Physics Department Rationale

"Physics teaches people to accept reality with awe and admiration, not to mention the amazement and joy that comes with it" Leis Meitner: Austrian-Swedish Physicist who led the team that discovered nuclear fission.

The word 'Physics' comes from the Greek, 'knowledge of nature,' and in general, the field aims to analyse and understand the natural phenomena of the universe. An understanding of the basics of Physics is essential for any modern citizen as it underpins so much of the modern world that we live in, including the most pressing challenges we currently face, such as: contagious diseases, climate change, the energy supply crisis and the eventual need to move from this world to others.

A world view enhanced through studying and applying the scientific method will empower our students by providing them with the skills needed to negotiate the bewildering volume of conflicting information & misinformation that they will encounter daily in the modern world. The study of Physics will enable our students to better evaluate information and solve problems to make evidence-based decisions that will help promote and ensure a better future for us all.

Studying Physics develops both the thinking and problem-solving skills that employers are looking for.

Through our Physics curriculum we aim to develop students':

-Curiosity about the world

-Enjoyment of scientific activity

-Understanding of how natural phenomena can be explained

-Ability to make informed decisions through the evaluation of evidence and to then take appropriate actions that affect their own wellbeing and the wellbeing of society and the environment.

-Appreciation of the international & cross-cultural history of Physics and the contribution of the world's nations & peoples to our current understanding of the Universe we live in.

-Understanding of the 'big ideas' in science which include ideas about Physics and its role in society including the historical role it has played in the development of modern ideas and attitudes to the world we live in.

Curriculum Intent:

By the end of year 9 students will have developed an understanding of the key principles behind the Energy Unit. Students will be able to use equations without changing the subject, as well as recall units without prefixes for different variables. Students will have developed their practical skills and be confident in following an experimental procedure, risk assessing, recording data, plotting the results of experiments. They will have a developing knowledge of the technical language we use in science and will be able to use the keywords covered in Year 9 in a range of practical experiments. Students will be able to interpret data, both tabulated and graphical.

By the end of year 10 students will have developed an understanding of the key principles behind the Particles of Matter, Electricity, Atomic Structure and Space (Triple only). Students will also have reviewed the principles behind the Energy topic studied in Year 9. Students will be able to answer both low, standard and for some high demand CGSE questions in familiar contexts. Students will be confident in the use of equations, including changing the subject of the equations. Students will be able to recall units for all variables used and be able to convert units with prefixes. Students will have further developed their practical skills and be able to plan and evaluate an experimental procedure, risk assessing, recording data, plotting the results of experiments, and drawing conclusions based on results.

By the end of Year 11 students in Physics should be able to remember the key principles and definitions of Forces, Waves & magnetism/Electromagnetism along with the basic equations including symbols, prefixes and units. Students should be able to apply knowledge of these concepts along with previously learned concepts (developed during Year 9 & 10 but extended and deepened in Y11) to solve problems and explain the science behind a wide variety of contexts, some of which will be novel. Students should be able to perform multi-step calculations involving more than one equation, change the subject of and equation and convert units/quantities.

By the end of Year 12 students in Physics should be able to remember the classification of subatomic particles along with definitions of key Physical terms, including symbols, prefixes and units. Students should be able to apply their knowledge of waves, forces, materials and electricity (developed during GCSE but extended and deepened in Y12) to solve both quantitative and qualitative problems in a wide variety of contexts. Students are expected to use higher level mathematical skills developed through GCSE Higher tier Maths to solve problems.

By the end of Year 13, students in Physics should be able to remember concepts, definitions and units within Field theory (Gravitational and Electromagnetic), Nuclear Physics and the optional unit of Astrophysics. Students should be able to solve complex quantitative problems and give detailed qualitative descriptions of the physics of a range of unfamiliar/novel situations, showing understanding of the interplay between different concepts. Students are expected to use exponentials & logarithmic functions (not taught in GCSE maths) in mathematical calculations both in problem solving and through practical experimentation

Students should be able to demonstrate the ability to plan, carry out, analyse and evaluate experiments and experimental data.

Key Stage	Year	Subject Topic/Focus	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
KS3	Year 9	Topic/Focus	KS3 Physics	KS3 Physics	P1 Energy	P1 Energy	P3 Particle Model of Matter	P3 Particle Model of Matter
		Assessment	KS3 Assessment	Practical Skills Assessment		P1 End of Topic Assessment		End of Year Exam (all Y9 topics)
KS4	Year 10	Topic/Focus	P3 Particle Model of Matter	P3 Particle Model of Matter/P2 Electricity	P2 Electricity Triple: P8 Space Physics	P4 Atomic Structure	Trilogy: P4 Atomic Structure	P5 Forces
		Assessment	P3 Mid topic Assessment	P3 End of Topic Exam	P2 Mid-Unit Assessment	P1-3 Asessment	P4 End of Topic Exam	End of Year Exam (all Year 9 & 10 topic)
	Year 11	Topic/Focus	P5 Forces	P5 Forces	P6 Waves	P6 Waves	P7 Magnetism and Electromagnetism.	P7 Magnetism and Electromagnetism.
		Assessment	P5 Mid topic assessment	Paper 1 Mock (P1-4)	Paper 2 Mock (P5-8)	Revision	Paper 1 and 2 GCSE Exam	
KS5	Year 12	Topic/Focus	2 Measurement & Units 4 Electricity 3 Mechanics	4 Electricity 3 Mechanics	3Materials 3 Mechanics	4 Quantum 4 Waves	5 Astrophysics 4 Waves	
		Assessment	Suitability Assessment	Test questions based on topics taught s far	Test questions based on topics taught so far	AS style exam on topics taught so far	Test questions based on topics taught so far	End of year AS style exam
	Year 13	Topic/Focus	7 Fields 8 Nuclear Physics	7 Fields 8 Nuclear Physics 9 Astrophysics	7 Fields 9 Astrophysics	Practical skills and assessment Revision	Revision	
		Assessment	Mini Assessments during teaching	Paper 1 mock based on all Y12 work and part of 6 (further mech)	Paper 2 mock based on 6 (thermal),7,8	Paper 3 mock based on 9/practical skills	A Level Physics Exams	

Science Department Marking and Feedback policy: Physics Dept

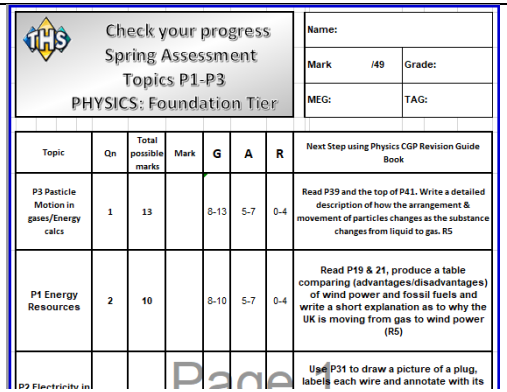
Overall impact of marking and feedback in Science

Our intention when providing good, structured feedback is to close the gap between the pupil's progress ensuring that the pupils are supported by building upon learning and addressing misconceptions in both substantive and disciplinary knowledge. This will therefore close the gap between where the pupil is and where the teacher wants them to be.

As a department we meet and complete moderation between mock examinations, this is to ensure reliability between markers so that comparative judgements can be confidently made between different students. We also use marked exam boards scripts as a source of moderation material.

It is important that Science has a consistent approach to marking and feedback of assessments which is why we have regular (daily,1-2 weekly, half termly and end of unit) assessment points.

Assessment	When and how the assessment will happen	Type of feedback in Science
Daily review	**Lesson by lesson** retrieval practice which takes no more than 8 mins and provides effective retrieval, spaced and interleaved practice. On-going self/peer assessment of exemplar/practice Q & A completed during a lesson	This is often **self-assessed -** sometimes **peer** - students receive instant feedback and marks awarded are clearly identifiable in students' books/handouts by students using a different colour pen (preferably green) where possible and a clear SA (self-assessment) or PA (peer-assessment) in the margin next to the task. This encourages students to reflect on their own learning so that they can calibrate the security of their learning. Assessment in classrooms involves all students, often through the use of mini whiteboards and using exemplar work/Wagolls following students completing practice qns. Students will regularly undertake exam practice using past exam questions to help develop exam skills and prepare them for their end of year and final examinations. This will occur more frequently as students' approach Y11 & Y13.
1-2 weekly reviews	HOMEWORK- Low stakes test such as a well-structured multiple-choice quiz, which will set as **homework** via Tassomai. These can be used to extend students' thinking. This offers the opportunity for teachers to set tests that address students' possible misconceptions and offers further ways to interleave topics across the curriculum.	HOMEWORK- Digital tools and applications, such as Tassomai and Seneca, can be used to generate feedback for students and teachers. Students' scores are recorded, gaps in knowledge highlighted and an understanding of what material needs to be re-taught is developed. Students can also check their work against the correct answers. Retrieval tasks will ensure previous knowledge from previous lesson/lessons/units are embedded in lessons
Half termly reviews	A carefully designed **summative assessment** task that judges the extent to which students have remembered the content of a recent topic as well as assessing what students have retained **away from the point of learning**.	**Whole class feedback** – **"Progress sheet"** which focuses on one or more of the 5Rs. Example below

		 Check your progress Spring Assessment Topics P1-P3 PHYSICS: Foundation Tier Name: Mark /49 Grade: MEG: TAG: Topic | Qn | Total possible marks | Mark | G | A | R | Next Step using Physics CGP Revision Guide Book P3 Pasticle Motion in gases/Energy calcs | 1 | 13 | 8-13 | 5-7 | 0-4 | Read P39 and the top of P41. Write a detailed description of how the arrangement & movement of particles changes as the substance changes from liquid to gas. R5 P1 Energy Resources | 2 | 10 | 8-10 | 5-7 | 0-4 | Read P19 & 21, produce a table comparing (advantages/disadvantages) of wind power and fossil fuels and write a short explanation as to why the UK is moving from gas to wind power (R5) P2 Electricity in | Use P31 to draw a picture of a plug, labels each wire and annotate with its **Each half term** during which each Science is taught, at least **ONE** specific assessment activity will be marked in depth by teacher, using a progress sheet style feedback form linked to the 5R's. may take the form of a formal mock exam during Y11/13, an end of year exam, an end of unit assessment/multi-unit assessment or a shorter mini-assessment. Prior to this books/revision work should also be checked most significant SPAG issues within the task should be highlighted and addressed (ie correct technical spelling errors) but where there are many errors, only the most significant should be highlighted. Most of the progress sheets have a section for teacher feedback which should be partly based on the work produce in the run up to the assessment • Teacher feedback (www) comments should be specific (e.g. you correctly determined the gradient of the graph) rather than general (e.g. great work!) • there is no expectation that all student work should be checked or marked, the teacher should look through the work and can then make a general comment about the quality of work through the green slip feedback if they wish. • there is an expectation that all improvement work should be completed by students in green pen, teacher feedback should be in red pen. • Students MEG/TAG for the year should be written onto the front of exercise books • Ideally student assessment grades should also be recorded on the front of books
Termly Review	A carefully chosen **summative assessment** exam, based off AQA exam questions, that judges the extent to which students have remembered content of the entire unit and crossing over content of previous units **away from the point of learning**. Assessing across units is a way of assessing students building on previous schemes. This is to be completed in classrooms under exam style conditions.	**Whole class feedback** – In line with the school assessment calendar, prior to the data deadline, at least one mid/end of topic/mock summative assessment will be completed by each Physics student. This will be marked by the teacher and the mark/grade achieved then fed back to students. These will generally be away from the point of learning i.e. based on topics taught earlier in the year or in previous years. Students will then be given the opportunity to improve on their original work. This will be achieved partly through the teacher using the mark scheme to help students identify lost marks & improve their answers (in green pen when possible so the improvements can be distinguished from the original answers). All Physics assessments will include a progress sheet, similar to the one shown above.

		Alternatively, the teacher may verbally highlight common issues both positive and negative as they use the mark scheme to go through the test or the teacher may go through the test by using the visualiser to handwrite model answers. This direct feedback helps the student immediately see where their strengths/weakness are, both in terms of substantive and disciplinary knowledge and helps them address the areas of weakness while the test is fresh in their minds and before moving on to the next topic (where the same issue may present themselves again if not addressed. Either the teacher of the student (with teacher guidance) will usually then complete the progress sheet to help them identify the science behind the questions (both substantive and disciplinary knowledge) that they need to develop further by RAG rating each question. Students then complete improvement tasks in their exercise books, each linked to the relevant test questions and designed to help review and/or provide further practice in the identified area. These improvement targets will be linked to one of "The 5R's of Action Feedback".
Practical assessment	AQA practical endorsement practical's that have been set by the exam board- they are scattered withing the 2-year scheme of work at the point of learning	Individual feedback provided based off AQA assessment feedback

Progression through feedback in science

Each year group and key stage will have different foci where one of the 5 R's will be used more than the other, however we will encourage to use all R's where applicable e.g. in year 9 we will focus on R2 which will encourage students to build skills through rehearsal and repetition on key skills they will develop over KS3 and 4 whilst in year 11 and KS5 we would focus more on R5 which encourage students to independently research and record (self-regulate) around the subject that they have just been assessed on. There are some R's that we would consistently use across all year groups and key stages such as R3 and R4, where students will develop their skills based off the assessment they have sat at the point of learning, by carrying out specific tasks/questions which encourage students to revisit and relearn weak areas from the assessment. R1 is not commonly employed in science feedback as there are not many extended questions or 'standard' questions that commonly come up.

The focus of the style of feedback we use will again depend on the year group and key stage. For example, in year 9 we will provide feedback that is more task orientated where students are required to complete very directed tasks with more structure and scaffolding. Developing through to KS4 we start to include more subject and self-regulatory feedback that encourages our students to identify their strengths and weaknesses independently and to work on these e.g. to develop individual revision plans by identifying their own areas of weakness following on from the assessment.

Subject: Science (Biology, Chemistry and Physics)

Key Stage	Low Stakes Quiz	Cultural Capital	Practice	Flipped	Frequency
3	✓	✓	✓	✗	Once a week
4	✓	✓	✓	✗	Once a week
5	✓	✓	✓	✓	At least once a week by both teachers

Subject Homework Rationale	**KS3 and KS4: Homework's can include:** **Low stakes quiz/revision sites like Tassomai/Seneca are used to help students consolidate knowledge and understanding of the concepts covered in the classroom both recently and in past learning (retrieval practice). Tassomai will form the bulk of the homework as the expectation (when Tassomai is in use) is that students will complete a minimum of 4 daily tasks per week, each taking between 10 and 20 minutes per day. Question/topics are set by a computer algorithm based on previous answers submitted by the student. Rationale: Tassomai interleaves topics and helps student develop long term recall of the key ideas and concepts needed to be successful in all 3 sciences. Tassomai claims that If students successfully complete 80% of the Tassomai course they are set to achieve nothing less than a grade 5 in their Science course.** **KS3 and KS4 additional homework:** **Following teaching of a topic, printed/digital low stakes quiz/practice tasks, may be provided for students to take and complete at home along with links to useful revision sites like Bitesize. These will often be in the form of exam-style questions. Rationale: Students become familiar with the style of questioning they will encounter in exams/assessments, both internal and externally set. This work will also develop independence in students who will not have the teacher there to help them and so will use the resources we want them to use in the run up to the final exams to help them complete the tasks.** **Students may be set research homework on an area of the topic which is in the news or simply of interest, examples will include video links, articles etc. Rationale: to develop cultural capital and overall interest in the subject and help students see its relevance and importance to the modern world.** **KS5: Homework's can include:** **Printed/digital low stakes quiz/practice tasks may be provided for students to take and complete at home OR links to sites like Physics & maths tutor and BBC Bitesize will be provided so students can choose their own topics/questions. These will often be in the form of exam-style questions or past papers. We then use the mark scheme to mark the work. Rationale: Students become familiar with the style of questioning they will encounter in exams/assessments, both internal and externally set. This work will also develop independence in students. They learn how to interpret the mark schemes and what the examiner is looking for in an answer.** **Flipped learning tasks may be provided in which students read/research the topic to be covered next lesson and come with a summary of the key points along with questions they want answers to or are not sure of. Rationale: This is good for topics which are heavy on content and it reduces the risk of cognitive overload. It also promotes greater independence.** **Presentation preparation. Students will be asked to prepare a presentation to be delivered to the class next lesson along with a summary to hand out to other students. This is to develop students' ability to present, a requirement of many post -18 courses and employment.**

Translating the subject: Physics

What will you see in Physics Lessons?

An **observer to Physics lesson would see the lesson follow a basic outline of stages, obviously in some cases the timing or nature of the lesson may change, but the general steps would be:**

Concept: After a brief reflection on prior learning a new concept is introduced to students through use of demonstrations building on ideas the pupils are already familiar with. For practical lessons, it will usually involve a demonstration of the practical/introduction to the hypothesis.

Quantitative Understanding: The second section of the lesson is more teacher led, teachers will use the resources at their disposal to develop the concept further by considering the factors which affect the concept and/or by providing contexts to which the concepts can be applied. If the concept links to an equation, the teacher may try to link in some of the factors which will affect the concept being taught, to add a mathematical grounding to the ideas introduced at the start of the lesson. For practical lessons this may include planning of the practical by considering the variables and/or use of a trial run.

Application: Students apply the equation, or other quantitative understanding of the concept. In cases where there is no equation(s), the students will answer describe-and-state question. In the case of a practical lesson, students carry out the practical and obtain data.

Analysis or Complexity and Contextualisation: Next we add more complexity to the questions, either in the form of longer mathematical problems in unfamiliar contexts, or by adding explain and compare command word questions. For practical lessons, the students will complete an analysis of the data from their experiment, usually by graphing the data & drawing a suitable conclusion based on the graph. Then, they will use the data to reflect on their original hypothesis. This may lead on to an evaluation of the practical where students use appropriate language to reflect on the validity the method they employed/data obtained.

What will you see in pupils' Physics Books?

In students books you will see a range of student responses to questioning, both short answer questions and longer exam style calculations and extended (6 mark) exam-style questions/answers. Assessment and feedback will be through a mixture of self, peer and teacher assessment. Notes will be kept to a minimum as we emphasise the importance of students actively thinking for themselves.

Over the course of their time here students will undertake a range of practical work including planning experiments, gathering and recording data and analysing/evaluating data through graphing & other analysis techniques. The results of this practical work will be evident in students' books.

Where work has been assessment and feedback provide you will usually see evidence of improvement/intervention work being completed by students to ensure progress is made post-feedback.

What formative assessment will you see in Books/PALs

Regular quick quizzes/short answer questions at the start of lessons to promote long term recall of key facts/ideas/equations

Short answer questions relating to both assessment of knowledge and understanding of the content as well as application of maths and practical skills to Physics problems based on a wide range of contexts.

As students' progress through the course they will move from short/basic questioning to answering more exam style questions on the relevant topics, of increasing demand (low through standard to high where suitable), again covering an increasingly wide & varying range of contexts

What is the department currently reading and discussing, and why?

What we are currently reading: The Ofsted Research and Review into Science education published April 2021

Why?

To help us review and improve our Physics curriculum.