

Science in Y9: an overview and rationale

Our aims:

The Y9 curriculum acts as an important bridge between Y7/8 and KS4. The main aim of the Y9 curriculum model is to revisit the key ideas and concepts first seen in Y7 and Y8, consolidating student knowledge and then developing understanding by adding increased challenge and new ideas, thus preparing students for the increased rigour of KS4. For example, we revisit the key ideas surrounding plants (as covered in Y8) but then explore these further- for example; uses of the products of photosynthesis and limiting factors are layered over existing prior knowledge of the reaction itself. As another example; forces (as covered in Y7) is reframed in the context of energy transfers (also seen in Y7), linking together previous modules to allow students to deepen their understanding and ability to apply their knowledge. We also introduce new ideas in these contexts- teaching moments and discussing new materials such as polymers and ceramics for example. By Easter, all national curriculum areas have been covered well. The main Y7/8 unit(s) from which progression is made is highlighted in each unit plan.

Later in the year (after Easter), we build on what has been taught at KS3 by exploring key scientific ideas in more detail. For example, we revisit cells and build on this by looking at organelle function and specialisation. This ambitious approach allows us to teach Y9 some of the key ideas underpinning the KS4 curriculum in biology, chemistry and physics. The idea is to improve student familiarity and therefore confidence regarding those concepts that underpin each of the 3 subjects.

As with Y7 and Y8 the curriculum model is ambitious and very skills focused. Each module provides us with a vehicle by which to allow students to develop and practice key skills which will help them to progress through the KS4 curriculum (in science and in other subjects too). Assessments for the initial units are all skills based assessments in order to review the needs of our students in terms of their scientific skill set, ready for the robust challenge of KS4.

As always, we ensure that science offers an engaging and suitably challenging programme of study. We typically have a high proportion of students selecting triple science in Y9 so we believe we are successful in delivering this.

By the end of Y9 we expect that students will have an understanding of the fundamentals in the following areas: plants, genetics, magnetism and forces, electricity and static, metal reactions, materials and properties. They should also have covered the fundamental areas in each of the KS4 courses (biology; cells, enzymes, transport, chemistry; real-world reactions, physics; energy)

Organisation and delivery:

Between Sep-March, science in Y9 follows the Exploring Science programme of study which ensures that national curriculum (NC) requirements are fulfilled. This allows us to take a modular approach which packages NC content into thematic modules. The content is broad and balanced as it encompasses the entire NC across all 3 subjects (Appendix C).

From Easter to summer, most students rotate between 3 subject specialists who will teach them key concepts that underpin each of the 3 sciences. As mentioned above, this improves familiarity and student confidence in understanding KS4 science but it also allows students to feel more comfortable with the shift to 3 teachers in KS4. This also allows our students to make informed choices about whether to select triple or combined science as an option at KS4.

Students are taught in sets which helps us to challenge/support appropriately. The benefits of this are outlined in the Y7 plan.

We have a bank of differentiated KS3 resources which have been produced collaboratively and then standardised by the CL to ensure consistency. The benefits of this are outlined in the Y7 plan. Resources have been developed in line with EEF recommendations in 'Improving Secondary Science' (2017) (Appendix B), providing opportunities for;

building on ideas, strategies for retaining and retrieving information, modelling, self regulation, practical work, developing vocabulary and feedback (see Appendix B).

The KS4 preparatory modules are produced by subject specialists in order to best cover the key ideas for each specialism.

Skills:

See appendix A for a full list of skills taught within the Y9 curriculum.

Suggestions for teaching skills within modules can be found in each unit guide along with differentiated resources in each of the unit powerpoints.

Some of the skills embedded into the Y9 curriculum may be new to Y9 given their higher demand level- evaluating results, devising investigations and calculating % change for example. These are more challenging skills that we have built up to over Y7/8. The skills progression document can be used to see how students make progress with their disciplinary knowledge over time.

Every module is used as a vehicle to teach valuable key skills that students need to be successful in science and beyond. These are taught within the context of the required content. Some of these skills are scientific skills (all those listed in the national curriculum ('working scientifically') are covered by our curriculum model)- e.g. devising experimental procedure, identifying experimental variables, working safely etc. Literacy based skills such as note taking, extended writing and reading and comprehension are also built into each module. Key numeracy skills are covered across all modules and these reflect increasing levels of demand at this point in their maths curriculum (liaising with the maths department has helped us to deliver these in line with their teaching models).

We aim to provide students with a skill set that will help them to access more challenging content in KS3 and beyond. We also aim to equip students with skills that will help them in everyday life and in other subjects such as maths. Teaching a curriculum rich in skills tasks helps students and staff to see tangible progress being made (and this is often hard to see with modular based curriculum modules). This helps students to gain confidence because they can see how they are making progress by continually returning to skills and building on them. Assessments for each module focus on skills so that staff and students can review their skills set in preparation for transitioning into KS4.

Teaching order

Y9 classes rotate between 6 discrete modules between Sep-Mar. For practical reasons, the order in which these are taught must vary so that there are no clashes for practical equipment. However, the 6 units are well placed as they all act to consolidate related content taught in Y7 and Y8- students will need to recap this content prior to KS4 as they can forget some of the key ideas. We prefer not to teach the KS4 key concepts until we have covered these units, hence why we wait until Easter to start our specialism rotation. By this point, students have been taught the entire KS3 curriculum and associated skills and so are ready to start to progress onto KS4 content.

Engagement and motivation

Y9 students are given opportunities to carry out practical work wherever it is possible. We feel it is important that this is carried out with clear purpose so that it compliments learning and/or skill development. Practical work engages students and makes them excited about science so we try to include it in every module where practically possible. Using real world contexts and familiar and/or interesting situations are also another key part of the science curriculum. Students are more engaged and interested when they can apply abstract knowledge to something they know or are interested in. Examples of this can be found throughout the KS3 resources and also in the exploring science resource pack which we subscribe to.

Students should also be sufficiently challenged to motivate and engage them, using appropriate scaffolding where needed to access harder tasks or difficult content.

Standards checks and assessment allow teachers to check that students are engaging with work as requested and self and peer review encourages regular student reflection and improvement.

We incorporate the school reward card system into lessons and tasks- often there are opportunities for competition which motivates students greatly (especially boys). We also have a department prize bag for special effort by students where they can come to the curriculum leaders for recognition and reward.

Adaptive practice: challenge and support

Each module has a bank of resources which have been designed specifically to challenge students regardless of set. The teacher guide for each module gives further guidance to staff but all tasks have differentiated options to allow all students to access difficult concepts or challenging tasks. Throughout each powerpoint students can access challenge questions/tasks and extension opportunities. These may be in the form of extra content (to broaden their depth of awareness and understanding), challenging questions or extra tasks. Furthermore, some modules also have a challenge card or other tasks attached to them- these can be used to stretch the most able as they are designed to promote higher order thinking and have answers on the back for students to check their own understanding.

The Exploring Science package that we subscribe to also has a bank of differentiated worksheets and assessments to stretch and challenge all abilities.

Throughout KS3 a simple code of 'H', 'F+' or 'F' is used to denote level of challenge. The rationale/ benefits of this are outlined in the Y7 overview document.

Staff can access the grading criteria documents for a breakdown of graded content but should remember that all content can be taught using the scaffolding resources to make more challenging content accessible in the vast majority of cases.

Independence

Each module has several opportunities for homework attached to it. This can be set by individual teachers as is appropriate to their class. Each module also has an assessed task attached to it which is designed to be done as an independent, open book task. Tasks have been designed to stretch and challenge all students into thinking or discussing independently. Rather than doing modular tests we have moved to summative tests at/near the end of the 6 module rotation. This has been better for encouraging students to revise at home independently and for emphasising the importance of revision to help prepare students for the rigour of linear exams.

Each Y9 module has a 'consolidation booklet' (similar to those in KS4). These are comprehension based tasks designed to be easily attempted independently in a range of scenarios- e.g. catch up, homework consolidation, revision etc. Each is accompanied by a pre-recorded video 'walk through'.

Literacy and communication

We build literacy skills into all of the modules we teach in Y9. There are opportunities for reading (and comprehension) throughout the curriculum as recognise the need to introduce students to a range of scientific literature from an early age to help them to access the reading level requirements in KS4 and beyond. We also address the importance of using appropriate key terminology and adopting a scientific writing style.

We embed oracy techniques into the majority of lessons as this helps students to write and answer in full sentences that make sense. Debate and discussion incorporate oracy strategies to encourage active listening and communicating opinions sensibly. We recognise the importance of building student confidence in writing as we

noticed that KS4 students would often leave extended writing answers blank in exams. Challenging students to write longer answers from KS3 onwards helps them to tackle these questions more confidently.

Tier 2 command words are highlighted in all resources and are aligned with those used in KS4 so that students recognise them from KS3. Using these also adds challenge to questions (rather than just the usual why, how etc.).

Every module has a tier 3 vocabulary list which should be available to students. This includes definitions, spellings and pronunciation to encourage students to be more confident in reading aloud.

Numeracy

Our KS4 curriculum has a large maths requirement so we recognise the importance to apply maths to science contexts from an early age. We have communicated with the maths department to ensure that we teach skills in an order that compliments their curriculum. Accessing maths in a cross curricular manner will help to improve students' general maths skills. It is an important part of our curriculum. The maths skills embedded into the Y9 curriculum tend to be of a higher demand to reflect the increasing challenge in their maths lessons (for example, all students using standard form, calculating % change etc).

Assessment

Each module has a teacher assessed task for students to complete at or near the end of the module. The assessments in Y9 are all very skills based in recognition of the importance of the AO3 component of KS4 (skills) which covers important disciplinary knowledge. Students are able to work on these independently using their notes which encourages them to maintain high standards in their books.

Staff will mark the assessment in a timely fashion and provide opportunities to develop answers based on star time opportunities. The teacher will go through the answers with students then correcting answers. The corrections will then help students to access a question given to them by their teacher which seeks to develop the areas they might have struggled with (or an area to stretch and develop their knowledge). This prepares students for the AO2 component of GCSE- applying knowledge to new contexts (something they often find difficult).

The assessed tasks are differentiated. The same skills are covered for each level (H, F+ or F) but scaffolding helps lower ability students to access them. The top grade available for each assessed task is reflective of this (which often motivates students to try a more challenging version of the task).

At/near the end of the 6 module rotation students sit a summative exam. In order to meet the Y9 exam window we ask students to sit an exam that covers skills and content. We provide revision materials and tasks as homework on SMH in advance of the exam. This encourages independent study at home and prepares students for revising larger chunks of information (which is a requirement at GCSE). Student sets are decided as a result of data obtained from assessments and tests which is often a motivator for them to revise (although we do it to appropriately challenge/support students).

Community and cultural capital

This is highlighted for individual modules in the medium term plan for each module we teach. Generally speaking, we provide a plethora of opportunities for students to make connections with the world they live in- it is hard not to in science since it is the study of life itself! Teachers are passionate about their subject and this shows in their teaching style. Teachers use real world examples as vehicles for teaching abstract content. In many lessons we try to incorporate aspects of the local community- using local geography, ecology and industry as examples. For example, we use the local conservation group 'Friends of Holywell Dene' to teach biodiversity and the local company Formica to teach pollutants. Cross-curricular links are also highlighted to allow students to see the relevance of what they learn in other contexts.

Each module includes a careers information slide so that students can see the importance of science skills and content in real world jobs (with local links). This also encourages them to think about future careers from a young age and builds aspirations.

Our curriculum also builds in opportunities to debate ethical issues- for example in discussing the fairness of banning plastic bags/fertilisers in response to the potential bee extinction crisis. We use ethical issues in science as grounds to develop communication skills through oracy techniques.

Finally, we aim to develop students as individuals by equipping them with skills for the wider world outside of their science lessons. In working to improve numeracy, literacy and communication skills for example and in encouraging them to investigate ideas and other opinions for themselves. We believe this makes for confident, resilient and independent learners.

Disadvantaged students

Staff should be aware of those students who fall into the disadvantaged groups. We aim to close the gap by focusing on key skills which will support such students to make good progress. Literacy skills are a major focus hence opportunities for reading, extended writing and other relevant skills occur frequently throughout the KS3 course.

Our oracy programme focuses on improving student ability to understand tier 2 language and this vocabulary set is also introduced early so that students may have a better grasp of tier 2 command words by KS4.

We believe that ensuring real world connection and practical activities to teach content is also vital in helping all students to make good progress via engaging them in lessons.

Use of rewards and positive phone calls should be used to motivate our disadvantaged students in order to boost confidence and engagement.

Our intervention classes target specific PP students based on data collected on their skills.

Consolidation booklets and narrated videos can be used to support students outside of lessons by other agencies.

For details of relevant intervention and blended learning please see below.

Intervention and blended learning

Each term KS3 students are given a short test, the results of this are used to identify the weakest students in each band. Students are placed into small groups with our science HLTA who then proceeds to deliver 10 lessons of targeted intervention based on identified required skills. The pupils resit the test again after 10 lessons to review the impact of their intervention. Each term sees a different focus: literacy, numeracy and science based skills so pupils in the intervention group are changeable each term.

Covering the knowledge gaps imposed by the pandemic is made simpler in science by the spiralling curriculum as there is a natural revisitation of key ideas when concepts are revisited.

The consolidation booklets and videos discussed earlier will also be used to assist in catch up and independent learning/intervention.

See Appendix below for a comprehensive list of skills covered in Y9 modules.

Appendix A

Skills taught within Y9 curriculum content with examples of where to find explicit opportunities to teach them (not necessarily limited to that module)

Science skills	Numeracy skills	Literacy and communication skills
<ul style="list-style-type: none"> -Application of knowledge to new contexts (All) -Working independently (All) -Designing tables (9A, 9E, 9F, 9J) -Devising investigations (9A, 9F, 9I, 9J) -Evaluating investigations and data (9A, 9E, 9F, 9J) -Classifying objects (9A) -Drawing conclusions from diagrams and data (9A, 9F) -Identifying and dealing with anomalies (9A) -Describing results (9B) -Writing a prediction using scientific ideas (9B, 9F) -Selecting appropriate equipment (9B, 9F, 9I) -Identifying bias (9E) -Commenting on data (9E, 9J) -Writing word equations (9F) -Writing a method (9F, 9J) -Identifying and dealing with risks (9F) -Recording observations (9F) -Balancing symbol equations (9F) -Justifying answers (9F) -Following a method (9F) -Identifying variables (9F, 9I) -Using models (9B, 9F, 9J) -Drawing and using circuit diagrams (9J) 	<ul style="list-style-type: none"> -Drawing graphs (9A, 9E, 9I, 9J) -Calculating % (9A) -Calculating % change (9A, 9B, 9F) -Calculating mean (9A, 9B, 9E, 9I, 9J) -Describing graphs and table data (9A, 9B, 9F, 9I) -Using significant figures and decimal places correctly (9B, 9J) -Calculating differences (9F) -Using a line of best fit to find values (9F) -Unit conversion (9I) -Using formula triangles to calculate values and rearrange formula (9I, 9J) 	<ul style="list-style-type: none"> -Reading and comprehension (All) -Use of oracy strategies (All) -Use of tier 2 terminology (All) -Use of tier 3 terminology (All) -Making notes (9A, 9F, 9I) -Writing comparatively (9B, 9J) -Communicating with others in a group (9B, 9I) -Debate (9B) -Extended writing practice (9E, 9F) -Using prefixes to find meaning (9F)

Appendix B

[Hyperlink](#) to summary of EEF recommendations (Improving Secondary Science, 2017)

Or see:

https://educationendowmentfoundation.org.uk/public/files/Publications/Science/EEF_science_summary_of_recommendations_poster.pdf

Appendix C

[Hyperlink](#) to National Curriculum KS3

Link to science National Curriculum in its entirety: <https://www.gov.uk/government/publications/national-curriculum-in-england-science-programmes-of-study/national-curriculum-in-england-science-programmes-of-study>