Newport Girls' High School Curriculum Summary

Faculty:	Science		Subject:	Physics

Our Vision

Faculty Vision

The Science Faculty teaches Biology, Chemistry and Physics as separate sciences from year 7. We aim to create and develop enthusiastic, informed, inquisitive and ultimately successful scientists. Students who study sciences at NGHS should be curious about the universe about them and enjoy learning how scientific models can be used to explain observations from the very large to the very small. We are committed to establishing a learning environment that encourages students to develop their observational, experimental, problem solving, critical thinking and evaluation skills so that they become confident at analysing and interpreting information and data. Students will be offered many opportunities to apply and expand on their mathematical and communication skills in the context of the different sciences. Students will become aware of the ethical implications of scientific advances and gain opportunities to independently extend their skills beyond the classroom. Fundamentally, our team want to inspire, foster and nurture a love of science and use scientific knowledge and skills to make informed decisions about the communication, application, and implications of science as these relate to their own lives and cultures and to the sustainability of the environment.

Subject Vision

In physics we will provide a broad view of the fundamental laws of nature. Through observation and the language of mathematics, we aim to make pupils appreciate the principal mechanisms that govern matter, motion and energy from the very small, such as the nucleus of an atom, to the whole universe itself. We aim to make them understand how things work from first principles. We focus on developing students' mathematical and analytical skills, as well as their problem solving skills and experimental skills which are valuable in areas beyond physics. The course has been designed to ensure students can apply the main principles to new contexts and have the confidence to use precise scientific terminology to explain processes, concepts and ideas.

Curriculum Intent

At KS3, the focus is to provide students with a wide range of observational and experimental skills and give them a broad introduction to the types of forces and phenomena they will encounter in nature. Through the context of electric fields, magnetism, light and heat, students will gain the confidence to connect circuits; see, draw and analyse ray diagrams; collect and analyse results in graphical form; apply the concept of proportionality in various contexts, develop an insight into the concepts of energy, and learn a wide range of scientific terms to describe phenomena and physics principles. The work is primarily hands-on and aimed to challenge, stretch and excite students, as well as provide them with a solid foundation to the subject.

At KS4, which starts at year 9, we study the AQA syllabus. We aim to develop their mathematical and problem solving skills, as well as ensure that they gain a high level of practical and graphical skills. The idea is to set a solid foundation from the onset to ensure that they can all potentially achieve a grade 7 or higher at GCSE. We teach students how to analyse complex problems and give them a strong quantitative background that can be applied in any technical field. At each stage and for each topic, we provide a wide range of real-life applications of the concepts. Experimental skills involving the collection, analysis and evaluation of data and the ten required practicals are delivered from year 9. At year 10, the students attend a Science Live event where they gain an insight into current research topics in science via a series of lectures. We aim for a high level of understanding allowing the students an easier transition into A-level should they wish to take the subject further.

At KS5, students follow the AQA two-year A-level syllabus. Students learn to handle complex equations, to critically analyse a situation and solve problems, and to embrace and understand

new concepts and ideas. We follow the CPAC requirements and carry out the twelve required experiments to ensure the students can be endorsed.

Curriculum Sequencing Rationale & Implementation

KS3:

In years 7 and 8, we focus on giving pupils the laboratory skills to be able to work safely in a lab. Most topics have a hands-on component that allows pupils to explore the concepts directly through experimentation, observation and analysis. The aim is to develop their observational and reasoning skills. Although there is a mathematical component, this is minimal and primarily limited to using ideas of proportionality or inverse proportionality. They learn to interpret data through graphs. In year 7, this is done in the context of the electrostatic and magnetic forces, and the whole topic of circuits and electricity. In year 8 the focus is on light and heat. Besides learning to draw and interpret ray diagrams, they explore shadows in a wide range of contexts including seasons and eclipses, they learn about reflection and the formation of images in mirrors, refraction, total internal reflection and their applications. In the topic of heat they explore the concepts of temperature, linear and volume expansion, conduction, convection and radiation.

KS4:

Students commence GCSE courses in Year 9. The curriculum is taught so that the foundation concepts such as force and energy, as well as basic experimental, graphical, mathematical and unit conversion skills are delivered first. The rest of the curriculum is carefully layered on top so that concepts not only follow logically, but also problem-solving skills are developed as new concepts are either derived from earlier ones, require them as part of a larger problem or require a skill to be able to fully grasp all angles. The required practicals are carried out when the topics relating to them are delivered.

At year 9, we concentrate on the concepts of forces, motion and energy. We start with setting up a sound qualitative understanding. They learn to tell when each type of force applies, the concept of resultant force in various settings and acquire a detailed grasp of the gravitational force, the normal force, friction, air resistance, and the spring force. The concepts gradually become more complex and more dependent on the use and handle of mathematical equations. Basic equations are introduced. Problem-solving is developed and pupils learn to lay out numerical work as well as learn to support their choices with the relevant physics concept.

In year 10, necessary computational and higher level experimental skills are delivered. These involve learning to convert units, collecting and tabulating accurate data, and learning to analyse and interpret experimental results. We sharpen all graphical interpretation skills and teach the topic of vectors. Forces and motion are re-delivered again in the context of vectors, and the complexity is taken a step up to make sure pupils can access grade 8-9 problems. The topics covered in year 9 are quickly revisited and extended to fully include all the GCSE topics linked to them such as moments, pressure, momentum, Newton's Laws, energy resources, potential and kinetic energy, power, heat and internal energy, heat transfer and heat capacities; and all the real world applications associated with each concept. Problem-solving becomes increasing more synoptic and knowledge of previous concepts is continuously used. For example, a problem on energy may require the knowledge of the types of forces acting (delivered in year 9), good handle of units, the concepts of power, work done-kinetic energy theorem and equations of motion (delivered in year 10).

In year 11, the top layer is delivered through a deeper and thorough analysis of the electrostatic and magnetic force and concept of fields. Major concepts of current, potential difference and resistance are linked with power (delivered in year 10). Students revisit circuit construction first done in year 7, but this time circuit component I-V characteristics and computational work is included. Basic concepts on magnetism and electromagnetism from year 7 become more sophisticated with the introduction on the motor and generator effect (links to energy resources in year 10), and a wide collection of real-world applications including transformers, the transport of electricity and the national grid. A more formal approach to the topic of waves brings back the ray diagrams delivered in year 8 to include the formation of images by convex and concave lenses. Finally the mostly stand-alone topics linking to modern physics: the structure of the atom, nuclear stability, radioactivity and applications, fission and fusion are delivered. This topic is mostly qualitative.

KS5:
In the first year, we start with revisiting and refining numerical and conversion skills, as well as practical skills, vectors and graphical interpretation. Topics are delivered historically and starting with the ones the students are more familiar with. Thus we start with statics and equilibrium, kinematics followed by forces, momentum and energy, materials, electricity and circuits, waves and interference, quantum phenomena and particle physics. The order ensures that foundation concepts such as force, energy, momentum and charge, as well as wave concepts are in place before addressing quantum phenomena and the four fundamental forces. For the second year, we start with further mechanics (circular motion and simple harmonic motion), forces and fields (gravitational, electric and magnetic), nuclear physics and thermal physics, and finally the optional topic. Further mechanics is needed for many aspects of forces and fields, and knowledge of the electric force, and the particle physics sections from year 1, supports the delivery of parts of the nuclear physics section. The thermal physics topic is mostly a stand-alone topic mainly requiring year 1 concepts on force, pressure and momentum.

For specific information relating to the content of the curriculum in each year group, opportunities for wider personal development and enrichment and ways for parents to support their daughter in her learning within this subject, please see the Learning Overviews on our website.