KS 3-4 Physics Curriculum

Curriculum statement

Physics is the science of the fundamental concepts of field, force, radiation and particle structures, which are inter-linked to form unified models of the behaviour of the material universe. From such models, a wide range of ideas, from the broadest issue of the development of the universe over time to the numerous and detailed ways in which new technologies may be invented, have emerged. These have enriched both our basic understanding of, and our many adaptations to, our material environment.

The Science curriculum is designed to foster a curiosity about the world around us, enable citizens of the future to understand and explore the world effectively and to be able to use scientific principles to both answer and ask questions about the universe and everything in it.

Intent

The principal focus of physics teaching in key stages 3 and 4 is to develop a deeper understanding of a range of scientific ideas in the subject. Pupils can see and understand connections between physics, chemistry and biology – become aware of some of the big ideas underpinning scientific knowledge and understanding.

Examples of these big ideas are the links between structure and function in living organisms, the particulate model as the key to understanding the properties and interactions of matter in all its forms, and the resources and means of transfer of energy as key determinants of all of these interactions. They are encouraged to relate scientific explanations to phenomena in the world around them and start to use modelling and abstract ideas to develop and evaluate explanations. Pupils can understand that science is about working objectively, modifying explanations to take account of new evidence and ideas and subjecting results to peer review. Pupils decide on the appropriate type of scientific inquiry to undertake to answer their own questions and develop a deeper understanding of factors to be taken into account when collecting, recording and processing data. They are able to evaluate their results and identify further questions arising from them.

Implementation

At KS3 and 4, Science is taught in distinct units. Each unit is designed to take a similar amount of teaching time. This allows different classes to study different units and finish them at the same time, taking pressure off the resources available. Students will continue to need help with things such as measuring accurately, graph plotting and so on at different stages in their studies, these are developed and supported via the comprehensive range of "Skills" delivered throughout the units. Ideas introduced earlier in the course are further reinforced and extended throughout the course, allowing students to revisit material on a regular basis and therefore progress in their knowledge and skills. Each unit is assessed to check that students are making the progress expected of them. Monitoring every student's progress is of key importance to ensure no learner gets left behind or 'stuck' in the Key Stage. At KS4, we use a range of materials to support formative and summative assessment, helping us to evaluate student progress and adapt teaching strategies accordingly.

• Science lessons start with a learning review, providing students with the opportunity to practise the recall of previous learning (from the previous lessons, previous weeks and previous months). This also allows teachers to quickly assess what has clearly been embedded and what areas still need some focus/time.

• Specialist vocabulary for topics is taught and built upon. Students are expected to use technical vocabulary in their answers.

• Complex processes are broken down into smaller steps to aid students' progression.

• Questioning is used to check understanding before moving on.

• Teachers regularly use modelling. This could be modelling of a written answer, a calculation, or how to use practical equipment.

• Students are given an opportunity for guided practise before moving on to completing work independently.

• Students receive regular verbal feedback as they complete tasks.

• To support progress with some more challenging work students are provided with a scaffold to help get them started and build confidence.

• Students complete an end of unit assessments for each topic, with feedback provided and time used to address areas of weakness.

• Exam practise in Y11 is used to build confidence, refine skills and the adequate use of technical vocabulary.

• Key Stage 4 students complete a number of cumulative assessments to help prepare them for their final GCSE exams.

Physics Programme

Year 7

'Energy' Unit 7I is a consolidation of KS2 knowledge on Food and transport. It serves also as a building block for one of the two foundations of Physics: forces and energy.

'Electricity' Unit 7J then follows and builds on the concept of 'energy' from unit P1, by furthering the idea of energy to include electricity as a means of transferring energy.

The unit 7K on 'Forces' introduces and develops the second foundation of Physics by building on units 7I Energy' and 7J Electricity', because forces exist as a result and consequence of energy. You need energy first in order to produce a force.

Finally, the unit on `Sound 7L builds on unit 7I Energy and 7K 'forces' because sound is the product of both energy and force. This is an example of applying the knowledge gained from units 'energy' and 'forces' to the production of sound unit.

Year 8

The unit 8I looks at changes of state, and then goes on to look at fluids and some of their effects, including pressure, floating and sinking, and drag.From KS2 most students will be able to: classify substances as solids, liquids or gases, observe and name changes of state.

The unit 8J revises work from KS2 on light, which is then extended to consider how light travels and what happens when it meets an object. The unit is set in the context of stage, film and illusions

The unit 8K looks at energy transfers by heating in the context of homes. Students can relate from their previous learning, use the particle model of matter to explain the properties of solids, liquids and gases (8I), recall some ways in which energy is transferred and stored (7I).

The unit8L builds on work from KS2 on the Solar System and looks at the Earth, including the seasons and the Earth's magnetic field and gravity. It also looks at the Solar System and what is beyond the Solar System. The theme is exploring the Solar System – in terms of observations and the use of models as well as via astronauts and space probes.

Year 9

Unit 9I 'Forces and motion' builds on work from Unit 7K on different forces, and the effects of balanced and unbalanced forces on stationary and moving objects, it builds on the work from Unit 7I, ways in which energy can be stored and transferred. And extends the concepts and knowledge by looking at calculations of speed, relative speed, and representing journeys on distance–time graphs and simple machines.

Unit 9J 'force fields and electromagnets' builds on ideas in Unit P8 on magnetic and gravitational fields by looking at electromagnets and their use in relays and simple motors; and Unit 7J on current in series and parallel circuits by extending into ideas of static electricity and electric fields.

Unit 9K 'conservation of energy' merges the concepts of forces (P9) and energy (P7) into the ideas of kinetic energy, elastic energy and electrical appliances.

and Unit 9L 'Energy transfer by heating' further develops the concepts of energy and work from P11 into how energy is transferred through: conduction, convection and radiation.

Cross-curricular opportunities:

IT	Evaluate new and emerging technologies
History	Development of technology
Maths	Substitute into formulae and solve equations change the subject of a simple formula draw and interpret distance–time graphs
Lit	Use cohesive devices to make text clearer and easier to read, identify features of writing produced for different purposes and audiences

Year 10

'Forces and motion' builds on year 9 'forces and motion' and year 7 'forces' to include moments, momentum, terminal velocity.

'Electricity' builds on year 7 'electricity' to increase depth, understanding and application of series and parallel circuits, and includes 'different types of resistors' and 'electrical components'

The 'waves' topic builds on year 7 'sound' and year 8 'light' by extending the concepts of reflection and refraction to include their uses, equations and total internal reflection.

The 'energy transfers' topic builds on year 9 'conservation of energy' and year 8 'energy transfers' to include coverage of the electromagnetic spectrum; its bands, uses and harms; and extends to conservation principle to include the sankey diagram and the efficiency equation.

Year 11

This unit on 'particle theory' in year 11 continues the themes introduced in KS3 chemistry 'the particle model' and physics 'energy transfers' by including the gas laws, pressure in liquids, and absolute zero.

'Magnets and electromagnetism' builds on KS3 topics of 'forces', 'force fields' and 'electricity' by including Fleming's left hand rule to understand motors, uses of electromagnets, and transformers.

'Radiation' also builds on the themes introduced in KS3 of 'particles' because radiation such as alpha, beta are particles; 'energy' because gamma is pure energy and it is by virtue of the particle motion that their energy is dangerous; and 'energy transfers' through ionising the medium that these particles travel through.