



Padgate Academy

Department Directory  
Science

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## Introduction

This is a comprehensive guide outlining all aspects of the curriculum delivered within the science department at Padgate Academy. It has been written with the intention that this guide will evolve over time as the department develops and builds from strength to strength. Fundamental to the success of the department is the natural ownership by team members of all aspects of pedagogy. We will establish a culture of collaboration, teamwork and celebration of excellent practice within the department. Only then will we deliver the first class education which our team will be passionate about delivering to every single student. In turn this will deliver excellent outcomes at GCSE and indeed every level.

## Purpose

Our purpose is to deliver a high-quality science education which provides the foundations for understanding the world through the specific disciplines of biology, chemistry and physics and encourages our students to be curious about the world around them. Our students have a limited experience of the wider world and our curriculum aims to widen that exposure and show how science is the foundation of our modern life.

The 5 year Science curriculum focuses on thinking, interpreting and evaluating rather than simply memorising scientific fact. It is our conviction that this will make science accessible for all. It is not enough to simply recall facts, it is more important to understand and appreciate how that knowledge was derived, how it came to be discovered and accepted by the scientific community. Within the science curriculum, there is a focus on knowledge, but with the intent that more knowledge enables you to be a better and deeper thinker.

The curriculum will encourage our students to be reasonable and logical thinkers as this is even more important in the modern world of social media and 'fake news'. Through building up a body of key foundational knowledge and concepts, students should be encouraged to recognise the power of rational explanation and develop a sense of excitement and curiosity about natural phenomena. They should be encouraged to understand how science can be used to explain what is occurring, predict how things will behave, and analyse causes.

The science curriculum is aspirational and provides the foundations for further study at A-Level and beyond. This is the case for all students, including disadvantaged, as it is vital they see going to college and University as a possible future pathway. In this way, our curriculum opens up future possibilities and scientific avenues for all students.

The study of science relies heavily upon evidence to test predictions and theories. Developing mathematical techniques as well as applying reasoning to present and justify information can be applied to most careers and further education.

## Curriculum

Our curriculum will build on knowledge gained at primary school whilst preparing students to excel at GCSE and beyond by providing the knowledge and skills required. We will provide a rigorous culture of academic study which will include well suited assessment opportunities that prepare students for success with terminal examination.

The curriculum will be matched with other TCAT schools to provide opportunities to share resources and collaborate in order to achieve the best possible outcomes.

## KS3/KS4

The Key Stage 3 curriculum will be matched against the national curriculum, and will be taught across Y7, 8 and 9. During Y9 most students will transition on to their KS4/GCSE programmes of study, this will vary depending on class and ability, i.e. for some it will be at the start of the Spring Term and others at the start of the Summer Term and for a small number it will be at the start of Y10.

The core body of knowledge delivered at KS3 will be based around 11 big ideas taken from the KS3 and KS4 programmes of study (national curriculum). These big ideas link to the three disciplines of Biology, Chemistry and Physics and are designed to be continually revisited throughout KS3/4 to provide regular interleaving opportunities and therefore build knowledge upon pre-existing schema. The knowledge builds from simpler, more concrete topics to more abstract.

Therefore, by the end of the curriculum, students will know and understand the following:

<b>Biology</b> Big ideas – Organisms, Bioenergetics, Genes	<b>Chemistry</b> Big ideas – Matter, Reactions, Earth	<b>Physics</b> Big ideas – Forces, Waves, Magnetism and electricity, Energy
<ul style="list-style-type: none"><li>• Develop scientific knowledge and conceptual understanding of biology, chemistry and physics</li><li>• Develop understanding of the nature, processes and method involved in biology, chemistry and physics</li><li>• Develop and learn to apply observational, practical, modelling, enquiry and problem-solving skills, both in the laboratory, in the field and in other learning environments.</li><li>• Develop their ability to evaluate claims linked to biology through critical analysis of the methodology evidence and conclusions, both qualitatively and quantitatively</li></ul>		

### **Working scientifically / practical investigation skills**

The development of practical investigation skills will be integrated within every opportunity through investigation work across the curriculum. This will be modelled using the 'Required Practical' approach throughout KS3/4. KS3 implementation will focus on the KS3 National Curriculum Working Scientifically framework, whilst KS4 will focus primarily on subject specific Apparatus and Technique (AT) skills. However, the KS3 experimental techniques link directly to those encountered in KS4, providing interleaving opportunities.

### **Scientific skills:**

The skills that students will gain from the scientific curriculum are:

- Understand theories that explain phenomena
- Apply basic ideas and models that support understanding
- Evaluate models and theories
- Present theories in mathematical form
- Recall quantitative relationships
- Derive quantitative relationships between various measured quantities
- Explain how theories are borne out by experiment.
- Apply experimental procedure and understand that it is a measure of success of a theory
- Present, interpret and evaluate experimental data
- Apply mathematical skills to solve problems

## Assessment

Students will be tested using end of unit tests for every discrete unit taught. In addition, students will complete terminal examinations at the end of each term followed by an end of year examination covering all aspects of prior learning. The results of each assessment will be recorded centrally within the departmental tracker. These results will inform any assessment data which is inputted in SIMS for whole school purposes.

End of unit tests will assess the knowledge and skills gained over a discrete unit of work.

End of term and end of year tests will assess the knowledge and skills cumulatively throughout the course of the curriculum, ensuring all students are provided the opportunity to retrieve key knowledge throughout the science curriculum, and therefore build their long-term memory.

Long term memory will also be supported through the incorporation of low stakes testing, in the form of quizzes. These will be completed at the beginning of a new unit to ensure all foundational knowledge is in place to allow new knowledge to be built upon it, as well as mid-way through larger units, and at the end of smaller ones. The quizzes are created referring to the key knowledge students are required to know to access the future curriculum.

Following all assessments, whole class feedback will be provided followed by a review lesson(s) to ensure that any gaps in knowledge or understanding are addressed as quickly as possible.

Throughout the 5 year science study students will be assessed using the following assessment objectives which ensure that they are able to cumulatively build their subject understanding in preparation for future GCSE and A Level study. We will assess how students at their current stage of study are on track to reach their end of stage targets which are formulated on aspirational expectation from their KS2 starting points. We make an informed prediction from our holistic assessments based on our subject mapping of expectation across the science curriculum.

### **Key assessment objectives:**

AO1: Demonstrate knowledge and understanding of:

- Scientific ideas
- Scientific techniques
- Scientific procedures

AO2: Apply knowledge and understanding of:

- Scientific ideas
- Scientific enquiry
- Scientific techniques and procedures

AO3: Analyse information and ideas to:

- Interpret and evaluate
- Make judgements and draw conclusions
- Develop and improve experimental procedure.

Regular formative, low stakes retrieval starters will also be used each lesson to assess understanding and allow responsive teaching, whilst simultaneously providing students with the opportunity to build their long term knowledge base through retrieval practice.

## Marking and Feedback

All assessments will be common across the department and will be marked by the teacher, who will provide specific feedback on how students will further their understanding and knowledge. Students will be expected to respond to this feedback. Assessments will be stuck in exercise books sequentially at the end of each topic.

### Staff responsibilities:

All staff will mark in purple pen, and students will complete response work in green pen.

Marking and feedback will be provided on the following areas within all subject areas:

#### 1. End of unit / topic assessments

At the end of each unit of work / topic (every 6-8 lessons), all students will complete a standardised assessment covering the areas that have been studied. There should be at least one assessment per half term.

Members of staff will mark all end of unit assessments. This marking will then be moderated as part of the department's 360 quality assurance processes.

Students will be directed to stick assessments in their books.

Following an end of unit assessment, all staff will provide whole class feedback using the 'Whole class feedback' document, print on green and provide a copy to each student that is stuck in books. At least one lesson will be taught based on areas of misconception identified, with planned opportunities for students to independently practice.

#### 2. Pre-public examinations (PPE's) at the end of years 7-11

This includes any mock examinations in Year 10 or 11, or any end of year examinations in Years 7, 8 and 9. Furthermore, this may include TCAT standardised tests in English, Mathematics or Science.

Members of staff will mark all end of year assessments. This marking will then be moderated as part of the department's 360 quality assurance processes.

Following a PPE, all staff will provide whole class feedback using the 'Whole class feedback' document, print on green and provide a copy to each student that is stuck in books. At least one lesson will be taught based on areas of misconception identified, with planned opportunities for students to independently practice.

#### 3. Classwork

##### Teacher assessment of classwork:

As students are directed to complete independent practice, all staff (teachers/teaching assistants) should circulate the class and provide live marking to individuals work in books with the purpose to check understanding, address misconceptions and identify common areas to be addressed.

Staff should aim to provide live marking to at least half of the class during the lesson as this will provide regular feedback and ensure student work is checked regularly.

Within every 2/3 lessons there will be some evidence of marking / acknowledgement for all students.

Staff should use 'best effort' consequence routinely to ensure all high expectations of all students.

### Student self / peer assessment:

During lessons, staff should routinely encourage students to self/peer assess their work to provide instant feedback and guidance on how this can be improved.

#### 4. Marking for literacy

All end of unit assessments should be marked for literacy, alongside marking for literacy during live marking during lessons, using the literacy codes.

Cp	Incorrect use of capital letters
//	Paragraph needed here
Sp	Spelling error
P	Punctuation missing or incorrect
Gr	Grammar is incorrect or misused. This may be an incorrect word or it may be a sentence that does not make sense.

Students will be directed to correct errors as soon as possible during lessons.

#### 5. Presentation

Staff will direct students to ensure that dates and titles should be underlined using rulers, students should only use blue or black ink, and any tables should be completed using rulers.

### Whole class feedback procedure

Following marking of an assessment / end of unit test, a whole class feedback sheet will be completed, printed on green paper and provided to each student to stick in books after each assessment.

A lesson (or lessons) is then spent on teaching the areas of misconception identified, with planned opportunities for students to independently practice.

## Units of Work and Assessment

Units of work should begin with intended learning outcomes linked to programmes of study and should build a progressive and sequential series to achieving these learning outcomes. Each unit of work should focus around teaching to the most able, differentiating downwards to establish different learning outcomes. Learning outcomes should be differentiated based on different starting points of students and their individual needs (informed by student data). Units of work should have built in assessments to assess learning of key concepts, knowledge, understanding and application. All assessments should be modelled on actual terminal examination assessments.

All units of work will detail the previous knowledge and understanding that is critical to allow new knowledge to build upon. This will be planned for and assessed before beginning the unit of work to ensure the foundations are in place. This will be identified through the KS2 and KS3 national curriculums as necessary.

All units of work will make clear the next steps and interleaving opportunities that will be provided later in the curriculum to allow students to revisit the key knowledge and skills required.

Challenge for all students will be embedded through the curriculum within the units of work. Departmental MER processes will be used to ensure that the challenge opportunities are implemented.

A long-term plan will be followed to ensure coverage of the curriculum.

All individual teachers will create a medium-term plan.



## Developing literacy in science

Literacy is key in to academic success across the curriculum, and as a result, all teachers are teachers of literacy. As such, this explicit teaching of literacy within the science curriculum will increase students' chance of success in the subject and provide the foundations for future study.

Whilst a range of pedagogical approaches will be taken to explicitly teach literacy, the following aspects will be prioritised and have been taken from the EEF guide to improving literacy in secondary schools:

- Targeted vocabulary instruction, particularly of tier 2 and tier 3 vocabulary – An adaptation of the Frayer model will be used by staff to break vocabulary down using etymology and morphology
- Do now recall tasks will regularly include the recall of key vocabulary to support long-term memory
- All units of work will identify the key vocabulary that should be explicitly taught, with a view to enabling later access to the curriculum
- Exploring key terminology within examination questions to allow students to plan their response and model how to do this
- Providing word, sentence and paragraph instruction to support all students to access complex writing tasks

## Individual Lessons

Each lesson should be themed around a **Key Learning Question** linked to the unit of work.

The learning outcomes should be made clear to students at the beginning of the lesson and will be taken from the unit of work.

A structured approach to lesson delivery should be applied in order to support deep learning to take place. Activities/support should be differentiated to enable students to achieve learning outcomes within each lesson.

## Lesson Delivery (Pedagogy)

Lessons will follow the approach below where possible, but may vary depending on content and ability of students within each class. It is advisable to chunk new knowledge in order to prevent cognitive overload. Where possible teachers should incorporate actual examination questions during each lesson. This approach has been adapted using Rosenshine's Principles of Instruction.

Aspect	Purpose
Retrieval Activity (as they enter)	<ul style="list-style-type: none"><li>• Check for retention and aspects of prior learning</li><li>• Engage students with topic</li><li>• Encourage higher order thinking</li></ul>
<b>Key Learning Question:</b> Big Picture and Challenge	<ul style="list-style-type: none"><li>• Promote thought</li><li>• Encourage deeper learning</li><li>• Stimulate discussion</li></ul>
New knowledge explained Modelling	<ul style="list-style-type: none"><li>• Exposing students to new knowledge and</li><li>• Explaining key concepts</li><li>• Model the application of new knowledge/skills</li></ul>
Independent practice	<ul style="list-style-type: none"><li>• Promoting literacy</li><li>• Checking written communication/depth of understanding</li><li>• Embedding examination technique</li></ul>
Checking for understanding	<ul style="list-style-type: none"><li>• Formative assessment opportunity for whole class – intervention if required to address misconceptions.</li><li>• Opportunity to extend learning.</li><li>• Further embed exam technique through examination Q's</li><li>• Provide feedback for progression</li></ul>
Questioning (at every opportunity)	<ul style="list-style-type: none"><li>• Knowledge recall</li><li>• Rigorously check and challenge understanding</li><li>• Encourage deeper thinking</li></ul>

# Monitoring, evaluation and review (MER)

## Purpose

Every child has an entitlement to the best education possible. In order to do this, all staff must be committed to a culture of continual professional development and seek regular feedback to improve all areas of their practice. **Monitoring, Evaluation, and Review** will be the foundation for this culture.

**Monitoring** – Regular checking that we are doing what we have set out to do

**Evaluation** – Assessing whether it is having the intended impact

**Review** – Deciding what the next steps are to lead to a greater impact.

MER in Science at Padgate Academy seeks to:

1. Empower all staff, led by the HoD to take collective responsibility for pedagogy, student outcomes and accurate self-reflection of everyday practice.
2. Enable all staff to be reflective regarding the impact their practice is having on student outcomes.
3. Provide regular opportunities for feedback on all areas of practice.
4. Identify training needs on a departmental level
5. Establish consistent, supportive and responsive line management for all, ensuring National Teacher Standards are being met and addressing underperformance when necessary.

## Science Departmental MER

MER will focus on 6 key areas. Please see priority action plan for more information.

Key Area	Source of Evidence
Outcomes	<ul style="list-style-type: none"><li>• Departmental tracker</li><li>• Student SPI data</li><li>• TIG actions</li></ul>
Validity of Assessments	<ul style="list-style-type: none"><li>• Standardised assessments to be included in student books</li><li>• Consistent grade boundaries to be used – informed by TCAT</li><li>• Moderation processes each half term</li></ul>
Curriculum	<ul style="list-style-type: none"><li>• Long term plan to be created and checked during work scrutiny to ensure it is being followed</li><li>• Medium term plans and roadmaps to be created by all staff and sent to HOD before the end of the current half term</li><li>• SOW to be moderated during department time at the start of each half term</li></ul>
Pedagogy	<ul style="list-style-type: none"><li>• Implementation of whole school calendar of MER activities</li><li>• Half termly drop in's to be completed by HOD with feedback to dept and individuals – to be calendared for HOD</li><li>• Developmental feedback to be provided to all staff on an individual basis</li><li>• Feedback to be reviewed during the subsequent learning walk</li></ul>
Marking & Feedback	<ul style="list-style-type: none"><li>• Implementation of whole school calendar of MER activities</li><li>• Half-termly work scrutiny to be completed by HOD and departments. Feedback to dept and individuals – to be calendared for HOD</li></ul>

Vocabulary	<ul style="list-style-type: none"><li>• Learning walks as part of whole school calendar of MER activities</li><li>• Student book checks – evidence of vocabulary strategy being implemented during curriculum review meetings at the end of each half term</li></ul>
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