# Bridgewater Science Curriculum Intent

* Our intent is to plan and teach an **inspiring and memorable** science curriculum that inducts **all** students into powerful knowledge leading to the specific development of the substantive and disciplinary **knowledge** that allow access to humanity’s most rewarding endeavours.
* Put simply, the curriculum intent is to **engage, support** and **challenge** learners at both Key stages 3 and 4 and in doing so provide all our learners with a strong grasp and understanding of the **fundamental science concepts that exist across biology, chemistry and physics** and for the curriculum to explicitly explain **“How we know what we know and why we believe it”**
* In **biology**, we want pupils to learn and master that the building blocks of life are cells. We want pupils to see how cells can build up to form tissues, organs and systems and then understand how all variety of living systems can interact with the world around us. We aim to build on concepts that offer low cognitive load during early parts of KS3 (eg Cells and Organs; Habitats and Ecosystems) so that in the following years, learners are ready for the challenge that further biological ideas may present i.e. Genes and evolution; Interdependence and the wonderful world of plant biology.
* To embed learning, we recognise the importance of biological terms and spoken language in pupils’ development across the whole biology curriculum and aim to build in recall of the numerous biological terms. We begin with simple tier two (and some tier 3) words in Y7 and then continually build on this with more frequent use of tier three words and terms during Y8 to 11. The knowledge organisers that we will use for each and every unit will highlight such words but the typical daily language used by teachers will also reflect our language intent from Y7 to Y11 so that the quality and variety of language that pupils hear and speak are key factors in developing their scientific vocabulary and articulating scientific.
* In **chemistry**, it is our aim to give pupils an appreciation of this fundamental science, and hence to develop an interest and understanding in the subject. It is our intention for pupils to gain an awareness of the role of the collaborative nature of Chemistry in the 21st century and its universal role in the development of new technologies and its potential to solve many of the worlds’ problems e.g. pollution, fuel crisis, feeding populations. This inspiration will hopefully encourage more pupils to study Chemistry at a higher level.
* This will be achieved through carefully planned sequence of lessons and topics. Key ideas and concepts are developed slowly as the course progresses, with fundamental concepts being constantly revisited and applied to unfamiliar situations. This ensures that revision is an ongoing process. Interwoven into the course are practicals in which pupils can explore scientific ideas for themselves.
* In **physics,** we aim to produce scientifically literate citizens, who will be able to engage with their environment on a practical and theoretical level. Physics, the most fundamental science, with its models, analytical approach, and mathematical demand, is the ideal vehicle for this. Importantly, we nurture and develop our students’ love of the subject, and of asking the difficult questions.
* We achieve this via a carefully planned route through the subject, beginning with basic concepts around energy, and force, for example; but also with content that inspires and engages – space science, for example. Lower down the school the fundamental skills are cemented, but so is an appreciation of the wonder of science. At key stage 4, we teach to a specification but continue to take opportunities to display the wonder of our subject. Lessons are well structured as part of a series of learning events, using evidence-based models of teaching. For example we consider cognitive load, the development of schema, and provision of opportunities to build skills, in order to lead to the best possible examination outcomes for our students.
* In science, we recognise that biology, chemistry and physics can be fundamentally and conceptually different, but appreciate that many concepts can overlap in each of the science subject domains. So, as an overarching approach for the delivery of our curriculum, we seek to implement great science lessons that are informed by:

1. cognitive science (eg retrieval, spaced practice, dual coding)

2. great explanations;

3. core knowledge and engaging illustrations;

4. Shed Loads Of Practice (SLOP);

5. frequent low-stakes tests and supportive resources;

6. sharp and purposeful cumulative summative and formative assessment to enhance ‘learning’.

7. commitment to a variety of STEM programmes and awards

To enable this to happen our curriculum in planned around the following **6 dimensions**:

1. Clarity around the sequence of learning over 5 years.
2. Clarity around the knowledge and the application of knowledge.
3. Vocab and literacy
4. Subject content which is Aspiring, Inspiring and ‘Real World Learning'
5. Memory and Cognition.
6. Assessment. Clarity around the end points and the assessment of what students know and can do.

**Six Dimensions of the BWH Curriculum**

1. **Clarity around the sequence of learning over 5 years**

**Knowing and understanding more at each stage of the curriculum.**

In science, topics taught are part of a progressive model of sequencing across key stages. Lessons taught, build on fundamental science content early in KS3 to the more challenging concepts and schema delivered at KS4. We are continually reviewing our schema so that the fundamental basics in biology ( cells and their components), chemistry ( atoms and particles) and physics ( energy and forces) are taught with clarity and purpose, providing the learning needed before further and more challenging science concepts are taught. We have considered the cognitive load that applies to the science concepts we choose to deliver and when we deliver it. We understand the impact this could have on working memory and therefore have carefully planned sequence so that learning is not restricted as we teach science throughout KS3 and then onto KS4. In summary, our pupils learn key concepts within each subject domain before further progressive concepts are taught and learnt. We have invested time ensuring focus at KS3 and AWOL target end point descriptors are inclusive of key content and principles. This then provides the platform needed for the mastering of subject specific knowledge and skills at KS4.

1. **Clarity around the knowledge and the application of knowledge**

**Explicit teaching of subject knowledge and relevant background knowledge that can be applied to problem solving and is transferable between contexts and subjects.**

Across the key stages, we deliver explicit lesson plans for each and every topic. Each lesson details what knowledge or skill is to be learnt as an outcome and how such outcomes should be delivered. All outcomes link to agreed endpoints for pupils within KS3 or 4. Many lessons begin with a short review of previous learning and can take the form of low stakes quizzing or simple recall of content previously learnt. The development of effective knowledge organisers for all topics, for use at KS3 and 4, provide consistency in low stakes quizzing practice as well worthwhile effective homework setting.

The presentation of new material occurs in small steps followed by plenty of student practice- SLOP. In this way pupils become confident applying the skills needed across the science topic domains.

Alongside written practice, a large number of questions are asked to elicit pupil ideas and to check for understanding. To ensure learning of knowledge has taken place, responses of all students are checked, learning gaps identified. Systematic feedback and corrections then follow either verbally or via written feedback and is then followed by DIRT activities. Material is re-taught when necessary.

1. **Vocab and Literacy**

**Vocabulary: Explicit teaching of vocabulary at all stages of a subject.**

All lesson plans contain key terms and words that need to be taught within a topic or specification. Key command words exist on lab walls and are used as point of reference when teaching the meaning of said command words. Within knowledge organisers, tier 3 words are included that are taught within schema and the meaning of such words form part of regular retrieval and low stakes testing, often at the start of lesson.

To develop deeper understanding of key science vocabulary, various resources may be used in lessons. eg the **Freyer Model** is a graphic organiser used for building student vocabulary. This technique requires students to define target vocabulary and apply their knowledge by generating examples and non-examples, giving characteristics, and/or drawing a picture to illustrate the meaning of the **word.** In addition and to develop confidence in the use of key vocabulary, other activities are typical within science lessons: repetitive starters that consider the use of tier 3 words; quick definitions tests following spaced practice; frequent writing activities requiring use of key terms such as ‘extended response’ questions at GCSE as well as the occasional spelling test, seen mainly at KS3.

Structure to extended writing is taught across all years within science. BUG (i.e. box command word- underline key points and then glance back over question) allows for commonality across science and the building of confidence for students

At a whole school level the use of Lexonics is used to enable students to employ and transfer meaning across subjects.

1. **Subject content which is Aspiring, Inspiring and ‘Real World Learning'**

Within science lessons, we have developed engaging, what we term ‘hinterland’ lessons. “Hinterland” refers to the supporting details, the examples, anecdotes and experiments that students don’t need to remember accurately, but that furnish the richness of their understanding and contribute to the building of knowledge. Across the key stages, examples of such inspiration and aspiration may be in the story of Alexander Fleming’s chance discovery of Penicillin or when Edward Jenner created the first vaccine. Real world learning may be delivered following lessons on the use of antacid tablets within acids and alkalis or via the teaching of railway welding and the thermite reaction. Hinterland lessons are varied, but as regular as they can be, engagement of pupils being key to this.

Within science we have some local links to science and do take part in a variety of STEM based projects. In recent years we have collaborated with United Utilities, Unilever and Solvay that offer STEM based projects. Enriching experiences within science and embedded within programmes of study are also annual visits to Chester Zoo, Daresbury laboratories, Jodrell bank and All About Stem’s ‘Big Bang fair. Year on year, the science faculty aims to enrich the science education of our pupils by seeking out and participating in the variety of science based enrichment our local area has to offer.

1. **Memory and Cognition**

Within science, regular retrieval of previous content and knowledge is typical in many lessons. Retrieval is encouraged in a low stakes fashion and may include the use of variety of resources from retrieval roulettes, quick quizzes or simple recall from knowledge organisers. We aim to reduce cognitive load that cannot be avoided in higher level questions by developing ease of recall in our learners so that working memory can be applied to the question being asked. From lesson to lesson, typical lessons may show ‘spaced practice’- content re-visited that was taught previously; Interleaving- cross topic references and teaching; Modelled examples- concrete display of approach to a problem or question and Dual coding- integrated images and writing to enhance learning, offering reduction in extraneous load (CLT). All learning strategies within science continue to be developed and are integral at reducing cognitive load for pupils whilst learning and therefore increasing the chances of ‘learning’ taking place. Alongside teacher practice, is the teaching of pupils why such techniques are important to their learning and therefore a large contribution to pupil metacognition.

1. **Assessment: Desired outcomes and how they are measured.**

The assessment of science knowledge and skills across KS3 and KS4 takes the form of common formative and summative assessment practice. Formative assessment across both key stages shows typicality in plentiful questioning, low stakes quizzing during starters and plenaries, whole class marking with questions directed at common misconceptions which are then completed during DIRT and knowledge organiser learning homework. Summative assessment content aims to cover as much of the key stage learning end points as possible. Summative assessment is cumulative with a general rule of 25:75, old to new content. This encourages the concept of spaced practice and solidifies ‘learning’. Summative assessment design mirrors assessment objectives at GCSE and AWOL end point descriptors at KS3, but both key stage assessments challenge the ability to recall and apply content. At KS3 and KS4, summative assessment currently runs alongside termly whole school reporting and therefore consists of three or four yearly summative assessments. Such assessment if followed by a variety of DIRT tasks that aim to identify learning gaps for further teaching and learning and therefore re-assessment at a later date.

Assessment as Bridgewater aims to:

**i) Promotion of Learning**

**ii) Informs teaching**

**iii) Is both formative and summative**

**iv) Recognises student progress and achievement**

**Class Level.**

At class level students are assessed through the following strategies:

* Daily recap quizzing
* Targeted questioning. (no hands up)
* Hinge questions
* Low stakes testing
* Peer to peer quizzing
* Self-quizzing
* Multiple choice questions
* Quality Mark Assessment (**Application tasks**)

**School Level**

Whole school/year assessment points are planned as the best fit to support learning, in a manner which is year group specific.  Whole school assessment is not tail wags the curriculum dog.

KS4 Formal standardised pre-public exams twice a year.

KS3 Formal examination style testing based on retrieval of information throughout the key stage.