

Subject: Physics

Year group: 12

Department Curriculum Vision: Department Curriculum Vision: Northwood students will be scientifically literate adults who:

- Can make informed personal decisions
- Engage with scientific news throughout their lives
- Have secure foundational knowledge that can be applied to any context.

	Autumn Term 1	Autumn Term 2
Content: (Know what...)	<u>Section 1:Particles and radiation</u> Ch 1: Matter and radiation Ch 2: Quarks and Leptons Ch 3: Quantum phenomena	<u>Section 2:Waves and radiation</u> Ch 4: Waves Ch 5: Optics
Skills: (know how...)	Demonstration of the range of alpha particles using a cloud chamber, spark counter or Geiger counter. Detection of gamma radiation Cosmic ray showers as a source of high energy particles including pions and kaons; observation of stray tracks in a cloud chamber; use of two Geiger counters to detect a cosmic ray shower.Demonstration of the photoelectric effect using a photocell or an electroscope with a zinc plate attachment and UV lamp. Observation of line spectra using a diffraction grating.	Investigation of two-source interference with sound, light and microwave radiation. Development of knowledge of the characteristics, properties, and applications of travelling waves and stationary waves. Topics treated include refraction, diffraction, superposition and interference.

Key vocabulary	Photons, Quarks, Leptons, Hadrons, Baryons, Mesons, threshold frequency, work function	Transverse, longitudinal, polarisation, fields, oscillation, phase difference, path difference, period,
Mid Term Assessment	End of chapter assessments	End of chapter assessments
End Term Assessment		End of term PPE
	Spring 1	Spring 2

Content: (Know what...)	<u>Section 3: Mechanics and materials</u> Ch 6: Forces in equilibrium Ch 7: On the move Ch 8: Newton's laws of motion Ch 9: Force and momentum Ch 10: Work, energy & power	<u>Section 3: Mechanics and materials</u> Ch 11: Materials <u>Section 4: Electricity</u> Ch 12: Electric current Ch 13: DC circuits
Skills: (Know how...)	Vectors and their treatment are introduced followed by development of the student's knowledge and understanding of forces, energy and momentum. The section continues with a study of materials considered in terms of their bulk properties and tensile strength. As with earlier topics, this section and also the following section Electricity would provide a good starting point for students who prefer to begin by consolidating work. Investigation of the conditions for equilibrium for three coplanar forces acting at a point using a force board. Determine g from a graph. Investigation of the factors that determine the motion of an object through a fluid. Students can apply conservation of momentum and rate of change of momentum to a range of examples.	opportunities for the development of practical skills at an early stage in the course and lays the groundwork for later study of the many electrical applications that are important to society. Investigation of the variation of resistance of a thermistor with temperature. Students can construct circuits with various component configurations and measure currents and potential differences. investigate the behaviour of a potential divider circuit.

Key vocabulary	Scalars, vectors, resolving vectors, forces, displacement, work,	Extension, proportionality, brittle, resistance potential difference, current, electromotive force, internal resistance
Mid Term Assessment	End of chapter assessments	End of chapter assessments
End Term Assessment		End of term PPE
	Summer 1	Summer 2
Content: (Know what...)	<u>Section 6: Further mechanics and thermal physics</u> Ch 17: Motion in a circle Ch 18: Simple harmonic motion	<u>Revision and required practical completion</u>
Skills: (Know how...)	The earlier study of mechanics is further advanced through a consideration of circular motion and simple harmonic motion (the harmonic oscillator). A further section allows the thermal properties of materials, the properties and nature of ideal gases, and the molecular kinetic theory to be studied in depth. Estimate	Uncertainties, range, Reproducibility, repeatability, lines of best fit, Sin and cosine curves, Errors

	the acceleration and centripetal force in situations that involve rotation Data loggers can be used to produce $s - t$, $v - t$ and $a - t$ graphs for SHM. Students should recognise the use of the small-angle approximation in the derivation of the time period for examples of approximate SHM. Investigation of the factors that determine the resonant frequency of a driven system.	
Key vocabulary	Radians, centripetal force, simple harmonic motion, damping, resonance	
Mid Term Assessment	End of chapter assessments	End of year PPE+ End of chapter assessments
End Term Assessment		

Additional information

Homework	Students will be set questions that are in line with the new content being taught. This is supported by recall and practice questions so that foundation knowledge can be cemented. Students will then be required to complete Exam questions once students are comfortable with the foundational skills.
Extra curricular and enrichment opportunities	Students will complete practicals that allow them opportunities to apply the knowledge they have gained.
Useful links that will support learning	https://www.physicsandmathstutor.com/physics-revision https://www.physicsandmathstutor.com/past-papers/a-level-physics/ https://www.savemyexams.com/a-level/physics/aqa/17/ https://senecalearning.com/en-GB/

How parents can support learning	Please support students by making sure they are spending time going over key knowledge and revisiting key definitions. Students should be doing at least 2 hours of extra work on top for each lesson.
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Subject: Biology

Year group: 12

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	Autumn Term 1	Autumn Term 2
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Content: (Know what...)	<u>Section 1: Biological Molecules</u> Ch 1: Biological molecules. Ch 2: Nucleic acids <u>Section 2: cells</u> Ch 3: Cell structure	<u>Section 2: cells</u> Ch4: Transport across cell membranes <u>Section 3: Organisms exchange substances with their environment.</u> Ch 6: Exchange
Skills: (know how...)	Biological Molecules: - Interpret the results of, qualitative tests for reducing sugars, non-reducing sugars and starch. - Use chromatography, with known standard solutions, to separate a mixture of monosaccharides and identify their components. - Produce a dilution series of glucose solution and use colorimetric techniques to produce a calibration curve with which to identify the concentration of glucose in an unknown solution. - Interpret the results of, the emulsion test for lipids. - Interpret the results of, a biuret test for proteins. - Use chromatography with known standard solutions, to separate a mixture of amino acids and identify their components. - Students could be given the hydrogen ion concentration of a solution in order to calculate its pH, using the formula: $\text{pH} = -\log_{10}[\text{H}^+]$ - Students could use incomplete information about the frequency of bases on DNA strands to find the frequency of other bases. Cells	Biological Molecules: - Interpret the results of, qualitative tests for reducing sugars, non-reducing sugars and starch. - Use chromatography, with known standard solutions, to separate a mixture of monosaccharides and identify their components. - Produce a dilution series of glucose solution and use colorimetric techniques to produce a calibration curve with which to identify the concentration of glucose in an unknown solution. - Interpret the results of, the emulsion test for lipids. - Interpret the results of, a biuret test for proteins. - Use chromatography with known standard solutions, to separate a mixture of amino acids and identify their components. - Students could be given the hydrogen ion concentration of a solution in order to calculate its pH, using the formula: $\text{pH} = -\log_{10}[\text{H}^+]$ - Students could use incomplete information about the frequency of bases on DNA strands to find the frequency of other bases. Cells

-All life on Earth exists as cells. These have basic features in common. Differences between cells are due to the addition of extra features. This provides indirect evidence for evolution. All cells arise from other cells, by binary fission in prokaryotic cells and by mitosis and meiosis in eukaryotic cells. All cells have a cell-surface membrane and, in addition, eukaryotic cells have internal membranes. The basic structure of these membranes is the same and enables control of the passage of substances across exchange surfaces by passive or active transport. Cell-surface membranes contain embedded proteins. Some of these are involved in cell signalling – communication between cells. Others act as antigens, allowing recognition of 'self' and 'foreign' cells by the immune system. Interactions between different types of cell are involved in disease, recovery from disease and prevention of symptoms occurring at a later date if exposed to the same antigen, or antigen-bearing pathogen.

-Calculation of a mitotic index.

-Students could determine the water potential of plant tissues using the intercept of a graph of, eg, water potential of solution against gain/loss of mass.

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-Calculation of a mitotic index.

-Students could determine the water potential of plant tissues using the intercept of a graph of, eg, water potential of solution against gain/loss of mass.

Substance exchange

The internal environment of a cell or organism is different from its external environment. The exchange of substances between the internal and external environments takes place at exchange surfaces. To truly enter or leave an organism, most substances must cross cell plasma membranes. In large multicellular organisms, the immediate environment of cells is some form of tissue fluid. Most cells are too far away from exchange surfaces, and from each other, for simple diffusion alone to maintain the composition of tissue fluid within a suitable metabolic range. In large organisms, exchange surfaces are associated with mass transport systems that carry substances between the exchange

		surfaces and the rest of the body and between parts of the body. Mass transport maintains the final diffusion gradients that bring substances to and from the cell membranes of individual cells. It also helps to maintain the relatively stable environment that is tissue fluid.
Key vocabulary	Eukaryotic, prokaryotic, DNA, RNA, Proteins, Polynucleotide, Polymerase, Metabolite, Golgi apparatus, transmission and scanning electron microscopes	Osmosis, ATP, Diffusion, active transport, co-transport, external membranes, semi-conservative, DNA helicase
Mid Term Assessment	End of chapter assessments	End of chapter assessments
End Term Assessment		End of term PPE

	Spring 1	Spring 2
Content: (Know what...)	<u>Section 3: Organisms Exchange Substances with their Environment</u> Ch 7: Mass transport <u>Section 2: cells</u> <u>Ch 5: cell recognition</u>	<u>Section 4: Genetic Information, Variation and Relationships between Organisms</u> Ch 8: DNA, genes & protein synthesis. Ch 9: Genetic diversity <u>Section 5: Energy Transfer in and between organisms</u> Ch11 : Photosynthesis Ch12: Respiration
Skills: (Know how...)	-Students could design and carry out an investigation into the effect of a named variable on human pulse rate or on the heart rate of an invertebrate, such as Daphnia. -Students could be given values of cardiac output (CO) and one other measure, requiring them to change the subject of the equation: $CO = \text{stroke volume} \times \text{heart rate}$ -Students could set up and use a potometer to investigate the effect of a named environmental variable on the rate of transpiration. Students should be able to: • discuss ethical issues associated with the use of vaccines and monoclonal antibodies • evaluate methodology, evidence and data relating to the use of vaccines and monoclonal antibodies.	Biological diversity – biodiversity – is reflected in the vast number of species of organisms, in the variation of individual characteristics within a single species and in the variation of cell types within a single multicellular organism. Differences between species reflect genetic differences. Differences between individuals within a species could be the result of genetic factors, of environmental factors, or a combination of both. A gene is a section of DNA located at a particular site on a DNA molecule, called its locus. The base sequence of each gene carries the coded genetic information that determines the sequence of amino acids during protein synthesis. The genetic code used is the same in all organisms, providing indirect evidence for evolution. Genetic diversity within a species can be caused by gene mutation, chromosome mutation or random factors associated with meiosis and fertilisation. This genetic diversity is acted upon by natural selection, resulting in species becoming better adapted to their environment. Variation within a species can be measured using

		differences in the base sequence of DNA or in the amino acid sequence of proteins. Biodiversity within a community can be measured using species richness and an index of diversity.
Key vocabulary	Osmosis, ATP, Diffusion, active transport, co-transport, external membranes, semi-conservative, DNA helicase, Eukaryotic, prokaryotic, DNA, RNA, Proteins, Polynucleotide, Polymerase, Metabolite, Golgi apparatus, transmission and scanning electron microscopes	ribulose biphosphate, ATP, reduced, NADP, Glycolysis coenzymes, substrates, Microorganisms
Mid Term Assessment	End of chapter assessments	End of chapter assessments
End Term Assessment		End of term PPE
	Summer 1	Summer 2

Content: (Know what...)	<u>Section 4: Genetic Information, Variation and Relationships between Organisms</u> Ch 10: Biodiversity	<u>Section 5: Energy Transfer in and between organisms</u> Ch 13: Energy and ecosystems
Skills: (Know how...)	complete diagrams showing the chromosome content of cells after the first and second meiotic division, when given the chromosome content of the parent cell • explain the different outcome of mitosis and meiosis • recognise where meiosis occurs when given information about an unfamiliar life cycle • explain how random fertilisation of haploid gametes further increases genetic variation within a species. use unfamiliar information to explain how selection produces changes within a population of a species • interpret data relating to the effect of selection in producing change within populations • show understanding that adaptation and selection are major factors in evolution and contribute to the diversity of living organisms. appreciate that advances in immunology and genome sequencing help to clarify evolutionary relationships between organisms. • interpret data relating to similarities and differences in the base sequences of DNA and in the amino acid sequences of proteins to suggest relationships between different organisms within a species and between species • appreciate that gene technology has caused a change in the methods of investigating genetic diversity; inferring DNA differences from measurable or observable characteristics has been replaced by direct investigation of DNA sequences. Knowledge of gene technologies will not be tested. Quantitative investigations of variation within a species involve: • collecting data from random samples • calculating a mean value of the collected data and the	Life depends on continuous transfers of energy. In photosynthesis, light is absorbed by chlorophyll and this is linked to the production of ATP. In respiration, various substances are used as respiratory substrates. The hydrolysis of these respiratory substrates is linked to the production of ATP. In both respiration and photosynthesis, ATP production occurs when protons diffuse down an electrochemical gradient through molecules of the enzyme ATP synthase, embedded in the membranes of cellular organelles. The process of photosynthesis is common in all photoautotrophic organisms and the process of respiration is common in all organisms, providing indirect evidence for evolution. AQA AS and A-level Biology . AS and A-level exams June 2016 onwards. Version 1.5 26 November 2021 Visit for the most up-to-date specification, resources, support and administration 37 In communities, the biological molecules produced by photosynthesis are consumed by other organisms, including animals, bacteria and fungi. Some of these are used as respiratory substrates by these consumers. Photosynthesis and respiration are not 100% efficient. The transfer of biomass and its stored chemical energy in a community from one organism to a consumer is also not 100% efficient

	standard deviation of that mean • interpreting mean values and their standard deviations. Students will not be required to calculate standard deviations in written papers.	
Key vocabulary	mRNA, DNA, RNA, tRNA	ribulose biphosphate, ATP, reduced, NADP, Glycolysis coenzymes, substrates, Microorganisms
Mid Term Assessment	End of chapter assessments	End of chapter assessments
End Term Assessment		End of term PPE

Additional information

Homework	Students will be set questions that are in line with the new content being taught. This is supported by recall and practice questions so that foundation knowledge can be cemented. Students will then be required to complete Exam questions once students are comfortable with the foundational skills.
Extra curricular and enrichment opportunities	Students will complete practicals that allow them opportunities to apply the knowledge they have gained.
Useful links that will support learning	https://senecalearning.com/en-GB/ https://www.physicsandmathstutor.com/biology-revision/
How parents can support learning	Please support students by making sure they are spending time going over key knowledge and revisiting key definitions. Students should be doing at least 2 hours of extra work on top for each lesson.

Subject: Chemistry

Year group: 12

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	Autumn Term 1	Autumn Term 2
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Content:
(Know what...)

Physical Chemistry

Atomic Structure

- Fundamental particles
- Mass number and isotopes
- Electronic configuration

Amount of substance

- Relative atomic mass and relative molecular number
- The mole and Avogadro's constant
- The ideal gas equation
- Empirical and molecular formula
- Balanced equations and associated calculations

Bonding

- Ionic Equations
- Nature of covalent and dative covalent bonds
- Metallic bonding
- Bonding and physical properties
- Shapes and molecules and ions
- Bond polarity
- Forces between molecules

Energetics

- Enthalpy change
- Calorimetry
- Application of Hess's Law
- Bond Enthalpies

Physical Chemistry

Kinetics

- Collision theory
- Maxwell-Boltzmann distribution
- Effect of temperature on rate
- Effect of concentration and pressure
- Catalysts

Equilibria

- Chemical equilibria and Le Chatelier's principle
- Equilibrium constant K_c for homogeneous systems

Redox

- Oxidation states and half equations

Organic

Introduction to organic chemistry

- Nomenclature
- Reaction Mechanisms
- Isomerism

Alkanes

- Fractional distillation of crude oil
- Modification of alkanes by cracking
- Combustion of alkanes
- Chlorination of alkanes

Skills: (know how...)	<u>Physical Chemistry</u> • Interpret simple mass spectra of elements • Calculate relative atomic mass from isotopic abundance, limited to mononuclear ions. • write equations for first and successive ionisation energies • carry out calculations: using the Avogadro constant, using mass of substance, M_r, and amount in moles, using concentration, volume and amount of substance in a solution • Students report calculations to an appropriate number of significant figures, given raw data quoted to varying numbers of significant figures. • Students carry out calculations using numbers in standard and ordinary form, eg using the Avogadro constant • Students carry out calculations with the ideal gas equation, including rearranging the ideal gas equation to find unknown quantities • calculate empirical formula from data giving composition by mass or percentage by mass • calculate molecular formula from the empirical formula and relative molecular mass. • write balanced equations for reactions studied • balance equations for unfamiliar reactions when reactants and products are specified • use balanced equations to calculate: masses, volumes of gases, percentage yields, percentage atom economies, concentrations and volumes for reactions in solutions. • predict the charge on a simple ion using the position of the element in the Periodic Table • construct formulas for ionic compounds. • Use $q = mc\Delta T$ to calculate the molar enthalpy change for a reaction • use Hess's law to perform calculations, including	<u>Physical Chemistry</u> • draw and interpret distribution curves for different temperatures. • use the Maxwell–Boltzmann distribution to explain why a small temperature increase can lead to a large increase in rate. • use a Maxwell–Boltzmann distribution to help explain how a catalyst increases the rate of a reaction involving a gas. • use Le Chatelier's principle to predict qualitatively the effect of changes in temperature, pressure and concentration on the position of equilibrium. • construct an expression for K_c for a homogeneous system in equilibrium • calculate a value for K_c from the equilibrium concentrations for a homogeneous system at constant temperature • perform calculations involving K_c • predict the qualitative effects of changes of temperature on the value of K_c • work out the oxidation state of an element in a compound or ion from the formula • write half-equations identifying the oxidation and reduction processes in redox reactions • combine half-equations to give an overall redox equation <u>Organic</u> • draw structural, displayed and skeletal formulas for given organic compounds • apply IUPAC rules for nomenclature to name organic compounds limited to chains and rings with up to six carbon atoms each • apply IUPAC rules for nomenclature to draw the structure of an organic compound from the IUPAC name limited to chains and rings with up to six carbon atoms each. • write balanced equations for the steps in a free-radical
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calculation of enthalpy changes for reactions from enthalpies of combustion or from enthalpies of formation.

- use mean bond enthalpies to calculate an approximate value of ΔH for reactions in the gaseous phase

mechanism.

Key vocabulary	electrostatic forces, proton number, relative atomic masses, molecular ions, atomic orbital, ionisation energy, empirical formula, molecular formula, stoichiometry, spectator ions, atom economy, lattice dative covalent bonding, lone pair, electronegativity, electron density, polar, Van der Waals, hydrogen bonding, dipole-dipole forces, electron pair repulsion theory, enthalpy change, standard enthalpy of formation, standard enthalpy of combustion, calorimeter, thermochemical cycle, bond dissociation enthalpy, mean bond enthalpy	Maxwell- Boltzmann distribution, dynamic equilibrium,, oxidising agent, reducing agent, redox reactions, spectator ions, half equation, oxidation states, functional group, homologous series, alkanes, saturated hydrocarbons,, fractions, catalyst cracking, incomplete combustion, free radicals,
Mid Term Assessment	Initial Assessment	End of chapter assessments
End Term Assessment		End of chapter assessments
	Spring 1	Spring 2

Content: (Know what...)	<u>Organic</u> Halogenoalkanes • Nucleophilic substitution • Elimination • Ozone depletion Alkene • Structure, bonding and reactivity • Addition reactions of alkenes • Addition polymers	<u>Inorganic</u> Periodicity • Classification • Physical properties of period 3 elements Group 2 • Trends in properties Group 7 • Trends in properties • Use of chlorine and chlorate
Skills: (Know how...)	<u>Organic Chemistry</u> • outline mechanisms by drawing the structures of the species involved and curly arrows to represent the movement of electron pairs. • draw the structures of chain, position and functional group isomers • draw the structural formulas of E and Z isomers • apply the CIP priority rules to E and Z isomers. • outline the nucleophilic substitution mechanisms of these reactions. • outline the mechanisms of these reactions. • use equations, such as the following, to explain how chlorine atoms catalyse the decomposition of ozone. • Outline mechanisms for the electrophilic addition reactions of alkene to form the major and minor products. • draw the repeating unit from a monomer structure • draw the repeating unit from a section of the polymer chain • draw the structure of the monomer from a section of the polymer.	•

Key vocabulary	Nucleophiles, nucleophilic substitution, elimination, electrophiles, electrophilic addition, carbocation, positive inductive effect, monomers,	periodicity, alkaline earth metals, displacement reactions, disproportionation
Mid Term Assessment	End of chapter assessments	End of chapter assessments
End Term Assessment		End of chapter assessments
	Summer 1	Summer 2
Content: (Know what...)	<u>Organic</u> Alcohols • Alcohol production • Oxidation of alcohols • Elimination Organic Analysis • Identification of functional groups by test tube reactions • Mass spectroscopy • Infrared spectroscopy	<u>Organic Chemistry</u> Nomenclature and Isomerism • Naming organic compounds • Optical isomerism NMR • Interpreting H-NMR • Interpreting C-NMR

Skills: (Know how...)	<u>Organic Chemistry</u> - outline the mechanism for the formation of an alcohol by the reaction of an alkene with steam in the presence of an acid catalyst. - write equations for these oxidation reactions (equations showing [O] as oxidant are acceptable) - outline the mechanism for the elimination of water from alcohols. - use precise atomic masses and the precise molecular mass to determine the molecular formula of a compound. - use infrared spectra and the Chemistry Data Sheet or Booklet to identify particular bonds, and therefore functional groups, and also to identify impurities	<u>Organic Chemistry</u> - draw the structural formulas and displayed formulas of enantiomers. - use ^1H NMR and ^{13}C NMR spectra and chemical shift data from the Chemistry Data Booklet to suggest possible structures or part structures for molecules - use integration data from ^1H NMR spectra to determine the relative numbers of equivalent protons in the molecule - use the n+1 rule to deduce the spin-spin splitting patterns of adjacent, non-equivalent protons, limited to doublet, triplet and quartet formation in aliphatic compounds.
Key vocabulary	Anaerobic respiration, carbon neutral, ketones, aldehydes, fingerprint region	Optical isomerism, enantiomers, chiral,
Mid Term Assessment	End of chapter assessments	End of chapter assessments
End Term Assessment		End of term PPE
Additional information		
Homework	Students will be set questions that are in line with the new content being taught. This is supported by recall and practice questions so that foundation knowledge can be cemented. Students will then be required to complete Exam questions once students are comfortable with the foundational skills.	

Extra curricular and enrichment opportunities	Students will complete practicals that allow them opportunities to apply the knowledge they have gained.
Useful links that will support learning	https://www.physicsandmathstutor.com/chemistry-revision/a-level-aqa/ https://www.youtube.com/playlist?list=PLX4e2DxFRGQKmHRsqKUim-3TQ77kYP6Kc
How parents can support learning	Please support students by making sure they are spending time going over key knowledge and revisiting key definitions. Students should be doing at least 2 hours of extra work on top for each lesson.