Science in Y7: an overview and rationale

Our aims:

The main aim of the Y7 curriculum is to build on KS2 skills and knowledge, developing both skills and understanding so they can be revisited later in KS3/KS4 (and beyond) in more detail and to a more challenging level. Our spiral curriculum is progressive in nature so we revisit key ideas frequently and in different contexts to enrich understanding. Our KS4 plans make clear links back to relevant KS3 modules so it is clear to see how the KS3 curriculum allows students to progress onto KS4 content. The curriculum is very skills-focused. We link content to the most relevant skills so that students can develop good scientific, literacy and numeracy skills within the context of new theory.

Of course the other important aim of the Y7 curriculum is to inspire students to enjoy science, so we have developed a curriculum which is ambitious for all students, engaging, interactive and challenging and full of real world context that students can relate to.

By the end of Y7 students should have an understanding of the fundamentals in the following key ideas in science: forces, energy, cells, ecology, acids and alkalis, sex, organ systems, particle theory, separating mixtures, atoms, elements and compounds, sound and electricity. Specific details can be found by looking at the 'grading grids' for each module.

Organisation and delivery:

Science in Y7 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. We make links between modules where possible. KS3 content is broad and balanced as it encompasses the entire NC across all 3 subjects (see Appendix C).

Students are taught in sets which helps us to challenge/support appropriately. Number of students in each set decreases with ability to help support lower ability students. Having trialled both mixed ability and sets in the past, we believe teaching students in sets helps us to better stretch the higher ability students by teaching at a pace that allows inclusion of extra content and extension work. Likewise, lower ability sets can be taught at a pace that allows them to gain a good understanding of the key ideas in science. Sets are first created by using baseline data (test in first lesson) and then reviewed using data from subsequent assessments each term.

We have a bank of KS3 resources which have been standardised by the CL to ensure consistency. All consider adaptive practice and have been developed to both support and challenge all students. These loosely follow the Pearson Exploring Science modular guide but have been specifically developed for our students by staff. The resources follow the recommendations by the EEF in their report 'Improving Secondary Science' (2017), providing opportunities for; building on ideas, strategies for retaining and retrieving information, modelling, self regulation, practical work, developing vocabulary and feedback (see Appendix B).

Staff can use the curriculum resources to ensure they hit the important content and skills outlined below. However, staff are free to modify lessons to suit individual classes/students and may explore alternative teaching and learning activities which they can then share with the department (providing the alternatives allow students to access the skills and content outlined in the Y7 plan). Thus, creativity of individual staff is not stifled by being forced to follow a 'one size fits all' approach. This is important to continual review and development of departmental T+L .

Skills

We ensure that 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 required content, providing a range of contexts to which skills can be applied. Some of these skills are scientific skills (all those listed in the national curriculum are covered by our curriculum model)- e.g. devising experimental procedure, identifying experimental variables, working safely etc. Some of the skills we focus on are literacy based such as extended writing, reading and comprehension and appropriate writing styles. We also focus on numeracy skills- most of these build on KS2 numeracy (calculating mean and drawing bar charts for example) but we have also worked alongside maths to build KS3 numeracy opportunities into our curriculum and to align these opportunities with the order in which they are taught in maths.

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.

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

See appendix A for a full list of skills taught within the Y7 curriculum.

Teaching order

All Y7 students start with basic safety lessons in order to ensure they can carry out practical work safely. This also introduces them to methodologies and equipment which they may not have encountered in KS2. We then move onto modules which investigate the 'big ideas' in science- cells, forces, energy, lab safety and the pH scale, atoms and elements and particle theory. These ideas underpin the majority of remaining content so it is important that these are taught well at the start of KS3. For the remaining modules there are logistical implications- for example, it is necessary to rotate the modules between sets accordingly to allow for practical equipment to be available to every class. 7B (sex education) is placed at the end of the year as students are more mature by the point and teacher-class relationships will be more solid which helps when teaching sensitive content! Ecology is best taught with opportunities to work outside so that is placed at the end of the year when weather is warmer.

Engagement and motivation

Y7 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. This makes for an ambitious curriculum which encourages students to engage with challenging concepts.

Standards checks and assessment allow teachers to check that students are engaging with work as requested.

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, most modules also have a challenge card, MA reading material 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 the cards 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. Whilst a small number of in-lesson questions and tasks may use the BASME grades to differentiate, as a rule we avoid differentiating by 'level' or 'target'. There are a number of reasons for this- firstly it gives greater flexibility as students may struggle with different skills, topics or even modules. Students are rarely always working at any one level. Avoiding use of specific B-E tasks also avoids students losing confidence because they can't do the task 'at their previous level' or 'at their target'. Instead differentiation is simplified- start at one, challenging level for all and scaffold down as appropriate so that all student reach a desired 'outcome' with an appropriate level of support. 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.

More recently we have developed a set of booklets to be used with our lowest sets. These have been developed in order to help support our lowest ability students to access literacy demands and curriculum content and skills.

Independence

Each module has several opportunities for homework attached to it. This can be set by individual teachers as is appropriate to their class. Pairs of modules (half termly) have an assessed task attached to them which is designed to be done as an independent, open book task. Tasks have been designed to stretch and challenge all students into thinking, working and/or discussing independently. Rather than doing modular tests we moved to larger, termly tests which Y7 all sit at the same time. 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 module has a 'consolidation booklet' attached to it (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 also accompanied by a pre-recorded video 'walk through'.

Literacy and communication

We build literacy skills into all of the modules we teach in Y7. There are many 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 Y7 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. This is important as some students can lack confidence in giving answers if they don't know how to pronounce words.

Numeracy

Our KS4 curriculum has a large maths requirement so we recognise the importance to apply maths to science contexts from an early age. For this reason we often use Y7 practical work to reinforce maths. We have communicated with the maths department to ensure that wherever possible 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.

Assessment

Assessed tasks cover disciplinary knowledge (skills) framed in substantive context (content) for the previous 2 topics (see module rotation). There are 6 of these half-termly assessments throughout the year and each one assesses key skills in different contexts. Staff provide timely feedback and students should track progress on tracker sheets. Staff use this information to shape teaching and provide relevant STAR time to aid progression.

Every term, students also have a test covering the modules for that term. This covers substantive and disciplinary knowledge. We provide revision materials and tasks as homework on GC in advance of the test. This encourages independent study at home and prepares students for revising larger chunks of information (which is a requirement at KS4). Students may move sets 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 rocky shore of our local coastline to teach food webs and the school field as an example of habitats. 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. . In addition students undertake a science careers enterprise led by external speakers where they can interact with local scientists.

Our curriculum also builds in opportunities to debate ethical issues- for example the role of zoos in preserving endangered animals. We use ethical issues in science as grounds to develop communication skills through oracy techniques. We also stress the importance of respecting themselves, the school and local community and wider world – for example in teaching our sex education and variation lessons (see 7B and 7D guides).

We seek to provide curriculum enrichment in the form of trips, events and (later in the year) STEM club. For example in recent years we have hosted the Medical Mavericks event to give Y7 students an idea of the types of careers available in medicine. Y7 students are now taking part in an activity to meet local scientists.

Finally, we aim to develop students as individuals by equipping them with skills for the wider world outside of their science lessons. This is apparent in working to improve numeracy, literacy and communication skills for example and in encouraging students 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 students who need the most support with skills 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. We believe that our skills-rich curriculum helps to address those gaps created by lack of practical work in the last few years.

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 (disciplinary knowledge) covered in Y7 modules.

Appendix A

Skills taught within Y7 curriculum content with examples of where to find opportunities to teach them (not necessarily limited to that module- explicit examples listed)

Science skills	Numeracy skills	Literacy and communication skills
-Practical work- following instructions safely (ALL) -Writing risk assessments (7F, 7E, 7H) -Devising investigations (7B, 7G, 7H) -Identifying variables (7G, 7F, 7K, 7H) -Scientific methodology (7B, 7G) -Sampling and using field guides (7D) -Making predictions using science (7D) -Forming hypotheses using evidence (7D, 7C, 7E) -Using and evaluating models (7J, 7L, 7A, 7C) -Making predictions (7J) -Independent research/investigation (7J, 7C, 7H, 7I) -Drawing tables (7J, 7G, 7I) -Making observations (7G, 7E) -Microscopy (7A) -Writing word equations (7F, 7H) -Application of knowledge to new situations (ALL) -Identifying anomalies (7F, 7K, 7H) -Using force meters and balances (7K) -Improving investigations (7K) -Writing conclusions (7K, 7C, 7H) -Using diagrams to describe processes (7C, 7I) -Asking/identifying scientific v ethical questions (7C) -Drawing apparatus (7E) -Using chemical symbols (7H)	-Drawing bar charts and histograms (7B, 7D, 7K, 7E) -Describing graphs (7B, 7D, 7G, 7F, 7K, 7H, 7I) -Using tally charts to collect data (7D) -Calculating percentages (7D) -Using an appropriate number of decimal places (7D, 7K, 7C) -Identifying normal distribution, mean, mode and median (7D) -Drawing line graphs and lines of best fit (7J, 7L, 7F) -Retrieving data from tables (7L) -Converting between units (7G) -Basic calculations (7A, 7F, 7E) -Making estimates (7F) -Drawing curves of best fit (7F) -Selecting appropriate units/prefixes (7K) -Identifying proportional and non linear relationships (7K) -Calculating averages (7K, 7C, 7H) -Using and rearranging formulae (7K) -Calculating difference (7H) -Retrieving data from pie charts (7H) -Calculating ratios (7I) -Comparing data accurately (7I) -Calculating minimum requirements (7I)	Throughout- but explicit examples listed: -Use of key, tier 3 vocabulary (ALL) -Use of tier 2 vocabulary (ALL) -General reading and comprehension (ALL) -Being resilient (teaching them that it is ok to be incorrect at first and can build on an answer) (ALL) -Reading and comparing a range of scientific literature types (7D, 7L, 7A, 7F, 7E) -Extending writing practice (7B, 7D, 7J, 7C) -Selecting appropriate terminology and writing styles (7B) -Communicating effectively via debate and discussion (using oracy) (7B, 7L, 7G, 7C, 7E, 7I) -Writing persuasively (7B, 7A, 7I) -Defining key words to create a glossary (7D, 7L) -Using root words to identify meaning in new terminology (7J) -Using connectives (7L) -Using appropriate nouns and adjectives (7F) -Writing comparative statements (7L) -Making notes and summarising (7A, 7F, 7K, 7C, 7H, 7I) -Sorting fact from opinion (7H)

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