Newport Girls' High School Curriculum Summary

Faculty:	Science		**Subject:**	Chemistry

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

Have you ever wondered what is in that sandwich you ate for lunch? Or what is in your bottle of water as well as the water? Or what is in anything come to that? Chemistry will give you the opportunity to find out by understanding about the properties of substances and how atoms can be joined together to make different things. By studying Chemistry at NGHS you will be challenged to use Mathematics, practical investigation, logic analysis and imagination to help you understand the materials that surround us every day. You will learn why things behave the way they do, and how chemists play a role in all aspects of our lives. Practical work is at the centre of all of our courses and you will acquire knowledge and understanding of chemical patterns and principles which you will learn to apply to familiar and unfamiliar situations.

Curriculum Intent

Our KS3 and KS4 Schemes of Work encourage the creation of engaging lessons and promotes teaching for understanding rather than covering fragmented content. It also provides a method to follow student progress as their understanding develops. Our students study a wide range of topics which will enable them to

- Analyse patterns
- Discuss limitations
- Draw conclusions
- Present data
- Communicate ideas
- Construct explanations
- Critique claims
- Justify opinions
- Collect data
- Devise questions
- Plan variables
- Test hypotheses
- Estimate risks
- Examine consequences
- Review theories
- Interrogate sources

The passion and belief of the Department ensures that students enjoy their Chemistry lessons and make excellent progress from their starting points. Whilst we cover the National Curriculum, we believe it is important to go beyond this to instil a love of our subject.

At KS4, we study the AQA syllabus single science Chemistry. Topics studied at KS3 are reinforced and developed in KS4. Practical skills are further developed with the delivery of required practical and additional experiments where appropriate.

At KS5, students continue to study the central concepts but in greater detail. The department aims to foster an interest in Chemistry such that our girls appreciate the work of chemists in a quest for innovation, enhancement and improving efficiency and ultimately we want all girls to consider pursuing further study or careers in STEM subjects. Further interest in the subject is cultivated by taking students to 6th form lectures at Birmingham University along with participation in the Cambridge Chemistry Challenge and the Chemistry Olympiad.

Curriculum Sequencing Rationale & Implementation

KS3

As with Physics and Biology, 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. The mathematical component is developed through the two years (mainly in year 8) and includes standard form and weighted averages. In year 7, the above are addressed through the study of the nature of matter, separation techniques, pH and the reaction of acids. In year 8 we seek to further ground them in the basics of the subject and too start to see its relevance in the ecological, economic and social spheres. The students deal with the history and philosophy of the subject through looking at atomic theory and includes evidence for the particulate nature of matter on which the subject is built. An introduction to bonding leads to understanding of the importance of electrostatic forces in chemistry and how atomic and molecular phenomena impact on the macroscopic in terms of melting, boiling and solubility. A study of the reactivity of metals and its relevance to extraction techniques introduces aspects of economics and sustainability which in turn leads on to a study of the properties of materials, corrosion prevention and sustainability. To complete a chemical overview of surface processes on the Earth we look at the evolution and structure of the atmosphere again emphasising the scientific process and use of evidence to reach conclusions.

KS4

At year 9, we introduce a number of concepts that the students will see in Years 10 and 11 together with some final experimental procedures and tests to fully prepare them for the assessed practical work. We start with some fundamental chemistry tests in the analysis of solids, liquids and gases, identifying the positive and negative ions in solids salts and their solutions and with tests for the principle gases that they will come across at GCSE. Following this we develop the acid work completed in Year 7 to give them a deeper understanding of the nature of acidity and to ensure that the standard reactions of acids are known; we also look at different ways of making salts and their importance economically, in health and agriculture. The concepts gradually become more complex and more dependent on the use and handle of mathematical equations as they move into studying the concept of amount of substance (this allows the students a more gentle introduction to a challenging concept that they will handle in detail in Year 10). Numeric and graphical work is further developed in studying energy changes and rates of reaction. If time we also introduce organic chemistry through a study of compounds obtained from crude oil.

In year 10, the conceptual and mathematical complexity increases and the students are introduced to methods to handle these. This is developed through theory and experimental work (through which skills required at GCSE and beyond are delivered and developed). The development of chemical concepts of the atom and bonding are studied in depth building on earlier work but leading to access to levels 8-9. Amongst skills developed are critical analysis of experiments and the limitation of data and the ability to analyse and interpret experimental results. An in-depth study of the quantitative aspects of the subject including mole calculations and titrations develop the students' mathematical skills within the subject to an appropriately high standard. To give a break

from the mathematical the acid and metals topics covered in year 9 are quickly revisited and extended to fully include all the GCSE necessary and the real-world applications associated with them. Work on energy changes is developed from that studied in Year 9; students are taught how to use experimental data to calculate enthalpy changes, draw energy level diagrams and reaction profiles. They also apply this knowledge to energy changes in batteries and fuel cells and the applications of all of these various energy changes. The year is completed by looking in more detail at rates of reaction and at the concept of equilibria. In these topics, graphical and mathematical skills are developed to handle all GCSE material and prepare for A-level study as required. At the end of Year 10 students should have all the mathematical sills and critical skills to handle any problems in Year 11.
In year 11, the final conceptual content is introduced in the topic of organic chemistry and the remaining topics develop details previously introduced in lower years. The synoptic aspects are developed showing how different topics link together to make a coherent whole. Organic chemistry introduces new reactions but links to separation techniques, resource management, and the environment. In chemical analysis, formulations are introduced and the quantitative nature of different forms of chromatography. Flame emission spectroscopy is studied with its links to Bohr's atomic model). The atmosphere topic is revisited and developed to look at the chemistry and physics of greenhouse gases and students learn about carbon footprints. Finally, the students look at a topic on using resources covering aspects from all nine previous topics in the GCSE course and topics introduced in years 7 and 8; this very much acts as a synoptic topic covering much of the theory, the skills (both practical and theoretical), the applications and the social relevance of the subject.

KS5

The A-level course is taught principally in two streams; physical and theoretical; inorganic and organic. In the first year, physical chemistry starts with refining atomic model of the students with particular attention to the electronic structure -some aspects of quantum chemistry are introduced which will be necessary for later topics in both streams. Other topics with in the physical stream develop from those with which the students are already more familiar, e.g., bonding, rates, equilibrium and redox. Concepts such as electrostatic force (viz. intra- and intermolecular forces), energy changes and the particulate nature of matter are used and developed in order to help students conceptualise the processes. In inorganic aspects of groups are further studied but incorporating explanations involving the magnitude of interparticle forces. Organic chemistry introduces homologous series and reaction mechanisms, again aspects of interparticle forces are involved together with some of the quantum chemistry in the formation and shape of molecular orbitals. Practical skills are developed through normal lab work and assessed practical work for the CPAC qualification.

For the second year, physical chemistry starts with thermodynamics introducing the concept of entropy (by building on energy and the random motion built into particulate theory). Rates, equilibria and electrode potentials follow developing on GCSE and Year 12 topics with the final topic being acids, bases and buffer solutions. The second year of the A-level course develops a number of higher-level mathematical skills (e.g. logarithms for pH) which are taught as necessary. In the inorganic/organic stream the quantum chemistry taught in Year 12 is utilised to explain shapes and colours of transitions metals and the energetics topic to explain complex ion stability. In the organic stream topics include: oxidation products of alcohols; aromatic compounds and their chemical reactions; acid-base nature organics; biological molecules (e.g. proteins and DNA); nmr. In all of these links to the topics studied in the physical stream are emphasised. Towards the end of the course synoptic questions are emphasised to show the interconnectedness of the different streams and parts of the course.