



Science Curriculum Statement

Intent

The Science department at Broughton believes in the potential of every pupil and works to develop the mind-set and skills necessary to be a successful scientist. We feel strongly that we want to teach pupils to be scientists, not just teach pupils Science. In line with the school's vision, we want to **'achieve together'** through a Science curriculum that delivers outstanding outcomes and opportunities for all pupils.

At Broughton the intention is that all pupils will have a good understanding of the world in which we live. The engaging and rigorous curriculum aims to ignite and maintain pupils' curiosity and promote skills of investigation, questioning, analysis and experimental techniques; it is ambitious, challenging, enriching, inclusive and enjoyable.

We want every pupil to have a firm grounding in Science, enabling them to make sense of and adapt to a rapidly changing world including key issues, with climate change being just one example. Careful consideration has been, and continues to be, put into developing the Science curriculum; the curriculum spirals and is planned and sequenced so that new knowledge and skills build on what has been previously taught; revisiting key concepts areas throughout years 7 -11 is routine.

Science should enable pupils to:

- Have an understanding of the world through the specific disciplines of Biology, Chemistry and Physics and understand how Science has changed our lives and is vital to the world's prosperity.
- Develop a sense of excitement and curiosity about natural phenomena.
- Understand how science can be used to explain what is occurring, predict how things will behave and analyse causes.
- Develop their own ideas and ways of working that enable them to make sense of the world in which they live through investigation, as well as using and applying process skills.
- Develop a repertoire of ambitious vocabulary which aids the pupil's knowledge and understanding not only of the topic they are studying but the world around them.
- Develop practical skills and their ability to make accurate and appropriate measurements to give pupils the opportunity to use a wide range of scientific equipment.
- Develop their use of ICT in their science studies by the use of data loggers and lap-tops for research.
- Develop their ability to apply numeracy skills to analyse, evaluate and interpret data.

Science has an important role in developing pupils' cultural capital. Studying Science helps shape pupils' sense of ethical values by giving them an opportunity to understand and discuss the impact of scientific developments on society. Some examples of key issues that are discussed are; nuclear energy, MMR vaccination, antibiotic resistance, genetic testing, genetic diseases, drug testing, nanotechnology, climate change, recycling and finite resources. Through **discussion of key scientific matters, experiences gained from trips** (visit to London Science and Natural History museums, 'Science Live' lectures, Lancaster University Faraday competition, Runshaw College masterclasses, and talks from STEM shows) to **understanding the utility and broad application of science qualifications, knowledge and skills used in science**, the department **builds on pupils' science capital**.

All pupils are capable of achieving in Science, regardless of their starting point or ability and all teachers are reminded of their responsibility to ensure that any obstacles to learning are removed.

We are mindful of the varied experiences, in Science, of our new starters and liaison work with our feeder primary schools has become a matter of routine; our 'Y5 Festival of Science' held to coincide with national 'Science Week', has been an annual event for many years and is an example of the work with our feeder primary schools.

We work hard to ensure the Science curriculum is accessible to all and Science staff know their pupils well, particularly Disadvantaged and SEND pupils. **SEND and Disadvantaged pupils** are taught the same ambitious curriculum as other pupils, differentiated where necessary. There is no narrowing of the Science curriculum for SEND or Disadvantaged pupils.

In relation to SEND pupils, all Science staff are familiar with the 'Pupil Passports' of SEND pupils in their classes and they adapt their practice accordingly for those who need additional support.

We monitor the progress of our **disadvantaged pupils** closely and provide timely intervention as and when necessary. This may take the form of providing resources, extra teaching, appropriate use of TAs or enrichment activities. We have the same high expectations and ambition for all.

Implementation

At Key Stage 3, pupils have 3 one-hour lessons per week; each class is assigned one specialist Science teacher to deliver all their Science lessons per week. Collaboration between our different Science specialists is a matter of routine and there is considerable sharing of good practice. At KS3, with each class having one teacher to deliver their lessons, we know our pupils well and staff have an enhanced understanding of the KS3 curriculum as a whole.

At Key Stage 4, we move to a system where Biology, Chemistry and Physics are taught by well-qualified subject specialists. Pupils studying 'Combined Science' have 5 one-hour lessons per week, two of which are taught on a rota basis. 'Triple Science' pupils have a total of 7 one-hour lessons per week in Year 10, followed by 8 one-hour lessons in Year 11, shared equally over the three scientific disciplines over a two-year KS4 course. 'Triple Science' is an option choice for all pupils; we cater for up to 64 pupils who have demonstrated high ability or aptitude for Science at KS3 and there is an expectation, but not compulsion, that the pupils, including Disadvantaged and SEND, demonstrating this high ability or aptitude in Science, will choose this pathway at the end of Year 9.

Our current curriculum model means that the KS4 Science accounts for 20% of the curriculum time for our Combined scientists and 30% of curriculum time for our Triple scientists, which is an appropriate proportion and in line with national expectations.

All science lessons are delivered by **well-qualified, experienced subject specialists** including a number of middle and senior leaders. The **quality of teaching and learning** in all science lessons is **excellent**. All Science teachers present subject matter clearly, prompting appropriate discussion and incorporating practicals/experiments at every possible opportunity. They create an environment which is safe and inspires, interests and excites pupils to want to be inquisitive. Pupils, and particular groups of pupils, have excellent educational experiences in Science; **pupils enjoy Science lessons**. The curriculum is engaging and varied, and these ensure that not only are they very well-equipped for the next stage of their education training or employment, but they have a better understanding of the world around them.

Sharing the very best practice has been the highest priority and staff routinely, **consistently teach great lessons**. **Collaboration** is a corner stone of the department and the relationships between all staff members are excellent. Staff understand the need to constantly develop their subject knowledge

and skills in this core curriculum area. Self-evaluation and a desire for improvement drive departmental development. The department continues to receive CPD for new initiatives and ways of teaching the latest GCSE specifications by attending HUB meetings organised by the examining board. Cooperative lesson planning is a significant feature of the department which allows for a wider pool of knowledge and pedagogical understanding to be incorporated into all schemes of work. Sharing good practice is a key part of the department. All members of the department are encouraged to share good examples of subject-specific teaching resources in the departmental shared area. In addition, colleagues will routinely teach their subject specialism and model good practice to other members of the department.

The Science Key Stage 3 curriculum is designed in such a manner that pupils are keen to know more and have developed all of the skills necessary for success at GCSE, which have been practised and honed throughout the pupils' initial three years of study. The KS3 curriculum is based around the national curriculum and beyond and is also informed by our knowledge of the requirements at KS4. Deliberate structuring and scaffolding are used lower down school to ensure that assessments are accessible and challenging to all pupils, enabling all pupils to experience the joy of success. This allows the department to more effectively track progress of pupils' knowledge skills and application from Year 7 all the way through to the end of Year 11. Topics are sequenced in a deliberate way, ensuring that pupils' knowledge and understanding develop appropriately over the KS3 course and to ensure that they are suitably prepared for the next phase of their Science education. For example, pupils study cell structure in Year 7 which is used to understand a cell process called respiration in Year 8, which is needed to understand inheritance in Year 9, which is needed to understand types of respiration in Year 10, which is connected to control of blood glucose levels in Year 11. Careful consideration of the sequencing of the Science curriculum is an ongoing conversation.

All Science teachers routinely check pupils' understanding of topics throughout the course of study. Teachers use starter activities as well as whiteboard tasks to assess knowledge and misconceptions. There is an expectation that **teachers teach** in a **pro-active** and **responsive manner** as a result of this information. Teachers provide pupils with relevant, subject specific feedback, based on whole school and departmental agreed criteria. This is via verbal feedback during lessons, formative written feedback on specific pieces of work and summative written feedback at the end of each topic.

The department continues to place considerable focus on **improving the long-term memory** of pupils and building upon previous learning. All teachers routinely use **low stake testing, spacing and interleaving** to ensure that pupils are able to learn more effectively. All end of unit tests have spacing of at least two weeks and include interleaving questions from prior topics. All pupils are aware of and are encouraged to use revision resources from Year 7 onwards to ensure techniques are embedded in practice, resulting in them taking a greater responsibility for their own learning.

Metacognitive talk is also routinely a part of lessons. Pupils are encouraged to show their metacognitive thought processes by demonstrating planning of extended answers. Teachers also model metacognitive processes, for example when analysing exam questions. This approach is vital to ensure pupils are confident in their approach to tackling exam questions with ease.

The teaching of **subject-specific vocabulary** is demonstrated and is an integral part of all Science lessons and there is an insistence on correct spelling and understanding of key scientific words. Etymology of key words is taught explicitly to improve pupils' understanding. Lists of key words for topics at KS3 are found in homework booklets.

Science teachers understand that 'every teacher is a teacher of reading'. Reading is an essential skill in the study of Science, be this the activity of learning the fundamentals of the taught curriculum or reading for pleasure. Reading is encouraged in Science lessons, placing an emphasis on scientific vocabulary, Tier 2 and Tier 3 language. We discuss the etymological basis of many of the words used

in Science and we build in opportunities to read during lessons. **Reading** closely for information, understanding and clarification is a key element of all Science lessons. Instructions, data and relevant facts are explained and interrogated by teacher/pupils. All teachers routinely ensure pupils read correctly so that they can de-code questions and interpret instructions accurately. Common mis-conceptions are corrected as a matter of course.

Alongside the importance of reading to successfully access Science lessons, **Mathematics** and **numeracy** necessarily feature strongly in many Science lessons: for example, plotting graphs, rearranging equations, titration calculations. The *GCSE Edexcel guide to Maths for Scientists* is used as a model for teaching maths skills. The department also liaises with the Maths department to ensure a consistent approach to teaching.

SMSC and **personal development** are embedded into the curriculum and delivered throughout Science. For example, moral development is enhanced throughout the consideration of issues such as the effects of human activity on the planet e.g. extinction of species, pollution, global warming.

Assessment within Science is through a variety of classwork and homework tasks, together with summative end of unit tests, and in addition an end of year exam. Results of end of unit tests and end of year exams are recorded on the departmental database, with a pupil's overall progress based on a combination of the end of unit tests and the end of year exam.

Once assessments have been marked, excellent feedback is a matter of routine across all Science staff. The information gathered is used to address any mis-conceptions and inform and adapt future teaching. To help every individual pupil, all Science teachers routinely adopt the whole school approach to **DIRT (Dedicated Improvement & Reflection Time)**. Pupils are prepared to improve their work in response to feedback, which is an integral part of all units. There are numerous examples of this, but some especially good practice can be seen after an assessment where pupils use their DIRT time to come up with a personalised learning checklist.

This approach helps to build an 'I can do' attitude in our Scientists and a good understanding and retention of the Science curriculum taught.

Science KS3 curriculum overview

Year 7	Year 8	Year 9
Introduction to Science	Digestion and Respiration	Inheritance, health and muscles
Cells	Earth and Atmosphere	Periodicity and chemical reactions
Particles and solutions	Light and Sound	Electricity and Static
Forces	Photosynthesis	Energy transfer
Human and Plant reproduction	Elements, mixtures, compounds and Periodicity	Motion and Pressure
Principles of Chemistry	Magnets	Energy and fuels
Ecology	Space	

**Please note all KS3 topics are taught on a rota basis*

KS4 curriculum overview

Biology
Topic 1- Key concepts in biology
Topic 2- Cells and control
Topic 3- Genetics
Topic 4- Natural selection and genetic modification
Topic 5- Health, disease and the development of medicines
Topic 7- Animal coordination, control and homeostasis
Topic 6- Plant structures and their functions
Topic 8- Exchange and transport in animals
Topic 9- Ecosystems and material cycles

Chemistry
Topic 1 - Atomic structure and the periodic table
Topic 2 – Bonding
Topic 3 - States of matter and mixtures and methods of separating and purifying substances
Topic 4 – Calculations
Topic 5 – Acids
Topic 6 - Electrolytic processes
Topic 7 - Obtaining and using metals, reversible reactions and equilibria
Topic 8 - Transition metals, alloys and corrosion
Topic 9 - Reversible reactions and dynamic equilibria
<i>*Topic 10 - Quantitative analysis</i>
Topic 11 - Chemical cells and fuel cells
Topic 12 - Group 1, 7 and 0 of the Periodic table
Topic 13 -Rates of reaction
Topic 14 - Heat energy changes in chemical reactions
Topic 15 - Fuels, Earth and atmospheric science
<i>*Topic 16 - Qualitative analysis: test for ions</i>

**Topic 17 – Hydrocarbons, Polymers, Alcohols and carboxylic acids*

**Topic 18 - Bulk and surface properties of matter including nanoparticles*

Physics

Topic 1 - Key concepts of Physics

Topic 2 - Motion and Forces

Topic 3 - Conservation of Energy

Topic 4 – Waves

Topic 5 - Light and the electromagnetic spectrum

Topic 6 – Radioactivity

**Topic 7 - Astronomy*

Topic 8 - Energy: Forces doing work

Topic 9 - Forces and their effects

Topic 10 - Electricity and circuits

Topic 11 - Static electricity

Topic 12 - Magnetism and the motor effect

Topic 13 - Electromagnetic induction

Topic 14 - Particle model

Topic 15 – Forces and matter

**These topics are only taught to Triple pupils.*

Impact

The Science department continues to foster an enjoyment and curiosity of the subject. Approximately 50% of A band pupils opt for Triple Science and this has been the trend for many years. A large proportion of these pupils continue the study of Science beyond Broughton, with many studying one or two of the three separate Sciences beyond GCSE level, as evidenced by the latest school destination figures available on the school website.

Pupils enjoy their experience in Science lessons and this is proven by the positive responses from pupil voice undertaken and the excellent behaviour, participation and enthusiasm of pupils during lessons. Pupils are genuinely interested in their Science education. Almost all pupils have high expectations and are prepared to work independently and creatively to solve problems, producing solutions of an excellent standard. In addition, they are prepared to spend time outside the lesson on research or to complete and improve work to ensure they meet or surpass their targets.

Consistently high-quality teaching in Science has resulted in **attainment at KS4** which is **significantly above national standards**. Furthermore, routinely excellent teaching enables **all groups of pupils** to

make **significant progress**, whatever their starting points. This proves the impact that our curriculum and high quality of our teaching and learning have. Sharing the very best practice is always the highest priority and the department understand the need to constantly develop their subject knowledge and skills in this core curriculum area. The department constantly reflect upon the Edexcel analysis of exam performance to evolve as practitioners and use this information to improve and enhance teaching. Internal monitoring of pupils continues to play a key role in this as teachers are able to closely track the progress of their pupils and intervene where necessary. Tests throughout KS3 show pupils' knowledge is progressing. The end of KS3 exam taken by all pupils at the end of Year 9 assesses knowledge and understanding from the whole of Key Stage 3 and this demonstrates the solid foundation that pupils have to prepare them and ultimately give them success at the next phases of their Science education. The quality of pupils' work across Years 7-11 is consistently high as evidenced by work scrutinies and daily visits to lessons.

To enhance the curriculum and pupils' enjoyment for Science the department hosts a number of extra-curricular activities. Science club takes place after school, with approximately 30 pupils attending across years 7, 8 and 9. Each year a number of pupils apply to be 'Science Ambassadors' and assist the department at science club, open evening and other events.

Annually, we take 50 year 7 pupils to London so that they can visit world renowned museums. Pupils are also exposed to STEM activities, both from the department and external providers. Giving pupils opportunities to explore STEM related concepts will hopefully encourage them to develop a passion and hopefully pursue a job in a STEM field. Year 10 'Triple scientists' attend Science Live lectures, the purpose of which is to broaden and hopefully ignite even more interest in all areas of science, with the hope of them moving onto study Science beyond GCSE, at college and then ultimately university. As previously mentioned, we are extremely proud of the uptake of Science beyond Broughton, and this is testament to the quality of the Science curriculum that our pupils experience.

Covid curriculum

During the second lockdown period all Science teachers delivered high quality lessons through Microsoft Teams. The department are now able to use Teams to good effect and have continued to receive training to inform their lesson planning. Teams has also been used in school to ensure that pupils who are isolating have the same experience as the pupils who are in the classroom. Remote lessons are as close to classroom lessons as possible; lessons are varied and include demonstrations, modelling, explanations and animations, with good use of aids such as a 'visualiser' to enhance the delivery for pupils in and out of the classroom. The levels of engagement across all years were exemplary meaning that most pupils did not fall behind with the curriculum.

After the first lockdown we rescheduled some of the KS3 units to optimise the teaching of them and so pupils could carry out the related practical(s) to enhance their learning and experiences.

Photosynthesis and plant reproduction units were moved from year 7 to year 9.

A three-week catch-up period towards the end of year 8 to cover the topics human reproduction and separating techniques (specifically filtration, chromatography and distillation).

Summative assessments were not completed during the lockdown periods; however, formative assessments using Activelearn, SENECA, Microsoft forms and multiple-choice questions were integral parts of all teachers' planning and delivery of lessons.

All pupils in KS3 were bought a revision workbook; this ensured that any pupil who did not have access to a printer was not disadvantaged, it also helped to provide consistency in the delivery of the KS3 curriculum.

Learning Recovery

In the Spring term of 2021-22, the Science department supported the 'school-led' tutoring programme offered as part of the National Tutoring Programme (NTP). We provided small group online tutoring sessions led by our own specialists, to a targeted group of Disadvantaged, SEND and vulnerable pupils.

Unfortunately, we cannot provide interventions on a one to one level for all, so as a department we must ensure we identify and support all pupils within the classroom. Quality first teaching will always be the most important lever for enhancing pupil progress. Every teacher is responsible for ensuring that all pupils who are underperforming are identified early and appropriate interventions are put in place. Intervention must include obligatory catch-up or booster sessions.

On that note, all Science staff have committed to providing exam preparation technique and booster sessions for all our current Year 11 pupils; these sessions take place one night after-school, on a weekly basis during half-term 4, and there is an expectation that all pupils attend and take advantage of the commitment of the Science team.