

# Oasis Sholing Science: Statement of Intent



## Our Curriculum

We have structured our curriculum around the most significant concepts in science and mapped students development of these concepts through lesson sequences and topics. To give our curriculum a deeper structure, when designing it, we have thought about how students' knowledge of those concepts enables them to answer our "big questions" in greater depth. We aim for all students to leave Year 11 being able to meaningfully answer each using their knowledge of our core concepts (often called 'big ideas'). This enables our teachers to think about both deepening students' knowledge of concepts and developing meaningful connections between those key concepts.

Our big questions have been developed from the ASE and Royal Societies curriculum project's which were first platformed publicly at the ASE conference in 2019 ([Chemistry](#), [Biology](#), [Physics](#)). We have also taken work from [Jasper Green's "powerful ideas of science"](#) and the '[BEST](#)' project. All projects took as their starting point the work [by Wynne Harlen's and others "the big ideas in science and how to teach them"](#) and some of the thinking behind the "[Beyond 2000](#)" report into science education. We have sought to integrate our big questions and core concepts with the research based "BEST Evidence science teaching" progression mapping which is lead by the world leading [University of York Science Education group](#). Our big questions are written so they make sense to students at all stages of their secondary science curriculum.

Biology	Chemistry (& Earth Science)	Physics
<p><b>What are living things made of?</b> Core concept: Cellular basis of life</p> <p><b>How do organisms grow and reproduce?</b> Core concept: Inheritance. <i>secondary concepts: growth and reproduction</i></p> <p><b>Why do organisms depend on each other and their environment?</b> Core concept: interdependence</p> <p><b>Why are living things so diverse?</b> Core concept: evolution</p> <p><b>What keeps organisms healthy?</b> Core concept: health</p>	<p><b>What are substances?</b> Core concept: substances</p> <p><b>What gives substances their properties?</b> Core concept: bonding</p> <p><b>What is chemical change?</b> Core concept: chemical change</p> <p><b>How does chemistry affect our world?</b> Core concept: chemical earth</p> <p><b>What is the Earth made of and how is it changing?</b> Core concept: dynamic earth</p>	<p><b>What is matter?</b> Core concept: matter</p> <p><b>Why do things move and change?</b> Core concepts: force and energy</p> <p><b>How does information and energy spread?</b> Core concepts: waves (and energy)</p> <p><b>What is electricity and magnetism?</b> Core concept: electromagnetism</p> <p><b>Where are we in space?</b> Core concept: space</p>

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Our Science Curriculum will leave students with a deep appreciation of the big ideas of science and an ability to use them to explain the world around them. We will equip our students with the knowledge they need to appreciate the wonder of the universe and the human capacity to make sense of it. Our students will develop a sense of what science is and how scientific knowledge has been developed through prediction, experimentation and the gathering of evidence. We believe experiencing the phenomena studied is essential to making sense of these ideas and have set out the experiences we want students to have in each year of their journey. This will give our students the ability to act as 'global citizens', able to grasp the major issues of their generation, and make good choices for themselves, their community, and our planet. Through our curriculum we aim to:

## **Build deep understanding**

We believe in stretching students understanding of the models and concepts at each key stage as far as is possible, whilst encouraging student practise which applies those models to their experience of the natural world. We believe in making the abstract concrete and maximising students direct experience of the phenomena they are studying. Wherever possible, we relate student practise to real world context and encourage students to make connections between their science curriculum and their experience of the material world.

Our curriculum introduces more complex models once students have embedded a deep knowledge of the more fundamental properties explored at earlier stages. We believe this gives students a deeper understanding of the substantive content and a more developed sense of the disciplinary use of models in highlighting some aspects of a phenomena, whilst neglecting others. This approach enables our KS4 to build upon students, deep understanding of the big ideas at KS3.

All our topics, and sequences within topics, develop via a series of "cognitive steps" based around exposition, checking for understanding and students' practice. Our topics are sequenced to enable students to build up an increasingly deep understanding of the key concepts in science. We have structured our approach to these big ideas around "big questions" which run through and between topics to build students' knowledge of concepts both in terms of the detail in which they make sense of them and the links between different concepts.

## Develop character, competence and community

We develop **students' character** through warm teacher – student relationships and a balance of teacher exposition and dialogic discussion. We work to enable students to be joyful at the wonder of the universe and our capacity to understand it, humble about our place within nature and hopeful about society's capacity to overcome the ecological crisis they have inherited. We have a strong belief that science is for all and aim to develop the “scientific capital” for all students, regardless of background or starting point.

We build **student competence** with a curriculum based on stretching students understanding of the big ideas in science. Our curricula model that starts from students' existing knowledge of the world and gives them the experiences and explanations they need to develop a more scientific understanding. Our students gradually build up a sense of key concepts through being exposed to them in a range of contexts, developing their ability to recognise the power of a small number of 'core concepts (big ideas)' to explain a wide range of phenomena. By doing this we aim to create students who can retain a wealth of scientific knowledge they can use flexibly in and beyond the classroom.

We advance our **students' sense of community** by applying students' knowledge to examples of how humans both change and attempt to understand the natural world. Our curriculum moves back and forwards between developing students' core knowledge of science and applying it to the major issues affecting the planet – climate change, biodiversity loss and the impact of pollution. By enabling students to relate their knowledge to these issues, and make sense of the enormity of them, we leave our students with the knowledge and skill they need to understand the issues and a deep sense of hope that science provides us with the potential to change and transform our world for the better. Students develop an awe and wonder for science through our curriculum which is supported by trips, clubs, and external visitors.

We develop our **staff's character** through warm professional relationships, a shared belief in our vision, and through a collaborative working environment. We build **staff competence** through developing teachers with deep 'subject knowledge for teaching' and 'pedagogic content knowledge', a culture of coaching and feedback, and a focus on developing the individual. Finally, we grow our **staff's sense of community** by building a strong understanding of our local context, encouraging all to participate and drive improvement, and offering all staff opportunities to reach their professional potential.

## Achieve outstanding outcomes for all

We believe in all our students and actively support and encourage all to reach their potential. We use the science of learning and cognitive science research to support students to reach their academic potential. This involves focusing on and placing importance on retrieval of core knowledge. We support our students to do this through home-learning and in-class retrieval opportunities. We encourage students to aspire to further academic science studies and make explicit links to future studies in our curriculum. We offer Separate Sciences to all students. We ensure all our students leave with the substantive and disciplinary knowledge needed to make educated decisions about the world around them and play an active role in society.

## Principles of Progression

Our curriculum is designed to ensure that our students are knowledgeable. Our curriculum is well-sequenced around a series of big questions starting from students' own experience of the world and moving towards a more developed scientific understanding. Over their science education, students will build up their knowledge of the most significant concepts in biology, chemistry, and physics.

**Secure Substantive Knowledge:** we believe that if students have secure substantive knowledge, they will feel confident in explaining the key scientific principles that govern everything that occurs within our universe. Concepts are revisited throughout their curriculum to ensure that they engage with the most important concepts in a range of applications and contexts.

**Experience of phenomena:** we feel it is important that students experience many of the phenomena they are studying. The tacit knowledge they gain strengthens and reinforces their declarative knowledge as they move through the curriculum. Experiencing phenomena also provides opportunities for students to challenge the existing models by making and justifying predictions.

**Develop Disciplinary Knowledge:** we also want to ensure that students have mastered the disciplinary knowledge – they understand and have some experience of what it means to be 'a scientist'. We feel it is important that this is taught alongside the substantive knowledge so that students understand how substantive scientific knowledge has been developed over time.

**Investigative and practical skills:** structured into our units are opportunities for students to carry out

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investigative work into the concepts they are studying. Students complete work accurately and precisely in order to develop their procedural knowledge of the scientific method, giving deeper meaning to their understanding and providing students with the foundations to study science at a higher level.

**Secure subject specific literacy:** We want to ensure that students are equipped with a wide range of scientific vocabulary, an understanding of how scientific ideas are presented and communicated and an opportunity to engage in discussions within the curriculum and at home so that they are able to communicate their ideas effectively.

**Link the 'Big Questions' in science:** over their science education, students will build on this knowledge in order to gain a deeper understanding of the big, overarching ideas in biology, chemistry and physics. From understanding that all material in the universe is made of very small particles, to the concept that energy cannot be created or destroyed to the key ethical arguments governing science; knowledge is constructed and deepened from the foundations up.

**Concrete examples and real life contexts:** students have the opportunity to practise application of knowledge to meaningful real life contexts so that we ensure it is flexible and that they can apply it to a range of different situations & scenarios both within the classroom and more importantly, their real lives.

## Substantive Knowledge

Our curriculum will equip all students with the substantive knowledge to meaningfully answer our big questions, as well as the disciplinary knowledge to appreciate that our answers are based on the best evidence we have and may be subject to change. The national curriculum, and AQA exam specifications, for science set out a body of target knowledge which is very broad. Our curriculum aims to help students scaffold this breadth of knowledge by structuring KS4 content around a firm foundational understanding of how our core concepts provide meaningful answers to our big questions. Our KS3 (Y7-Y9) establishes a deep understanding of each question and our KS4 enriches these answers using the breadth and detail of the AQA exam specification. We aim for students to leave school having retained the ability to explain and expand the following answers to our questions long after their GCSE exams have been passed.

## Biology:

Big Question	Core concept(s)	End point
What are living things made of?	Cellular basis of life	The cell is the basic unit of life from which organisms emerge. Organisms are adapted to survive in their environment. Multicellular organisms have different levels of organisation to maintain the conditions for life for all their cells.
How do organisms grow and reproduce?	Inheritance.	Organisms reproduce by passing their genetic information from one generation to the next. How an organism develops depends on its genome and its environment.
Why do organisms depend on each other and their environment?	Interdependence	Organisms compete with and depend on other organisms for the materials and energy that cycle through ecosystems. A change to one population, or environmental condition can have a huge impact on biodiversity.
Why are living things so diverse?	Evolution	The diversity of organisms, living and extinct, is the result of evolution by natural selection.
What keeps organisms healthy?	Health	Health results from interactions between an organisms body, behaviour, its environment and other organisms.

## Chemistry:

Big Question	Core concept(s)	End point
What are substances?	Substances	Most materials are mixtures of substances. Materials made of single substances have distinct properties.
What gives substances their properties?	Bonding	All matter is made of atoms. The arrangement and bonding between atoms explains a substances properties. Bonding is the result of electrostatic attractions

What is chemical change?	Chemical change	In chemical reactions atoms are rearranged to form new substances. The new substances produced will have different properties from the substances they are formed from. Mass and energy are always conserved in chemical changes.
How does chemistry affect our world?	Chemical Earth	Substances can move within and between Earth's atmosphere, hydrosphere, geosphere and biosphere as part of large-scale Earth systems. Chemical substances produced by human activity are changing our planet.
What is the Earth made of and how is it changing?	Dynamic Earth	The structure of the earth is slowly changing. The Earth provides us with a rich source of resources

## Physics:

Big Question	Core concept(s)	End point
What is matter?	Matter	The world is made of matter and all matter is made of particles. The particle model can be used to explain how matter behaves. All matter is made of atoms which are made of smaller, sub atomic, particles.
Why do things move and change?	Force and energy	Changing the motion of an object requires a net force to be acting on it. Calculating the "energy" stored in a system allows us to make predictions about how much change is possible. This is because energy is always conserved but some energy is always dissipated into smaller and less useful stores.
How does information and energy spread?	Waves (and Energy)	Waves, including sound, water and electromagnetic waves transfer energy and information.

What is electricity and magnetism?	Electromagnetism	The movement of charge forms electric current and causes magnetic fields. We use electrical currents to power our society.
Where are we in space?	Space	The Earth is a tiny part of an unimaginably large universe. All mass in the universe attracts other mass with a gravitational force. We can use the idea of gravity to explain how the universe is changing.

## Disciplinary Knowledge

Embedded into our curriculum plans are explicit opportunities for students to develop their disciplinary knowledge of science. We have sequenced how students develop their sense of how the three disciplines of science work around the following, discipline specific, concepts. These concepts and end points are based upon those suggested by the [royal society of chemistry](#), [royal society of biology](#) and [IOP](#)'s work on developing curriculum frameworks. We have also referenced relevant procedures and techniques in our sequencing as set out in the national curriculum and GCSE specifications.

## Biology

How Biology works	
Concept	End point
Investigations <i>in Biology</i>	Biologists collect data in a variety of settings including field work. Variables in biology can be difficult to control.
Levels of study <i>in Biology</i>	Different biologists study life at different levels. From biological models to population of organisms
Ethics <i>in Biology</i>	Biologists have to carefully consider how specimens are sourced and treated during research

<i>Analysis in Biology</i>	Observations and data can be analysed and interpreted quantitatively and qualitatively
<i>Continuous cycles in Biology.</i>	A cycle of collecting and analysing data provides evidence that biologists use to develop and improve explanations, classification systems and models
<i>Communication in Biology</i>	Biologists communicate about their work with a range of audiences within and beyond the scientific community, to facilitate evidence-informed debate and decision-making.

## Chemistry

How Chemistry works	
Concept	End point
<i>Models in Chemistry</i>	Chemists use models of the sub microscopic domain of substances to explain the properties and behaviour of substances
<i>Representations in Chemistry</i>	Chemists use a range of unique symbols, formula, nomenclature, diagrams, and equations
<i>Classification, grouping &amp; trends in Chemistry</i>	Substances can be classified into groups. This enables chemists to identify patterns and trends.
<i>Mathematics in chemistry</i>	Data from chemical measurements can be used to identify trends.
<i>Investigation in Chemistry</i>	Provides evidence to test ideas. There are a range of qualitative and quantitative investigative techniques

Techniques <i>in Chemistry</i>	Chemistry requires skilled use of specialised equipment. This includes chemical measurement.
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## Physics

How Physics works	
Concept	End point
Explanations <i>in Physics</i>	Aims for the most fundamental explanations that apply in widest range of situations
Falsification <i>in Physics</i>	Explanations include tests which support or disprove the idea.
Measurement <i>in Physics</i>	Explanations are based on observations and experimental measurements
Reasoning and argument <i>in Physics</i>	Arguments are developed from data, discussed, and debated
Modelling <i>in Physics</i>	Many explanations use models to think with and use to make predictions
Mathematical formulation <i>in Physics</i>	Many models can be expressed as mathematical formulas

## How science works

'How science works'	
Concept	End point
Investigation	Many scientific investigations require careful consideration of what to control, change and measure. Where this is not possible other methods, like control groups can be used to increase validity
Reproducibility	Experimental findings must be repeatable by the team conducting them and reproducible by other teams.
Scientific community	New ideas are submitted for debate in scientific communities through publication in specialist journals with a process of peer review.
Analysis	There are conventions for presenting and interpreting scientific data including the use of tables and graphs.
Conclusions	Scientific conclusions are based on the strength of evidence provided. This includes the publishing and identification of anomalies and estimating uncertainty.