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. In year 7, the above are addressed through the study of acids and alkalis, separation techniques, particle theory and the historical development of the periodic table. In year 8 we seek to further ground them in the basics of the subject and to 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 elements, mixtures and compounds, air and the atmosphere, formulae and equations, the reactivity series and energy changes. All of these topics will be developed further in KS4.

KS 4

The AQA GCSE course starts in year 9 and from September 2022 we will teach chemistry on 2 periods a week. This year group will continue to have 2 periods a week of chemistry when they reach years 10 and 11. Students starting years 10 and 11 in September 2022 will continue with the old curriculum and receive 3 periods a week of teaching in year 10 and 2 periods of teaching in year 11.

From September 2022 the year 9 scheme of work starts with an in depth look at atomic structure and bonding, building on previous work and immediately giving access to levels 8 and 9. Chemical analysis is introduced through theory and experimental work; developing the practical skills required at GCSE level and beyond. The concepts gradually become more complex as they move into studying the concept of amount of substance which will be developed further in year 10. Year 9 also covers an introduction to organic chemistry through a study of compound obtained from crude oil.

In September 2022 year 10 students will continue with the old scheme of work. From September 2023 year 10 students will start with rates of reaction where numeric and graphical skills are developed further. 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. The topic on chemical changes allows development of the reactions of acids and the reactivity series before introducing electrolysis. 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. Organic chemistry theory continues by studying the reactions of alkenes, alcohols and manufacture of polymers.

In September 2022 year 11 will continue with the old scheme of work. From September 2024 the year 11 students will start by completing the remaining organic chemistry work on carboxylic acids, polymers, amino acids and DNA. The atmosphere topic will recall and expand on the knowledge of this area studied in year 8 and is developed to look at greenhouse gases in more detail and finally carbon footprint. 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 al 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.

The teaching of each class in years 12 and 13 will be split between two teachers.

Year 12 have 9 periods of chemistry over 2 weeks. CT and JW have 4 periods and APC 5 periods. The scheme of work will be split as follows**:**

Inorganic and physical Chemistry (JW + CT)

- 3.1.1 Atomic structure (3)
- 3.1.2 Amount of substance (6) CPAC 1
- 3.1.3 Bonding (6)
- 3.1.7 Oxidation, reduction and redox equations (2)
- 3.2.1 Periodicity (1)
- 3.2.2 Group 2, the alkaline earth metals (2)
- 3.2.3 Group 7(17), the halogens (3) CPAC 4

Organic and Physical Chemistry (APC)

- 3.3.1 Introduction to organic chemistry (1)
- 3.3.2 Alkanes (2)
- 3.3.3 Halogenoalkanes (2)
- 3.3.4 Alkenes (3)
- 3.3.5 Alcohols (3) CPAC 5
- 3.3.6 Organic analysis (3) CPAC 6
- 3.1.4 Energetics (6) CPAC 2
- 3.1.6 Chemical equilibria, Le Chatelier's principle and K_c (3)
- 3.1.5 Kinetics (3) CPAC 3

Year 13 have 10 periods of chemistry over 2 weeks. CT and APC will have 5 periods each. The scheme of work will be split as follows

Inorganic and Physical (CT)

- 3.1.8 Thermodynamics (A-level only) (5)
- 3.1.9 Rate equations (A-level only) (4) CPAC 7
- 3.1.10 Equilibrium constant K_p for homogeneous systems (A-level only) (2)
- 3.1.11 Electrode potentials and electrochemical cells (A-level only) (5) CPAC 8
- 3.1.12 Acids and bases (A-level only) (5) CPAC 9
- 3.2.4 Properties of Period 3 elements and their oxides (A-level only) (2)
- 3.2.5 Transition metals (A-level only) (5)
- 3.2.6 Reactions of ions in aqueous solution (A-level only) (2) CPAC 11
- 3.3.13 Amino acids, proteins and DNA (A-level only) (2)

Organic and Physical (APC)

- 3.1.6 Chemical equilibria, Le Chatelier's principle and K_c (3)
- 3.3.7 Optical isomerism (A-level only) (1)
- 3.3.8 Aldehydes and ketones (A-level only) (2)
- 3.3.9 Carboxylic acids and derivatives (A-level only) (4) CPAC 10a and 10b
- 3.3.10 Aromatic chemistry (A-level only) (4)
- 3.3.11 Amines (A-level only) (1)
- 3.3.12 Polymers (A-level only) (1)
- 3.3.14 Organic synthesis (A-level only) (2)
- 3.3.15 Nuclear magnetic resonance spectroscopy (A-level only) (3)
  3.3.16 Chromatography (A-level only) (1) CPAC 12