and exchange surfaces in plants

Year 11: Biology

Go to unit resources

Threads

- BQ01 Biology: What are living things and what are they made of?

Unit description

This unit covers water and mineral uptake in plants, focusing on root hair cells, xylem, and phloem. It includes transpiration, translocation, and factors affecting water uptake. Emphasis is on rate calculations, graph interpretation, experiments, and data analysis.

Why this, why now?

This unit builds on pupils' prior learning from Aerobic and anaerobic cellular respiration, where they explored how energy is released from glucose. It deepens their understanding by examining how plants transport water, minerals, and gases through specialised exchange surfaces like roots and leaves. This prepares pupils for the next unit, Coordination and control: maintaining a constant internal environment, where they will explore how organisms regulate processes like temperature and water balance to maintain homeostasis.

Lessons in unit

1. Plant roots are adapted to absorb water and mineral ions
2. Transport systems in plants: xylem and transpiration
3. Observing the structure and distribution of stomata: practical
4. Transport systems in plants: phloem and translocation
5. Observing xylem and phloem using a light microscope: practical
6. The effect of light on water uptake by a plant: practical
7. The effects of environmental factors on the rate of water uptake by a plant
8. The importance of exchange surfaces and transport systems in plants

Prior knowledge requirements

- Plants are multicellular organisms – they are made up of millions of living cells.
- Plants do not have a circulatory system (they do not have blood, blood vessels or a heart).
- Cells need to be supplied with nutrients including carbohydrates, proteins, lipids and water for growth and repair.
- Cells need to be supplied with oxygen and glucose for cellular respiration to provide energy for life processes.
- Cells with chloroplasts need to be supplied with carbon dioxide and water for photosynthesis.
- Particles of substances move by diffusion into and out of cells through selectively-permeable cell membranes.

- Exchange surfaces are adapted to maximise the surface area for diffusion of particles across membranes.
- In humans, the circulatory system transports essential substances around the body and minimises the distance they have to diffuse so cells can be supplied quickly.

5. Hormones and human reproduction

Year 11: Biology

Go to unit resources

Threads

- BQ02 Biology: How do living things grow and reproduce?

Unit description

This unit covers the roles of hormones in reproduction, including the menstrual cycle and the effects of FSH, LH, oestrogen, and progesterone. It explains contraception methods, and fertility treatments, and evaluates their social, economic, and environmental impacts.

Why this, why now?

This unit builds on pupils' prior learning from Stem cells and differentiation, where they explored how cells specialise and develop. It deepens their understanding by focusing on the role of hormones in human reproduction, including how hormonal regulation affects processes like puberty and fertility. This prepares pupils for the next unit, Plant growth and development, where they will apply their knowledge of hormonal regulation to explore how hormones control growth and development in plants, reinforcing the concept of hormonal control across living organisms.

Lessons in unit

1. Hormones: puberty, the menstrual cycle and the menopause
2. Hormonal and non-hormonal methods of contraception

Prior knowledge requirements

- The structures and functions of the human male and female reproductive systems.
- The human body has an endocrine system that uses hormones to control changes in the body.
- During puberty the male and female human bodies undergo changes, which are brought about by sex hormones.
- Adult human females have a menstrual cycle that prepares them for sexual reproduction.
- The roles of ovulation and fertilisation in sexual reproduction in humans.

6. Plant growth and development

Year 11

Go to unit resources

Threads

- BQ02 Biology: How do living things grow and reproduce?

Unit description

This unit covers the role of plant hormones like auxins, gibberellins, and ethene in growth and development, including phototropism and gravitropism. It explores their commercial uses and focuses on experiments, data analysis, and presenting scientific explanations.

Why this, why now?

This unit builds on pupils' prior learning from Hormones and human reproduction, where they explored how hormones regulate processes like fertility and development. It deepens their understanding by focusing on Plant growth and development, examining how hormones control growth and responses in plants. This prepares pupils for the next unit, Gene technology, where they will explore how genetic modification influences growth and reproduction, connecting hormonal regulation to advancements in biotechnology and agriculture.

Lessons in unit

1. Auxins, phototropism and gravitropism
2. The effect of light on the growth of seedlings: practical
3. The effect of gravity on the growth of seedlings: practical

Prior knowledge requirements

- Multicellular plants are made up of millions of living cells.
- Hormones are chemicals that are made and secreted by groups of specialised cells called glands.
- Hormones are detected by receptors on cells and tissues.

7. Coordination and control: maintaining a constant internal environment

Year 11: Biology

Go to unit resources

Threads

- BQ01 Biology: What are living things and what are they made of?

Unit description

This unit covers the importance of maintaining a constant internal environment, focusing on body temperature control, osmotic balance, and kidney function. It explains the roles of the skin, kidneys, and ADH, and emphasises data extraction, experiment techniques, and accurate data interpretation.

Why this, why now?

This unit builds on pupils' prior learning from Transport and exchange surfaces in plants, where they explored how plants transport water, minerals, and gases. It deepens their understanding by focusing on how organisms maintain a constant internal environment, including processes like temperature and water balance. This prepares pupils for the next unit, Photosynthesis: factors affecting the rate, where they will apply their knowledge of internal regulation to explore how environmental factors influence the rate of photosynthesis in plants.

Lessons in unit

1. Effect of osmosis and sugar concentration on the mass of plant tissue: practical
2. Effect of osmosis and sugar concentration on the mass of plant tissue: analysis
3. The importance of maintaining constant conditions in the body
4. The importance of maintaining constant conditions in the body, including osmosis
5. The role of the skin in thermoregulation
6. Controlling water balance: the kidneys, and treating kidney failure

Prior knowledge requirements

- Some substances can move into and out of cell by diffusing through the cell membrane.
- Water moves between the blood and cells by osmosis, a type of diffusion.
- The net movement of particles by diffusion and osmosis is along a concentration gradient.
- Enzymes are the catalysts for many chemical reactions in the body.
- Enzymes work best in optimum conditions and less well when conditions change away from the optimum.
- Humans have a nervous system that that enables us to sense and respond quickly to changes outside and inside the body.

- The human body has an endocrine system that uses hormones to control changes in the body.
- The human endocrine and nervous systems work together to maintain a constant environment in the body.

8. Photosynthesis: factors affecting the rate

Year 11: Biology

Go to unit resources

Threads

- BQ01 Biology: What are living things and what are they made of?

Unit description

This unit explores factors affecting photosynthesis rates and focuses on planning and conducting experiments. It includes selecting techniques, accurate measurements, data analysis, and evaluating methods to improve reliability and suggest further investigations.

Why this, why now?

This unit builds on pupils' prior learning from Coordination and control: maintaining a constant internal environment, where they explored how organisms regulate internal processes. It deepens their understanding by examining the factors that affect the rate of photosynthesis, such as light, temperature, and carbon dioxide. As the final unit in the big question, What are living things and what are they made of?, it reinforces pupils' knowledge of how living organisms use energy to sustain life.

Lessons in unit

1. Factors affecting the rate of photosynthesis
2. The effect of light intensity on rate of photosynthesis in pondweed: plan
3. The effect of light intensity on rate of photosynthesis in pondweed: practical
4. The effect of light intensity on rate of photosynthesis in pondweed: evaluation

Prior knowledge requirements

- Producers, including plants, use a chemical process called photosynthesis to make their own food in the form of glucose (a type of carbohydrate).
- A balanced symbol equation to summarise the chemical reactants and products of the process of photosynthesis.
- Plant leaves are adapted for photosynthesis; they have stomata for gas exchange, to absorb carbon dioxide and release waste oxygen.
- Photosynthesis takes place in chloroplasts in cells that make up the aerial parts of plants.
- Chloroplasts contain a pigment called chlorophyll that absorbs light.
- Light is not a chemical reactant, but transfers energy to chlorophyll to enable photosynthesis to take place.
- Enzymes are the catalysts for many chemical reactions in living organisms.
- Photosynthesis involves many chemical reactions, catalysed by enzymes.

- Enzymes work best in optimum conditions and less well when conditions change away from the optimum.

9. Medicines and new treatments for disease

Year 11: Biology

Go to unit resources

Threads

- BQ05 Biology: How do living things stay healthy?

Unit description

This unit covers vaccines, medicines, and monoclonal antibodies for disease prevention and treatment. It explains aseptic techniques, medicine development, and antibody uses. The focus is on ethical considerations, risk evaluation, and societal impacts of scientific advances.

Why this, why now?

This unit builds on pupils' prior learning from Defences against pathogens, the human immune system and vaccination, where they explored how the body fights infections and the role of vaccines. It deepens their understanding by examining the development of medicines and new treatments, including antibiotics and monoclonal antibodies. As the final unit in the big question, How do living things stay healthy?, it reinforces pupils' understanding of how medical advancements support the immune system and improve health outcomes.

Lessons in unit

1. Antibiotics
2. The effect of antimicrobial substances on bacterial growth: practical
3. The effect of antimicrobial substances on bacterial growth: analysis and conclusions
4. Development of new medicines

Prior knowledge requirements

- Disease is a cause of ill health.
- Lifestyle factors can cause or increase the risk of disease.
- Communicable diseases are caused by pathogens including viruses, bacteria, protists and fungi.
- Ways in which pathogens can be spread.
- Some common communicable diseases caused by viruses, bacteria, protists and fungi.

10. Variation and natural selection at the genetic level

Year 11: Biology

Go to unit resources

Threads

- BQ04 Biology: Why are there similarities and differences between living things?

Unit description

This unit covers genetic variation, comparing asexual and sexual reproduction. It explores mutations' impact on phenotypes, evolution through natural selection, and how scientific theories develop, explaining how advantageous traits lead to adaptation.

Why this, why now?

This unit builds on pupils' prior learning from Fossil evidence, selective breeding and explaining evolution, where they explored how evolutionary changes are supported by fossil records and human-driven selection. It deepens their understanding of genetic variation and natural selection, focusing on how these processes drive evolution. This prepares pupils for the next unit, Classification in modern biology, where they will apply their knowledge to understand how genetic traits are used to classify organisms, reinforcing the connection between evolution and classification.

Lessons in unit

1. Variation and genetic mutations
2. Natural selection at the genetic level
3. Mutations and evolution in bacteria
4. Sexual and asexual reproduction

Prior knowledge requirements

- The genome is the entire genetic material of an organism.
- The genome, and its interaction with the environment, influence the phenotype (characteristics) of an organism.
- There is variation in the features of individuals of the same species.
- Variation can be caused by information in the genome and by the environment, but only variation caused by information in the genome is heritable (can be passed on to offspring).
- Due to variation, some individuals within a species have features that make them better adapted to complete and survive in their environment.
- Better adapted individuals are more likely to reproduce and pass heritable adaptations (caused by genetic variation) on to the next generation.
- This 'natural selection' of better adapted individuals causes advantageous features to become more common in each generation of offspring.
- Natural selection can cause the common features of a species to change (evolve) over generations.
- Natural selection can cause the common features of a population to change (evolve) over generations, and

eventually to become so different that we classify the population as a new species.

- Some bacteria have become resistant to some antibiotics.

11. Classification in modern biology

Year 11: Biology

Go to unit resources

Threads

- BQ04 Biology: Why are there similarities and differences between living things?

Unit description

This unit explores the impact of biology developments on classification systems, highlighting how electron microscopy enhances understanding of sub-cellular structures. It covers eukaryotic and prokaryotic cells, quantitative skills, unit conversions, and the evolution of scientific methods.

Why this, why now?

This unit builds on pupils' prior learning from Variation and natural selection at the genetic level, where they explored how genetic variation drives evolution and creates differences within species. It deepens their understanding by examining modern biological classification, focusing on how evolutionary relationships and genetic traits are used to categorise organisms. As the final unit in the big question, Why are there similarities and differences between living things?, it reinforces pupils' understanding of how genetics and evolution shape the diversity of life.

Lessons in unit

1. Classifying organisms as eukaryotic or prokaryotic
2. Electron microscopy, and the size and scale of cells
3. Classification into kingdoms and domains: sub-cellular evidence
4. Classification and reclassification: genetic evidence

Prior knowledge requirements

- Organisms can be classified into groups based on similarities and differences in their observable characteristics at the macroscopic level.
- Scientists classify every organism into a group, including a species and a genus.
- Organisms can be classified into groups within larger groups, from species up to kingdom.
- The common structures of animal and plant cells.
- Organisms can be classified into groups based on their characteristics at the microscopic, cellular level.

12. Gene technology

Year 11: Biology

Go to unit resources

Threads

- BQ02 Biology: How do living things grow and reproduce?

Unit description

This unit covers the human genome's importance and genetic engineering, outlining steps, benefits, and risks. It explores gene technology in agriculture and medicine, focusing on ethical considerations, and societal impacts, and evaluating scientific limitations and risks.

Why this, why now?

This unit builds on pupils' prior learning from Plant growth and development, where they explored how hormones regulate growth and reproduction in plants. It deepens their understanding by focusing on Gene technology, examining how genetic engineering is used to modify organisms for medical and agricultural purposes. As the final unit in the big question, How do living things grow and reproduce?, it reinforces pupils' understanding of how genetic manipulation influences growth and reproduction, connecting natural processes to modern technological advances.

Lessons in unit

1. Genetic engineering
2. Genetic testing for healthcare
3. Genetic testing for family planning

Prior knowledge requirements

- The genetic material of all organisms is made of DNA, wound up into structures called chromosomes.
- Sections of chromosomes are called genes, which store instructions for making proteins (including enzymes).
- There are usually two versions of each gene in a pair of chromosomes; the two versions of a gene are called alleles.
- Some alleles are associated with conditions that affect people's health (e.g. cystic fibrosis).
- Consumers, including humans, are dependent upon crop plants to maintain our food security.
- Plants can be infected by communicable diseases.
- Earth's climate is changing as a result of human actions.

Threads in science

See how to use threads ↑

BQ01 Biology: What are living things and what are they made of?

BQ02 Biology: How do living things grow and reproduce?

BQ03 Biology: How do living things live together in their environments?

BQ04 Biology: Why are there similarities and differences between living things?

BQ05 Biology: How do living things stay healthy?

BQ06 Chemistry: How do we explain how substances behave?

BQ07 Chemistry: What are things made of?

BQ08 Chemistry: How can substances be made and changed?

BQ09 Chemistry: How can we explain changes in the air, land and oceans?

BQ11 Physics: How do forces make things happen?

BQ12 Physics: How do we see, hear and communicate?

BQ13 Physics: How do electricity and magnetism work?

BQ14 Physics: How does the Earth fit into the Universe?

BQ15 How can we live sustainably to protect Earth for a better future?

BQ10 Physics: Why do materials have different properties?

Thread, **'BQ01 Biology: What are living things and what are they made of?'**

Year 7

- **Unit 3,** 'Cells'
- **Unit 10,** 'Human skeleton and muscles'
- **Unit 12,** 'Diffusion'

Year 8

- **Unit 1,** 'Human digestive system'

Year 9

- **Unit 1,** 'Breathing and respiration'
- **Unit 4,** 'Plant nutrition and photosynthesis'

Year 10

- **Unit 1,** 'Eukaryotic and prokaryotic cells'
- **Unit 4,** 'Biological molecules and enzymes'
- **Unit 5,** 'Transport and exchange surfaces in humans'
- **Unit 6,** 'Coordination and control: the human nervous system'
- **Unit 7,** 'Coordination and control: hormones and the human endocrine system'
- **Unit 8,** 'Photosynthesis: requirements and products'

Year 11

- **Unit 2,** 'Aerobic and anaerobic cellular respiration'
- **Unit 4,** 'Transport and exchange surfaces in plants'
- **Unit 7,** 'Coordination and control: maintaining a constant internal environment'
- **Unit 8,** 'Photosynthesis: factors affecting the rate'

Thread, **'BQ02 Biology: How do living things grow and reproduce?'**

Year 7

- **Unit 8,** 'Heredity and DNA'

Year 8

- **Unit 10,** 'Reproduction in humans'

Year 9

- **Unit 13,** 'Reproduction in plants'

Year 10

- **Unit 2,** 'DNA and the genome'
- **Unit 9,** 'Inheritance, genotype and phenotype'
- **Unit 10,** 'Cell division: mitosis and meiosis'
- **Unit 11,** 'Stem cells and differentiation'

Year 11

- **Unit 5,** 'Hormones and human reproduction'
- **Unit 6,** 'Plant growth and development'
- **Unit 12,** 'Gene technology'

Thread, **'BQ03 Biology: How do living things live together in their environments?'**

Year 7

- **Unit 6,** 'Ecosystems'

Year 8

- **Unit 3,** 'Biodiversity'

Year 10

- **Unit 13,** 'Living organisms and their environments'

Year 11

- **Unit 3,** 'Maintaining biodiversity and human impacts'

Thread, **'BQ04 Biology: Why are there similarities and differences between living things?'**

Year 8

- **Unit 6,** 'Species and classification (differences between species)'
- **Unit 7,** 'Variation (differences within species)'

Year 9

- **Unit 7,** 'Adaptations, competition, natural selection and evolution'

Year 10

- **Unit 12,** 'Fossil evidence, selective breeding and explaining evolution'

Year 11

- **Unit 10,** 'Variation and natural selection at the genetic level'
- **Unit 11,** 'Classification in modern biology'

Thread, **'BQ05 Biology: How do living things stay healthy?'**

Year 8

- **Unit 13,** 'Diet and exercise'

Year 9

- **Unit 10,** 'Disease and drugs'

Year 10

- **Unit 3,** 'Health and disease'

Year 11

- **Unit 1,** 'Defences against pathogens, the human immune system and vaccination'
- **Unit 9,** 'Medicines and new treatments for disease'

Thread, **'BQ06 Chemistry: How do we explain how substances behave?'**

Year 7

- **Unit 2,** 'Solid, liquid, gas states and changes of state'
- **Unit 5,** 'Solutions'
- **Unit 9,** 'Separation techniques'

Year 8

- **Unit 2,** 'Atoms, elements and compounds'
- **Unit 4,** 'Understanding chemical reactions'

Year 9

- **Unit 2,** 'Acids and bases'
- **Unit 5,** 'Materials'
- **Unit 11,** 'Patterns in the periodic table'

Thread, **'BQ07 Chemistry: What are things made of?'**

Year 8

- **Unit 2,** 'Atoms, elements and compounds'
- **Unit 8,** 'Earth's resources'

Year 9

- **Unit 5,** 'Materials'
- **Unit 11,** 'Patterns in the periodic table'

Thread, **'BQ08 Chemistry: How can substances be made and changed?'**

Year 7

- **Unit 2,** 'Solid, liquid, gas states and changes of state'
- **Unit 5,** 'Solutions'
- **Unit 9,** 'Separation techniques'

Year 8

- **Unit 4,** 'Understanding chemical reactions'
- **Unit 11,** 'Fuels and energetics'

Year 9

- **Unit 2,** 'Acids and bases'
- **Unit 5,** 'Materials'
- **Unit 8,** 'Carbon cycle and climate change'

Thread, **'BQ09 Chemistry: How can we explain changes in the air, land and oceans?'**

Year 8

- **Unit 8,** 'Earth's resources'
- **Unit 11,** 'Fuels and energetics'

Year 9

- **Unit 8,** 'Carbon cycle and climate change'

Thread, **'BQ11 Physics: How do forces make things happen?'**

Year 7

- **Unit 1,** 'Forces'

Year 8

- **Unit 5,** 'Moving by force'

Year 9

- **Unit 6,** 'Hidden forces'

Thread, **'BQ12 Physics: How do we see, hear and communicate?'**

Year 7

- **Unit 7,** 'Sound, light and vision'

Year 8

- **Unit 12,** 'Making images'

Year 9

- **Unit 9,** 'Waves'

Thread, **'BQ13 Physics: How do electricity and magnetism work?'**

Year 8

- **Unit 9,** 'Series circuits'

Year 9

- **Unit 3,** 'Magnets and electromagnets'
- **Unit 12,** 'Resistance and parallel circuits'

Thread, **'BQ14 Physics: How does the Earth fit into the Universe?'**

Year 7

- **Unit 4,** 'Our solar system and beyond'

Thread, **'BQ15 How can we live sustainably to protect Earth for a better future?'**

Year 7

- **Unit 13,** 'Climate change and living sustainably'

Year 8

- **Unit 14,** 'Climate change and greenhouse gases'

Year 9

- **Unit 8,** 'Carbon cycle and climate change'
- **Unit 14,** 'Climate change and biodiversity'

Year 11

- **Unit 3,** 'Maintaining biodiversity and human impacts'

Thread, **'BQ10 Physics: Why do materials have different properties?'**

Year 7

- **Unit 11,** 'Heating and cooling'