CURRICULUM INTENT: SCIENCE

The intention of the Science Department here at the North London Grammar School, NLGS, is to equip our students with skills for life from a scientific perspective. We aim to challenge our students by introducing them to a wide range of science topics, which form a sturdy foundation for their futures. Students successfully develop practical, mathematical, and scientific literacy skills through the exploration of integral topics in Biology, Chemistry and Physics. Our well-structured educational pathway in science trains our students, as part of their personal and academic development, to think logically and independently, to increase their problem-solving skills.

Initially, students follow a thorough two-year key stage three curriculum that covers key concepts in all sciences. All Year 7 students complete an introduction to secondary science module before their science teaching commences.

Confidence in these ideas is strengthened more using an in-depth approach at GCSE for three years from Year 9 to Year 11 in key stage four. At NLGS we teach the OCR Gateway science GCSE for both Combined Science and Separate sciences where each science discipline is given equal weighting. These courses provide a strong platform to progress into any Biology, Chemistry or Physics key stage five courses which subsequently lead on to all Higher educational qualifications and universities.

Within the areas of Biology, Chemistry and Physics, the science department also introduce numeracy and literacy within science along with building skills to work scientifically, especially within practical activities. The science department also aims to introduce students to careers in science to raise awareness of the many pathways that science qualifications can lead towards. In addition, Cultural capital will be embedded into each topic to ensure students are able to relate the science they learn about to a variety of contexts and to understand the importance of each scientific concept in day-to-day life.

The Science Department offer an exciting range of extracurricular experiences to give students a flavour of science beyond the classroom. Educational visits, STEM clubs, guest speakers and careers advice are available at each key stage to feed students' natural curiosity and allow access to novel ideas and experiences.

CURRICULUM IMPLEMENTATION: SCIENCE (CHEMISTRY)

	AUTUMN TERM		SPRING TERM		SUMMER TERM		Trips and Events
	Autumn 1	**Autumn 2**	**Spring 1**	**Autumn 1**	**Autumn 2**	**Spring 1**	
Year 7 Knowledge: What will students know?	**Introduction to Secondary Science** -Lab safety and equipment -How to use the Bunsen burner -Variables in science -How to draw a table -How to draw a graph -Drawing conclusions -Evaluating experiments	**C1.3 Mixing, dissolving and separating** Name and draw equipment and explain obvious laboratory risks. Select and draw apparatus accurately; explain safety precautions.	**P1.5 Forces and effects** **Please refer to Physics Implementation document for details**	**B1.2 Eating, drinking and breathing** **Please refer to Biology Implementation document for details**	**C1.4 Elements compounds and reactions** Give examples of elements and explain how they are organised in the Periodic Table. Define elements, use symbols, link the organisation of the Periodic Table to element features and	**P1.6 Energy transfer and sound** **Please refer to Physics Implementation document for details**	**Trip to RAF Museum Spring 1**

	B1.1 Cells, the building blocks of life **Please refer to Biology Implementation document for details**	Justify equipment choice and measurements; explain how to reduce risks. Use laboratory equipment safely to gather evidence. Record evidence in an effective way. Describe how to separate mixtures. Select and explain appropriate separation techniques. Describe the process of dissolving and the effect of temperature. Describe methods for producing crystals of different sizes. Explain why most water is not pure, and why this is not necessarily a problem. Explain why contaminated water is a problem and identify what can be done about it.			explain how scientists organised the Periodic Table. Explain why different elements are found in different places and why they were discovered at different times. Identify some common properties of metal elements and non-metal elements and their uses. Identify similarities and differences between metals and how these relate to their uses; compare and contrast properties of metals and non-metals. Explain the properties of elements using data and why they are used for different applications. Select and justify the use of elements for different purposes, based on their properties. Describe an example of a compound and		

		Describe how salt is extracted. Recognise advantages and disadvantages of salt extraction methods. Describe the process of distillation. Explain the physical processes involved in distillation. Describe the composition of air Identify sources of air pollution and their impact. Identify mixtures using chromatography. Explain how to separate a mixture using chromatography and interpret chromatograms. Use chromatograms to explain the composition of mixtures; compare chromatography and DNA analysis. Explain the idea of a solvent.			represent a chemical reaction using a simple model. Explain how compounds can be formed and explain a chemical reaction using simple models. Make links between simple models of compounds and chemical symbols. Make accurate observations, explain them using a simple model and a word equation and explain differences between chemical and physical changes in terms of atoms. Make accurate observations, identify differences, and with support, describe reactions using simple models or word equations. Recognise where carbon and its compounds are used. Explain why oxidation is a reaction; explain the differences between oxidation		

		Explain mass changes during dissolving; select solvents for different uses. Use a model to explain dissolving and separation; link the uses of solvents to their properties.			and thermal decomposition. Use models and word equations to explain changes during oxidation and thermal decomposition reactions.		
Year 7 Skills: What skills will students have developed?	**SMSC:** •Science Cultural capital in all lessons. **Literacy:** •Language for learning – keywords shared every lesson. •Comprehension style/ cloze style activities in all lessons. •present reasoned explanations, including explaining data in relation to predictions and hypotheses •identify further questions arising from their results. **Numeracy:** •Graphing skills •understand and use SI units and IUPAC (International Union of Pure and Applied Chemistry) chemical nomenclature use and derive simple equations and carry out appropriate calculations •undertake basic data analysis including simple statistical techniques. •evaluate data, showing awareness of potential sources of random and systematic error •apply mathematical concepts and calculate results •present observations and data using appropriate methods, including tables and graphs •interpret observations and data, including identifying patterns and using observations, measurements and data to draw conclusions **GATSBY Benchmark 4:** Introduction to science linked careers at the start of each topic. **Practical Skills/ Working Scientifically:** •ask questions and develop a line of enquiry based on observations of the real world, alongside prior knowledge and experience •make predictions using scientific knowledge and understanding •select, plan and carry out the most appropriate types of scientific enquiries to test predictions, including identifying independent, dependent and control variables, where appropriate •use appropriate techniques, apparatus, and materials during laboratory work, paying attention to health and safety •make and record observations and measurements using a range of methods for different investigations; and evaluate the reliability of methods and suggest possible improvements **Please refer to Physics and Biology Curriculum Maps for Physics and Biology implementation.**					

Year 8 Knowledge: What will students know?	**B2.1 Getting the energy your body needs** **Please refer to Biology Implementation document for details**	**C2.3 Explaining physical changes** Compare the properties of solids, liquids and gases. Use particle diagrams to explain the differences in energy and forces between the particles in different states of matter, accounting for differences in their properties. Recognise how theories are developed. Change hypotheses in the light of new evidence and use this evidence to develop theories. Use correct terminology and the particle model to describe changes of state, including evaporation. Interpret and explain data relating to melting and boiling points. Describe how solids, liquids and gases	**P2.5 Exploring contact and non-contact forces** **Please refer to Physics Implementation document for details**	**B2.2 Looking at plants and ecosystems** **Please refer to Biology Implementation document for details**	**C2.4 Explaining chemical changes** Identify some everyday substances that contain acids and alkalis. Explain what all acids have in common and what all alkalis have in common. Evaluate the hazards posed by some acids and alkalis and how these risks may be reduced. Give an example of an indicator and state why indicators are useful. Explain what an indicator is and analyse results when using an indicator. Describe some examples of neutralisation. Describe the changes to indicators when acids and alkalis are mixed. Explain the changes to indicators in terms of pH when acids and alkalis are mixed.	**P2.6 Magnetism and electricity** **Please refer to Physics Implementation document for details**	**Trip to Science Museum Spring 1**

		behave when heat is applied to them. Describe applications and problems caused by thermal expansion. Use the particle model to explain expansion in solids, liquids and gases. Evaluate the strengths and limitations of particle models. Use the particle model to explain the density differences between gases and calculate density of solids. Describe what is meant by the terms 'concentration' and 'pressure'. Calculate concentrations of solutions Explain observations relating to diffusion in terms of particles. Make predictions, using ideas about particles, about factors affecting the rate of diffusion.			Explain the formation of salt and water during neutralisation, giving some examples of common salts. Predict the reactants or products of different neutralisation reactions. Describe the observations of reactions between acids and metal, and acids and carbonate, that tell us that a chemical change is taking place. Describe what indigestion remedies are and explain how they work. Design an investigation to compare the effectiveness of indigestion remedies. Summarise the reactants and products of complete combustion Compare the reactants and products of complete		

		Describe features of physical and chemical changes, recognising how mass is conserved. Evaluate the particle model in its ability to explain colloids and their properties. Use particle models to explain how the solubility of solids and gases changes with temperature.			and incomplete combustion. Describe how combustion contributes to acid rain and the effects of acid rain.		
Year 8 Skills: What skills will students have developed?	**SMSC:** Science Cultural capital in all lessons. **Literacy:** •Language for learning – keywords shared every lesson. •Comprehension style/ cloze style activities in all lessons. •present reasoned explanations, including explaining data in relation to predictions and hypotheses •identify further questions arising from their results. **Numeracy:** •Graphing skills •understand and use SI units and IUPAC (International Union of Pure and Applied Chemistry) chemical nomenclature use and derive simple equations and carry out appropriate calculations •undertake basic data analysis including simple statistical techniques •evaluate data, showing awareness of potential sources of random and systematic error •apply mathematical concepts and calculate results •present observations and data using appropriate methods, including tables and graphs •interpret observations and data, including identifying patterns and using observations, measurements and data to draw conclusions **GATSBY Benchmark 4:** Introduction to science linked careers at the start of each topic. **Practical Skills/ Working Scientifically:** •ask questions and develop a line of enquiry based on observations of the real world, alongside prior knowledge and experience •make predictions using scientific knowledge and understanding					

	•select, plan and carry out the most appropriate types of scientific enquiries to test predictions, including identifying independent, dependent and control variables, where appropriate •use appropriate techniques, apparatus, and materials during laboratory work, paying attention to health and safety •make and record observations and measurements using a range of methods for different investigations; and evaluate the reliability of methods and suggest possible improvements **Please refer to Physics and Biology Curriculum Maps for Physics and Biology implementation.**						
GCSE Examination Board: OCR (GATEWAY 9-1)							
Year 9 Knowledge: What will students know?	**C1.1 The particle model** Explain the changes of state Explain in terms of the particle model the distinction between physical changes and chemical changes **C1.2 Atomic structure** Explain how the work of Rutherford changed ideas about the atom Describe that the nuclear radius is much smaller than that of the atom and that most of the mass in the nucleus Recall the typical size (order of magnitude) of atoms and small molecules	**C2.1 Purity and separating mixtures** Use word equations to describe chemical reactions calculate the sum of the relative formula masses of reactants and products Suggest separation and purification techniques for mixtures distinguish pure from impure substances Interpret chromatograms and determine Rf values **C2.2 Bonding** Explain how the electronic arrangement of atoms follows a pattern up to the atomic number 20	Explain why the modern periodic table has the elements in order of atomic number Explain how Mendeleev was able to make predictions of as yet undiscovered elements such as eka-silicon Explain how electrons are used in the three types of bonding Draw a dot and cross diagrams for ionic compounds explain the limitations of diagrams and models Describe that metals form giant structures Explain how metal ions are held together	**C3.1 Introducing chemical reactions** State the law of the conservation of mass Explain how to balance equations in terms of numbers of atoms on both sides of the equation Explain that when there is a mass change in a reaction it may be because a gas is being given off Describe the measurement of amounts of substance in moles Calculate the number of moles in a given mass calculate the masses of substances in a balanced symbol equation	Investigate the variables that affect temperature changes in reacting solutions Recognise that energy transfer during a reaction is due to bonds being broken and then new bonds being made Calculate the energy transferred in chemical reactions using bond energies **C3.3 Types of chemical reactions** Describe how to make pure, dry samples of soluble salts Explain how to name a salt Describe the use of universal indicator to measure pH	Explain weak and strong acids by the degree of ionisation Describe neutralisation through the effect on hydrogen ions and pH **C3.4 Electrolysis** Explain the process of the electrolysis of aluminium oxide Use apparatus to electrolyse aqueous solutions in the laboratory Predict the products of the electrolysis of aqueous solutions Explain the electrolysis of copper sulfate using inert electrodes Represent reactions at electrodes by half equations	**Trip to Science Museum Spring 1**

	Calculate the atomic masses of elements from the numbers of protons and neutrons Calculate numbers of protons, neutrons and electrons in atoms given the atomic number and mass number of isotopes	Explain that atoms of metals have 1, 2 or 3 electrons in their outer shell Work out the charge on the ions of metal and non-metals from the group number of the element	Identify small molecules from formulae Identify polymers from formulae **C2.3 Properties of materials** Explain how the properties relate to the bonding in diamond Explain why diamond differs from graphite Describe the structure of graphene Explain the structures and uses of fullerenes	Calculate the masses of reactants and products from balanced symbol equations Calculate the mass of a given reactant or product **C3.2 Energetics** Identify exothermic and endothermic reactions from temperature changes Identify examples of exothermic and endothermic reactions	Use the pH scale to identify acidic or alkaline solutions Investigate pH changes when a strong acid neutralises a strong alkali.		
Year 9 Skills: What skills will students have developed?	**SMSC:** •Science Cultural capital in all lessons. **Literacy:** • language for learning – keywords shared every lesson. • comprehension style/ cloze style activities in all lessons. **Numeracy:** • graphing skills • using SI units and IUPAC chemical nomenclature unless inappropriate • using prefixes and powers of ten for orders of magnitude (e.g. tera, giga, mega, kilo, centi, milli, micro and nano) • interconverting units • using an appropriate number of significant figures in calculations. **GATSBY Benchmark 4:** •Introduction to science linked careers at the start of each topic. **Practical Skills/ Working Scientifically:**						

	•using scientific theories and explanations to develop hypotheses •planning experiments to make observations, test hypotheses or explore phenomena • applying a knowledge of a range of techniques, apparatus, and materials to select those appropriate for experiments • carrying out experiments appropriately, having due regard to the correct manipulation of apparatus, the accuracy of measurements and health and safety considerations • recognising when to apply a knowledge of sampling techniques to ensure any samples collected are representative • making and recording observations and measurements using a range of apparatus and methods • evaluating methods and suggesting possible improvements and further investigations.						
Year 10 Knowledge: What will students know?	**C4.1 Predicting chemical reactions** Describe the unreactivity of the noble gases Explain the trend down Group 0 of increasing boiling point in terms of atomic mass Predict the reactions with water of Group 1 elements lower than potassium Predict and explain the relative reactivity down the groups Explain the trend down the group of increasing reactivity by electron structure Describe the order of reactivity and explain the displacement of halogens Predict the properties of	**C4.2 Identifying the products of chemical reactions** Carry out flame tests and identify the colours of flames of ions Explain how to use sodium hydroxide to test for metal ions Explain the tests for halides and sulfates Describe some instrumental techniques Identify the advantages of instrumental methods compared with the chemical tests **C5.1 Monitoring chemical reactions** Describe the reactant that is used up first in a reaction as the limiting reactant	Calculate the theoretical amount of products from the amounts of reactants Calculate the percentage yield from the actual yield and the theoretical yield Calculate the atom economy of a reaction to form a desired product Explain why a particular reaction pathway is chosen to produce a product given the atom economy, yield, rate, equilibrium position and usefulness of by-products Calculate the volume of a gas at RTP from its mass and relative formula mass Calculate volumes of gases from a balanced equation	Identify which factors affect the rate of reactions Explain how the changes of surface area affect rates Explain how rates are affected by different factors Analyse experimental data on rates of reaction Predict the effects of changing conditions on rates of reactions Explain the effects of changes of factor on rates of reaction using collision theory Identify catalysts in reactions Explain catalytic action Explain activation energy	Identify a reversible reaction Describe how equilibrium is reached **C5.3 Equilibria** Predict the effects of changes on systems at equilibrium Identify reactants and products in a reversible reaction Explain how changing concentrations changes equilibrium Interpret data to predict the effect of a change in concentration Explain how exothermic reactions behave if the temperature of systems at equilibrium changes	**C6.1 Improving processes and products** State examples of natural products that are supplemented or replaced by agricultural and synthetic products Distinguish between finite and renewable resources from given information Extract and interpret information about resources from charts, graphs and tables Describe the process of phytomining and bioleaching Evaluate alternative biological methods of metal extraction Describe the components of a life cycle assessment (LCA) Interpret LCAs of materials or products from information	**Trip to New Scientist Live Autumn 1**

	'unknown' elements from their position in the group Explain that transition metals are less reactive than group 1 metals and form coloured solutions Explain how the reactivity is related to the tendency of the metal to form its positive ion Use the reactivity series to predict displacement reactions Write ionic equations for displacement reactions	Explain the effect of a limiting quantity of a reactant on the amount of products it is possible to obtain, using moles or grams Relate mass, volume and concentration Relate concentration in mol/dm3 to mass and volume describe how to carry out titrations calculate the concentrations in titrations in mol/dm3 and in g/dm3	and a given volume of a reactant or product Identify how to measure the amount of gas given off in a reaction **C5.2 Controlling reactions** Calculate the mean rate of a reaction Draw tangents to the curves as a measure of the rate of reaction		Explain how endothermic reactions behave if the temperature changes Interpret appropriate data to predict the effect of a change in temperature on reactions at equilibrium Predict the effects of changes in pressure Explain why these effects of pressure change occur Apply Le Chatelier's principle to reactions in equilibrium	Carry out a simple comparative LCA for shopping bags	
Year 10 Skills: What skills will students have developed?	**SMSC:** •Science Cultural capital in all lessons. **Literacy:** • language for learning – keywords shared every lesson. • comprehension style/ cloze style activities in all lessons. **Numeracy:** • graphing skills • using SI units and IUPAC chemical nomenclature unless inappropriate • using prefixes and powers of ten for orders of magnitude (e.g. tera, giga, mega, kilo, centi, milli, micro and nano) • interconverting units • using an appropriate number of significant figures in calculations. **GATSBY Benchmark 4:** Introduction to science linked careers at the start of each topic.						

	Practical Skills/ Working Scientifically: •using scientific theories and explanations to develop hypotheses •planning experiments to make observations, test hypotheses or explore phenomena • applying a knowledge of a range of techniques, apparatus, and materials to select those appropriate for experiments • carrying out experiments appropriately, having due regard to the correct manipulation of apparatus, the accuracy of measurements and health and safety considerations • recognising when to apply a knowledge of sampling techniques to ensure any samples collected are representative • making and recording observations and measurements using a range of apparatus and methods • evaluating methods and suggesting possible improvements and further investigations.						
Year 11 Knowledge: What will students know?	**C6.1 Improving processes and products (cont'd)** Describe the composition of common alloys Interpret the composition of other alloys from data Evaluate the uses of other alloys Compare quantitatively the physical properties of materials Compare properties of glass and clay ceramics, polymers, composites and metals Explain how the properties of materials are related to their uses and select appropriate materials	**C6.2 Organic chemistry** Describe why crude oil is a finite resource Identify the hydrocarbons in the series of alkanes Explain the structures and formulae of alkanes Describe the difference between an alkane and an alkene Draw displayed structural formulae of the first four members of the alkenes Explain why alkenes are called unsaturated molecules	Explain how a voltage can be produced by metals in an electrolyte Evaluate the uses of cells Interpret data for the relative reactivity of different metals **C6.3 Interpreting and interacting with Earth systems** Discuss the scale of global climate change Discuss the risk of climate change Discuss the environmental implications of climate change Describe how emissions of carbon dioxide can be reduced	**Year 11 GCSE Revision**	**Year 11 GCSE Exams**	**Year 11 GCSE exams**	**Trip to Kew Gardens Autumn 1**

	Apply the principles of dynamic equilibrium to the Haber process Explain the trade-off between rate of production and position of equilibrium Explain how the commercially used conditions for the Haber process are related to the availability and cost of raw materials and energy supplies, control of equilibrium position and rate		Describe how emissions of methane can be reduced Give reasons why actions on reductions may be limited Explain how waste water is treated Describe how sewage is treated Compare the ease of treating waste, ground and salt water				
Year 11 Skills: What skills will students have developed?	**SMSC:** •Science Cultural capital in all lessons. **Literacy:** • language for learning – keywords shared every lesson. • comprehension style/ cloze style activities in all lessons. **Numeracy:** • graphing skills • using SI units and IUPAC chemical nomenclature unless inappropriate • using prefixes and powers of ten for orders of magnitude (e.g. tera, giga, mega, kilo, centi, milli, micro and nano) • interconverting units • using an appropriate number of significant figures in calculations. **GATSBY Benchmark 4:** Introduction to science linked careers at the start of each topic. **Practical Skills/ Working Scientifically:** •using scientific theories and explanations to develop hypotheses •planning experiments to make observations, test hypotheses or explore phenomena						

	•applying a knowledge of a range of techniques, apparatus, and materials to select those appropriate for experiments •carrying out experiments appropriately, having due regard to the correct manipulation of apparatus, the accuracy of measurements and health and safety considerations •recognising when to apply a knowledge of sampling techniques to ensure any samples collected are representative •making and recording observations and measurements using a range of apparatus and methods •evaluating methods and suggesting possible improvements and further investigations.	

CURRICULUM IMPACT: SCIENCE (CHEMISTRY)

All students will:

Demonstrate a love of science work and an interest in further study and work in this field
Retain knowledge that is pertinent to Science with a real life context through Cultural Capital and exploring science through cross curricular links.
Be able to question ideas and reflect on knowledge.
Be able to articulate their understanding of scientific concepts and be able to reason scientifically using rich language linked to science.
Demonstrate a good application of mathematical skills through their work, organising, recording and interpreting results.
Work collaboratively and practically to investigate and experiment.
By evaluating key theories and studies, students will develop the confidence to develop critical thinking skills · Students will be able plan and design research investigations so that they are both ethical and feasible
Students will be able to use mathematical skills to analyse and interpret data
By an emphasis on carrying out and analysing the results of practical investigations, students will develop curiosity and key scientific skills.
By encouraging students to aim high and evaluate their own investigations, students will develop confidence and resilience.
Demonstrating an increase in their effective use of key scientific terminology, particularly in extended writing pieces.
Extending the length and quality of their scientific explanations, particularly regarding Key stage 4 students' ability to respond to the six-mark questions on their GCSE papers.
Consistently using evidence obtained from scientific diagrams in their explanations.
Discussing ideas and issues such as the ethics associated with Radioactivity, Nuclear reactions and Fossil fuels appropriately and whilst being respectful of others' ideas and opinions.