# Our Lady Queen of Peace
## Catholic Engineering College

## Curriculum Overview

# YEAR 10 SCIENCE

| | Knowledge & Understanding | | | Subject Specific Literacy Development | | Cultural Capital / Enrichment Opportunities |
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| | **Composites (Bigger Picture)** | **Components (Key Concepts)** | **Retrieval Practice Focus** | **Reading for meaning** | **Key Vocabulary** | |
| **Autumn Term (HT1)** | **<u>Paper 1 Biology:</u>**<br><u>Cell Biology</u><br>Cell structure and transport<br>Cell Division | Describe cells as basic structural units of all organisms; adaptations of cells related to the functions; the main sub-cellular structures of Eukaryotic and Prokaryotic cells.<br><br>Understand how microscopy techniques have developed over time<br><br>Use a microscope to make observations of biological specimens and produce labelled scientific drawings (RP1).<br><br>Recognise, draw and interpret images of cells and to interpret diagrams that model diffusion and osmosis (RP2).<br><br>Use models and analogies to develop explanations of how cells divide.<br><br>Evaluate the practical risks and benefits, as well as social and ethical issues, of the use of stem cells in medical research and treatments.<br><br>Describe and explain the need for cellular transportation (diffusion, osmosis, and active transport).<br><br>Describe the three main stages of the cell cycle and the process of mitosis.<br><br>Describe differences between embryonic and adult stem cells. | Fundamentals of cell biology, including the characteristics of living organisms, the levels of biological organisation, and the basic principles of cell theory. | Discovering cells<br><br>The magic of stem cells | Eukaryotic<br>Prokaryotic<br>Mitosis<br>Cell cycle<br>Chromosome<br>Diffusion<br>Osmosis<br>Active transport<br>Concentration gradient<br>Partially permeable membrane | Reading for meaning. Opportunities to share related news stories.<br><br>Historical development of key concepts and discoveries; Students should be familiar with influential scientists, experiments, and milestones in the history of cell biology, such as the discovery of the cell theory, the structure of DNA, and the development of cell culture techniques. |

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| **Autumn Term (HT1))** | **<u>Paper 1 Chemistry:</u>** Atomic Structure and the periodic table. | Define the key terms atom, element, compound and mixtures.<br><br>Describe how compounds are formed and how chemical reactions are identified.<br><br>Describe and label the basic structure of an atom.<br><br>State the charges and mass of protons, neutrons and electrons.<br><br>State why atoms have no overall electrical charge.<br><br>Calculate the number of protons, neutrons and electrons in an atom or ion when given its atomic number and mass number.<br><br>Draw and write the standard electronic configuration notation from a diagram for the first 20 elements.<br><br>Describe and compare the differences between the plum-pudding and the nuclear model of the atom.<br><br>State what isotopes are.<br><br>State how the elements are arranged in the periodic table including chemical symbols and formulae for elements and compounds.<br><br>Describe trends in reactivity for groups 1, 7 and 0.<br><br>Describe the development of the periodic table including Newlands and Mendeleev.<br><br>Describe, explain and give examples of the processes of separation of filtration, crystallisation, simple distillation, fractional distillation and chromatography. | fundamental concepts in atoms, elements, compounds., including the periodic table, chemical bonding, chemical reactions, and the properties of matter. | Mendeleev and Newlands periodic table<br><br>Interpreting and understanding a method | Group<br>Period<br>Atomic number<br>Mass number<br>Isotope<br>Filtration<br>Distillation<br>Chromatography<br>Crystallisation<br>Fractional distillation | Reading for meaning.<br>Opportunities to share related news stories.<br><br>Historical development of atomic theory, from early Greek philosophers to modern scientists like Dalton, Thomson, Rutherford, and Bohr. Understanding the evolution of atomic models and experiments that led to our current understanding of atomic structure.<br><br>Students should understand the historical context in which the periodic table was developed, including the contributions of scientists like Mendeleev and the significance of their work in organising the elements based on their properties |
| **Autumn Term (HT 1)** | **<u>Paper 1 Physics: Energy</u>** | Name and identify stores and transfers for common situations.<br><br>Describe how in all system changes energy is dissipated. | Awareness of different mechanisms of heat transfer, including conduction, | The invisible forces that power or world | Kinetic energy<br>Gravitational potential energy | Reading for meaning. |

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| | Conservation and dissipation of energy<br>Energy transfers by heating<br>Energy resources | Describe how to determine the specific heat capacity of a material (RP14).<br><br>Calculate the amount of energy from given data for gravitational field strength, kinetic energy, elastic potential energy, efficiency and power.<br><br>Describe how energy can be transferred by conduction and how the rate of cooling of a building is affected by the thickness and thermal conductivity of its walls.<br><br>Describe the main energy sources available.<br><br>Distinguish between energy resources that are renewable and energy resources that are non-renewable.<br><br>Compare methods of generating electricity and evaluate their environmental impact.<br><br>Describe how energy is conserved when a transfer occurs. | convection, and radiation, is beneficial. Students should understand how heat transfer occurs and its implications for energy transfer and thermal equilibrium. | – energy transfers.<br><br>Understanding and interpreting methods<br><br>Energy demands data interpretation | Elastic potential energy<br>Power<br>Thermal conductivity<br>Dissipation<br>System<br>Renewable<br>Non-renewable | Opportunities to share related news stories.<br>Potential opportunity for project/visit linked to renewable energy.<br>Students should have an awareness of technological innovations and advancements in energy production, storage, and distribution, such as smart grids, energy-efficient appliances, electric vehicles, and grid-scale energy storage systems. |
| **Autumn Term (HT2)** | **<u>Paper 1 Biology:</u>**<br><u>Organisation</u><br>Organisation and the digestive system<br>Organisation in Animals and Plants | State and arrange the different levels of organisation into order.<br><br>Give functions of cells, tissues, organs, organ systems and organisms using examples.<br><br>Label and describe the structure and function of organs within the digestive system.<br><br>State where the enzymes carbohydrase, protease and lipase are produced and describe what they do.<br><br>Explain the lock and key theory of enzyme action.<br><br>Describe what the products of digestion are used for in the body.<br><br>Describe and explain the effects of changing temperature and pH on enzyme action (RP4). | Students should have a strong grasp of fundamental biological principles, including the characteristics of living organisms, levels of biological organisation, and basic cell biology concepts.<br><br>Students should be familiar with the concept of tissues and organs, including the types of tissues (e.g., epithelial, connective, muscular, nervous) and their functions in various organ systems. | Interpreting enzyme graphs<br><br>Saving lives with science | Denature<br>Active site<br>Substrate<br>Enzyme<br>Stent<br>Statin<br>Transpiration<br>Translocation<br>Phloem<br>Extinction | Reading for meaning.<br>Opportunities to share related news stories. |

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| | | State the reagents used in food tests for starch, glucose, protein and fat and recall what a positive result looks like (RP3).<br><br>Label and describe the structure and function of the circulatory system, including the heart and blood vessels.<br><br>Describe the roles of the different components of blood and explain how they are adapted for their function.<br><br>Evaluate interventions of the heart and the different methods.<br><br>Label and describe the structure and function of the respiratory system including adaptations.<br><br>Label and describe the function of different tissues found in a plant and the leaf.<br><br>Describe how root hair cells, xylem and phloem cells are adapted to their functions.<br><br>Describe and explain how factors such as temperature, light intensity, humidity and air movement affect the rate of transpiration.<br><br>Compare and contrast transpiration and translocation. Explain how the fossil record provides evidence for evolution.<br><br>Define the term extinction and describe factors which can contribute to the extinction of a species.<br><br>Describe Carl Linnaeus' classification system: KPCOFGS.<br><br>Explain why classification systems have developed over the years since Linnaeus.<br><br>Interpret evolutionary trees to extract information about how organisms have changed over time. | | | | |

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| **Autumn Term (HT2)** | **<u>Paper 1 Chemistry:</u>** <u>Bonding, Structure & Properties</u><br>Ionic bonding<br>Covalent bonding<br>Metallic bonding | Describe and explain the three types of strong chemical bond: ionic, covalent and metallic.<br><br>Draw dot and cross diagrams of ionic bonds between elements in group 1 and 7 and 2 and 6.<br><br>Describe how ionic compounds are held together.<br><br>Describe limitations of dot and cross diagrams, ball and stick diagrams and 2 and 3D diagrams of giant ionic structures, particularly NaCl.<br><br>Describe and explain the properties of ionic compounds in terms of high melting point and whether the conduct electricity.<br><br>Draw dot and cross diagrams of simple covalent bonds.<br><br>Describe the difference between covalent bonds and intermolecular forces and link them to melting and boiling point.<br><br>Describe the properties of simple covalent molecules in terms of low melting and boiling point and not conducting electricity.<br><br>Describe and explain in detail the properties of giant covalent structures such as graphite, diamond, and silicon dioxide.<br><br>Recognise fullerenes from diagrams and descriptions of their structure and bonding.<br><br>Describe the structure of metallic bonding and use this to explain the properties.<br><br>Define an alloy and describe how alloys are harder than pure metals. | Students should understand the basic structure of the atom, including the arrangement of subatomic particles (protons, neutrons, and electrons) and their charges. They should also be familiar with the concept of atomic number and mass number.<br><br>Knowledge of the periodic table and its organisation is essential. Students should understand how elements are arranged based on atomic number, and they should be able to identify groups, periods, and trends such as atomic radius and electronic structure. | Properties od molecules data interpretation<br><br>Nanoparticles | Ion<br>Ionic bond<br>Giant ionic lattice<br>Electrostatic force<br>Covalent bond<br>Molecule<br>Giant covalent<br>Metallic bond<br>Intermolecular<br>Delocalised electrons<br>Alloy | Reading for meaning. Opportunities to share related news stories.<br><br>Students should recognise the practical applications of structure and bonding concepts in everyday life, including in materials science, pharmaceuticals, agriculture, and environmental science. Cultural capital involves understanding how chemistry influences various aspects of modern society. |
| **Autumn Term (HT2)** | **<u>Paper 1 Physics:</u>** <u>Particle Model and Matter</u> | Recall and draw simple diagrams to model the difference between solids, liquids and gases.<br><br>Explain the differences in density between the different states of matter in terms of the arrangement of atoms or molecules. | Knowledge of the three states of matter—solid, liquid, and gas—is necessary. Students should understand the characteristics of each state and the | Density Method interpretation<br><br>Uses of pressure | Internal energy<br>Specific latent heat<br>Specific heat capacity<br>Sublimation<br>Temperature | Reading for meaning. Opportunities to share related news stories. |

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| | | Describe in detail how to determine the density of regularly and irregularly shaped objects (RP17).<br><br>Describe how, when substances change state (melt, freeze, boil, evaporate, condense or sublimate), mass is conserved.<br><br>Interpret heating and cooling graphs that include changes of state.<br><br>Distinguish between specific heat capacity and specific latent heat.<br><br>Explain how the motion of the molecules in a gas is related to both its temperature and its pressure.<br><br>Explain qualitatively the relation between the temperature of a gas and its pressure at constant volume. | transitions between them, including melting, freezing, evaporation, condensation, and sublimation. | | Latent heat of fusion<br>Latent heat of vaporisation<br>Mass<br>Volume<br>Density | Students should recognise the practical applications of the particle model and matter concepts in fields such as materials science, chemical engineering, and nanotechnology. |
| **Spring Term (HT3)** | **<u>Paper 1 Biology:</u>**<br><u>Infection and Response</u><br>Communicable disease<br>Preventing and treating disease<br>Non-Communicable disease | Describe the difference between communicable and non-communicable diseases.<br><br>Give examples of types of pathogen which cause disease.<br><br>Explain how bacteria and viruses can make us feel ill.<br><br>Describe the effects of the bacterial diseases salmonella and gonorrhoea and explain how they are spread and treated.<br><br>Describe the effects of the viral diseases measles, HIV and tobacco mosaic virus (TMV) and explain how they are spread and treated.<br><br>Describe the effects of the fungal disease rose black spot and explain how it is spread and treated.<br><br>Describe the effects of the protest disease malaria and explain how it is spread and treated. | Understanding of human health and disease, including risk factors, prevention strategies, and the impact of lifestyle choices on health, contributes to understanding the broader implications of infection and response. | Vaccines and graph interpretation<br><br>From lab to pharmacy | Antibody<br>Antigen<br>Vaccine<br>Antibiotic<br>Antibiotic resistance<br>Herd immunity<br>Non-communicable<br>Pathogen<br>Placebo<br>Vector<br>Malignant<br>Benign | **Epidemiology:** The History of disease and epidemics |

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| | | Describe the non-specific defence mechanisms of the human body found on/in the skin, nose, trachea, bronchi and stomach.<br>Explain the role of the immune system in the defence against disease.<br><br>Describe the role of white blood cells in the immune system.<br><br>Describe the role of vaccinations and explain how they work.<br><br>Describe the action and limitations of antibiotics and explain why the emergence of antibiotic resistant strains of bacteria is a concern.<br><br>Describe the role of painkillers.<br><br>Recall that many traditional drugs were obtained from plants and microbes but modern drugs may be synthesised.<br><br>Describe the stages in the development of a new drug including the stages of preclinical and clinical testing.<br><br>Describe the relationship between disease and health.<br><br>Interpret diagrams and graphs show incidences of disease, including identifying correlations.<br><br>Describe the effects of smoking on health, including the health of unborn babies.<br><br>Describe the effects of poor diet and lack of exercise on health.<br><br>Describe the effects of excessive alcohol on health, including the health of unborn babies.<br><br>Describe the effect of other carcinogens such as ionising radiation on health. | | | | |

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| | | Explain what cancer is and identify risk factors which increase the risk of developing it.<br>Describe the difference between benign and malignant tumours. | | | | |
| **Spring Term (HT3)** | **<u>Paper 1 Chemistry:</u>**<br><u>Chemical Changes</u><br>Reactivity series<br>Making Salts<br>Electrolysis | Explain reduction and oxidation in terms of Oxygen.<br><br>Link reactivity of metals to number of outer shell electrons and how easily they form ions.<br><br>Describe the reactions of metals (K, Na, Li, Ca, Mg, Zn, Fe, Cu) with water and dilute acids and put the metals in order of reactivity.<br><br>Describe what a displacement reaction is and write equations.<br><br>**Explain oxidation and reduction in terms of electrons.**<br><br>**Identify which species have been oxidised and reduced in half equations.**<br><br>State what is produced when acids react with metals, metal oxides, metal carbonates and alkalis.<br><br>Name salts made from hydrochloric acid (HCl), nitric acid ($HNO_3$) and sulfuric acid ($H_2SO_4$) and the metal in the base, alkali or carbonate.<br><br>Use the formulae of common ions to give the formula of salts.<br><br>Describe in detail the preparation of a pure, dry sample of a soluble salt from an insoluble oxide or carbonate (RP8).<br><br>State what ion makes an aqueous solution acidic or alkali and use the pH scale of universal indicator to identify solutions which are acidic, alkali and neutral.<br><br>**Define what is meant by a strong or weak acid and concentrated or dilute acid.** | Students should have a strong grasp of fundamental chemistry principles, including atomic structure, chemical bonding, the periodic table, and balancing equations. | Extracting metals data interpretation<br><br>Electrolysis in industry | Reactivity series<br>Neutralisation<br>Base<br>Alkali<br>Electrolysis<br>Anode<br>Cathode<br>Oxidation<br>Reduction<br>Redox reaction | Reading for meaning.<br>Opportunities to share related news stories. |

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| | | Describe the process and aim of electrolysis.<br><br>Predict the products of electrolysis of molten compounds such as lead bromide and other simple compounds.<br><br>Explain how aluminium is extracted from aluminium oxide including why the electrolyte is a mixture and why the anode needs constantly replacing.<br><br>Predict the products of the electrolysis of aqueous solutions such as NaCl and $CuSO_4$.<br><br>Describe in detail what happens when aqueous solutions are electrolysed using inert electrodes (RP9). | | | | |
| **Spring Term (HT3)** | **<u>Paper 1 Chemistry:</u>**<br><u>Energy Changes</u> | Explain what an endothermic and exothermic reaction is in terms of energy.<br><br>Describe in detail how to Investigate the variables that affect temperature changes in reacting solutions such as acid + metal, Acid + carbonate, neutralisation and displacement (RP10).<br><br>Draw simple reaction profiles (energy level diagrams) for exothermic and endothermic reactions.<br><br>**Describe energy in a reaction relating to energy to break bonds and energy released when making bonds.**<br><br>**Calculate the energy transferred in reactions using bond energies supplied.** | Understanding of the basic concepts of chemical reactions, including reactants, products, chemical equations, and the conservation of mass, is essential. | Reactions for everyday use. | Endothermic<br>Activation energy<br>Reaction profile<br>Bond energy<br>Energy level diagram<br>Temperature change<br>Combustion<br>Neutralisation<br>Calorimetry | Reading for meaning.<br>Opportunities to share related news stories.<br><br>Students should recognise the relationship between energy changes, bond breaking, and bond forming during reactions, linking to real life uses. |
| **Spring Term (Halt term 4)** | **<u>Paper 1 Biology:</u>**<br><u>Bioenergetics</u><br>Photosynthesis<br>Respiration | Describe what the process of photosynthesis.<br><br>Explain the effects of changing light intensity, temperature, carbon dioxide concentration and amount of chlorophyll present on the rate of photosynthesis.<br><br>Draw and interpret graphs which demonstrate the effects of different factors on the rate of photosynthesis. | structure and function, including the anatomy of typical animal and plant cells, the functions of organelles such as mitochondria and chloroplasts, and the basics of cellular | Graph interpretation | Photosynthesis<br>Chlorophyll<br>Limiting factor<br>Respiration<br>Aerobic<br>Anaerobic<br>Mitochondria<br>Lactic acid<br>Oxygen Debt | Reading for meaning.<br>Opportunities to share related news stories. |

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| | | Describe and explain in detail the effects of changing light intensity on the rate of photosynthesis (RP5).<br><br>Describe what the process of aerobic respiration and anaerobic respiration in animals and in plants.<br><br>Describe the changes that happen to heart rate, breathing rate and breathing volume when you exercise.<br><br>Describe what metabolism is and the chemical reactions involved. | respiration and photosynthesis. | | Metabolism | |
| **Summer Term (HT5)** | **<u>Paper 1 Chemistry:</u>**<br><u>Quantitaive Chemistry</u> | State the law of conservation of mass.<br><br>Describe and calculate uncertainty.<br><br>Calculate the relative atomic mass and relative formula mass.<br><br>**Define the Avogadro constant and state what one mole of a substance means relating to atoms, molecules and ions.**<br><br>**Use Mr of a substance to calculate the number of moles and vice versa.**<br><br>**Explain the effect of a limiting quantity of a reactant on the amount of product it is possible to obtain.**<br><br>Calculate the mass of solute in a volume of solution when you know the concentration. | | Concentration data interpretation | Relative formula mass<br>Avogadro constant<br>Concentration<br>Limiting reactant<br>Excess reactant<br>Yield<br>Titration<br>Atom economy<br>Empirical formula | Students should recognise the industrial applications of quantitative analysis in fields such as pharmaceuticals, chemical manufacturing, environmental monitoring, and quality control. |
| **Summer Term (HT5)** | **<u>Paper 1 Physics:</u>**<br><u>Electricity</u><br>Electric circuits<br>Electricity in the home | Draw and interpret circuit symbols and diagrams.<br><br>Describe the difference between series and parallel circuits.<br><br>Explain the design and use of a circuit to measure the resistance of a component by measuring the current | Understanding that matter is composed of atoms, which contain positively charged protons, negatively charged electrons, and neutral neutrons. | Series and parallel application | Potential difference<br>Series circuit<br>Parallel circuit<br>Ammeter<br>Voltmeter<br>Alternating current<br>Direct proportion | Reading for meaning.<br>Opportunities to share related news stories. |

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| | | through, and potential difference across, the component.<br><br>Calculate the currents, potential differences and resistances in dc series circuits.<br><br>Describe in detail how to investigate factors that affect electrical resistance (RP15).<br><br>Explain that, for some resistors, the value of R remains constant but that in others it can change as the current changes.<br><br>Describe in detail how to investigate I-V characteristics of a filament lamp, diode and resistor (RP16).<br><br>Explain the difference between direct and alternating potential difference.<br><br>Describe how different domestic appliances transfer energy from batteries or ac mains to the kinetic energy of electric motors or the energy of heating devices.<br><br>Explain why the National Grid system is an efficient way to transfer energy. | They should know that like charges repel each other, and opposite charges attract.<br><br>Familiarity with the basic components of an electric circuit, including resistors, capacitors, diodes, and switches. | IV graph interpretation | Resistance<br>Coulomb<br>Current<br>Direct current | Students should understand the importance of electrical safety practices, including the hazards of electric shock, fire, and electrical overloads. Students should recognise safety symbols, precautions, and procedures for working with electrical equipment and circuits. |
| **Summer Term (HT6)** | **<u>Paper 1 Physics:</u>**<br><u>Atomic Structure</u><br>Radioactivity | Describe the uses of radiation and evaluate the best sources of radiation to use in a given situation.<br><br>State the names and symbols of common nuclei and particles to write balanced equations that show single alpha (α) and beta (β) decay.<br><br>Explain and determine the concept of half-life and how it is related to the random nature of radioactive decay. | Students should have a strong grasp of the basic structure of the atom, including the arrangement of subatomic particles (protons, neutrons, and electrons) and their charges. They should also understand the concept of atomic number and mass number. | The discovery of nuclear radiation<br><br>SEP ONLY Was Chernobyl an accident? | Isotope<br>Alpha<br>Ionisation<br>Irradiation<br>Contamination<br>Beta<br>Count-rate<br>Decay<br>Gamma<br>Half-life | Reading for meaning. Opportunities to share related news stories.<br><br>Students should recognise the environmental impacts of radioactive contamination and the challenges associated with radioactive waste management and disposal. This should |

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| | | | | | | involve the understanding the risks and regulations associated with nuclear facilities and activities. |

# Key Assessments – Year 10 Science

| When | What will be assessed? | Why is this being assessed? |
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| Half Term 1 | • B2 (Organisation), C2 (Bonding, Structure and Properties) and P1(Energy) are taught from and are continually assessed through Essential Knowledge Checks and Formative assessments, including end of unit assessments. | • Essential Knowledge Checks are our opportunity to look at the work in books and assess the learning taking place so we can address gaps in knowledge early. |
| Half Term 2 | • In HT2 we continue with B2 and P1, start C4 these are continually assessed through Essential Knowledge Checks and Formative assessments, including end of unit assessments. | • To track progress and give teachers and students a clear picture of strengths and weaknesses, which can then be addressed through feedback and students' responses to feedback.<br>• |
| Half Term 3 | • The Mid-Year Exam will assess content covered in the year so far i.e. B1 cells, B2 Organisation C1 Atoms, C2 Bonding Structure and Properties, C4 Chemical Change and P1 Forces, in a mock exam style.<br>• We also start B3 (Infection and Response) and C5 (Energy Changes) this term, which again are assessed through Essential Knowledge checks | • The mid-year supports conversations at parents evening, and setting decisions where applicable, as well as giving students and teachers a quantitative test score so we can trach progress over time<br>• To track progress and give teachers and students a clear picture of strengths and weaknesses, which can then be addressed through feedback and students' responses to feedback. |
| Half Term 4 | • B3 (Infection and Response), C5 (Energy Changes), C3 (Quantitative Chemistry) and P2 (Electricity) are taught this term, which are assessed through Essential Knowledge checks at various intervals and at the end of each topic. | • To track progress and give teachers and students a clear picture of strengths and weaknesses, which can then be addressed through feedback and students' responses to feedback. |
| Half Term 5 | • B3, B4 (Bioenergetics), C3 (Quantitative Chemistry) and P2 are taught this term, which are assessed through Essential Knowledge checks at various intervals and at the end of each topic. | • To track progress and give teachers and students a clear picture of strengths and weaknesses, which can then be addressed through feedback and students' responses to feedback. |

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| Half Term 6 | • The End of Year Exam will take place in Half Term 6, assessing a broad range of content covered in the year so far B1, B2, B3, B4, C1, C2, C3, C4, C5, P1, P2 as well as assessing skills e.g. drawing a graph, safety in the lab etc.<br>• P4 6 (Atoms and Radiation) will be taught in HT as well as revising for the End of Year Exam. | • The End of year guides setting decisions where applicable, as well as giving students and teachers a quantitative test score so we can trach progress over time and against progress targets.<br>• To track progress and give teachers and students a clear picture of strengths and weaknesses, which can then be addressed through feedback and students' responses to feedback. |