Science

CURRICULUM OVERVIEW – YEAR 10 (KS4)

Maximise our potential, to be the best we can be, every day.

Curriculum Overview

Subject: KS4 Science

Year group	Topic and length	Key Words	Key Skills	Key Knowledge	Assessments	Cultural Capital	Links to NC and Spec
10	B1- Cell Biology CS- 9 hours SS- 12 hours	Cells Organelles Nucleus Mitochondria Ribosomes Magnification Microscopes Cancer Mitosis Stem cells Differentiation Diffusion Osmosis Active transport	**WS-** Applying the cycle of collecting, presenting and analysing data Experimental skills and strategies **Maths-** use of standard form, conversion of units **Communication & Literacy-**Using scientific vocabulary, terminology and definitions. Use of prefixes.	Explore how structural differences between types of cells enables them to perform specific functions within the organism. For an organism to grow, cells must divide by mitosis. Understanding of how doctors can repair damaged organs by growing new tissue from stem cells. The transport of substances in plants and animals.	6-mark mid-topic assessment RP: Using a light microscope RP: Investigate bacterial growth [triple only] RP: Investigate osmosis	Refining microscope skills Comparing electron and light microscopes Awareness of macro to micro model Studying disease or problems with organs/systems and changing approaches to solutions with improved Science/ technologies	Cells as the basic structural unit of all organisms; adaptations of cells related to their functions; the main sub-cellular structures of eukaryotic and prokaryotic cells. Stem cells in animals and meristems in plants. The need for transport systems in multicellular organisms, including plants.

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10	C1- Atomic structure & the periodic table CS- 11 hours SS- 11 hours	Atoms Elements Compound Proton Electron Neutron Properties Charge Mass Mendeleev Atomic model	**WS-** Applying the cycle of collecting, presenting and analysing data Experimental skills and strategies **Maths-** use relative atomic mass and atomic number in calculations **Communication & Literacy-** Using scientific vocabulary, terminology and definitions	How the periodic table provides chemists with a structured organisation of the known chemical elements from which they can make sense of their physical and chemical properties. The historical development of the periodic table and models of atomic structure. The arrangement of elements in the modern periodic table and how this can be explained in terms of atomic structure which provides evidence for the model of a	6-mark mid-topic assessment	Studying the work of Scientists throughout history and their impact on current understanding The development of scientific thinking and changing ideas over time	A simple model of the atom consisting of the nucleus and electrons, relative atomic mass, electronic charge and isotopes. The number of particles in a given mass of a substance. The modern Periodic Table, showing elements arranged in order of atomic number. Position of elements in the Periodic Table in relation to their atomic structure and arrangement of outer electrons.

				nuclear atom with electrons in energy levels.			

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10	P1- Energy CS- 11 hours SS- 11 hours	Energy changes Heating Work Forces Electric current Stored energies Power Conservation Closed system Dissipation Efficiency Renewable Non-renewable Transfer	**WS-** Applying the cycle of collecting, presenting and analysing data Experimental skills and strategies **Maths-** substitute numerical values into equations **Communication & Literacy-** Using scientific vocabulary, terminology and definitions	How energy is used to explain ideas about work output, chemical reactions and biological systems. How limits of fossil fuel and global warming are critical problems in the current century and how physicists and engineers work hard to identify alternative energy resources.	6-mark mid-topic assessment RP: Determine specific heat capacity RP: Investigate thermal insulators [triple only]	Usefulness of experimental data in everyday contexts. Discussing issues of energy loss and social responsibility in choosing energy resources.	Energy changes in a system involving heating, doing work using forces, or doing work using an electric current. Calculating the stored energies and energy changes involved power as the rate of transfer of energy. Conservation of energy in a closed system, dissipation. Calculating energy efficiency for any energy transfers. Renewable and non-renewable energy sources used on Earth, changes in how these are used.

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10	B2-Organisation CS- 15 hours SS- 15 hours	Adaptations Functions Sub-cellular Eukaryotic Prokaryotic Stem cells Meristems Enzymes Respiration Aerobic Anaerobic Carbohydrates Proteins Lipids Multicellular Organisms	**WS-** Applying the cycle of collecting, presenting and analysing data Experimental skills and strategies **Maths-** find arithmetic means, use ratios and percentage **Communication & Literacy-** Using scientific vocabulary, terminology and definitions	Human digestive system and how it provides the body with nutrients and about the respiratory system and its role in gas exchange. Understand how damage to these systems is often caused through lifestyle choices. Recognise how a plants transport system is dependent on environmental conditions to ensure reactants for photosynthesis are provided.	6-mark mid-topic assessment RP: Use qualitative reagents to test for nutrients RP: Investigate the effect of pH on enzyme activity	Increasing awareness of health and disease. The capacity to make more informed, science-based food choices to sustain a healthy lifestyle.	The relationship between the structure and functions of the human circulatory system. Enzymes. Factors affecting the rate of enzymatic reactions. The importance of cellular respiration; the processes of aerobic and anaerobic respiration. Carbohydrates, proteins, nucleic acids and lipids as key biological molecules. The impact of lifestyle factors on the incidence of non-communicable diseases.

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10	C2- Bonding CS- 10 hours SS- 13 hours	Particle kinetics Energy Transfers Relative Intermolecular Ionic Covalent Metallic Natural Synthetic Organic Compounds Diamond Graphite Fullerenes Buckyballs Nanotechnology Graphene	**WS-** Applying the cycle of collecting, presenting and analysing data Experimental skills and strategies **Maths-** use of standard form, apply SI units of measurement **Communication & Literacy-** Using scientific vocabulary, terminology and definitions	How chemists use theories of structure and bonding to explain chemical and physical properties of materials. Understand how atoms are arranged in a variety of ways and how this knowledge is used to engineer new materials with desirable properties.	6-mark mid-topic assessment	Studying Graphene as a Manchester discovery and discussing the story of its discovery. Exploring medical applications in relatively new technologies like Nano. STEM careers	Changes of state of matter in terms of particle kinetics, energy transfers and the relative strength of chemical bonds and intermolecular forces. Types of chemical bonding: ionic, covalent, and metallic. Bulk properties of materials related to bonding and intermolecular forces. Bonding of carbon leading to the vast array of natural and synthetic organic compounds that occur due to the ability of carbon to form families of similar compounds, chains and rings. Structures, bonding and properties of diamond, graphite, fullerenes and graphene.

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10	P2- Electricity CS- 18 hours SS- 20 hours	Resistance Current Circuits, Series Live Neutral Earth Power transfer National grid	**WS-** Applying the cycle of collecting, presenting and analysing data Experimental skills and strategies **Maths-** plot variables from data on suitable graphs, change the subject of an equation, substitute values **Communication & Literacy-** Using scientific vocabulary, terminology and definitions	Electric charge is a fundamental property of matter everywhere. Understanding the difference in components, conductors and insulators allowing electric circuits to be built. Students should know that many circuits are powered with mains electricity, how this is transferred to homes via the national grid.	6-mark mid-topic assessment RP: Investigate resistance in circuits RP: Investigate I/V characteristics of given components	Studying the work of Scientists throughout history and their impact on current understanding The development of scientific thinking and changing ideas over time Scientists include Tesla, Ohm, Ampere, Faraday and Edison. STEM careers	Measuring resistance using p.d. and current measurements. Exploring current, resistance and voltage relationships for different circuit elements; including their graphical representations quantity of charge flowing as the product of current and time drawing circuit diagrams. Exploring equivalent resistance for resistors in series. The domestic a.c. supply; live, neutral and earth mains wires, safety measures. power transfer related to p.d. and current, or current and resistance

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10	B3- Infection and response CS- 13 hours SS- 17 hours	Health Disease Communicable HIV/AIDS Non-communicable Bacteria Virus Fungi Pathogen Immune system Lymphocyte Antibody Antibiotic	**WS-** Applying the cycle of collecting, presenting and analysing data Experimental skills and strategies **Maths-** use of standard form, conversion of units **Communication & Literacy-** Using scientific vocabulary, terminology and definitions	To understand the types of pathogens and how these can cause infectious diseases. Recognise how the human body and plants can avoid disease. Pupils should also know how development of drugs and vaccines have enhanced the human body's ability to fight off disease.	6-mark mid-topic assessment	Studying diverse problems like epidemics and pandemics. Debating if Alexander Fleming should have gained the Nobel Prize. Increasing awareness of the awarding of prestigious prizes in science for work done and contributions.	The relationship between health and disease communicable diseases including sexually transmitted infections in humans (including HIV/AIDs). Bacteria, viruses and fungi as pathogens in animals and plants. Body defences against pathogens and the role of the immune system against disease. Reducing and preventing the spread of infectious diseases in animals and plants. The process of discovery and development of new medicines.

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10	C3- Quantitative chemistry CS- 8 hours SS- 12 hours	Mass Isotopes Atomic mass Relative formula mass Empirical formula Compounds Conservation Solutions Concentration, Solute Solvent	**WS-** Applying the cycle of collecting, presenting and analysing data Experimental skills and strategies **Maths-** substitute values into equations, use standard form and appropriate SI units **Communication & Literacy-** Using scientific vocabulary, terminology and definitions	Chemists use quantitative analysis to determine the formulae of compounds and the equations for reactions. Given this information, analysts can then use quantitative methods to determine the purity of chemical samples and to monitor the yield from chemical reactions. Chemical reactions can be classified in various ways. Using chemical equations to provide a means of representing	6-mark mid-topic assessment	Applying and rehearsing key numeracy skills in Chemistry.	Determination of empirical formulae from the ratio of atoms of different kinds. Balanced chemical equations, ionic equations and state symbols. Quantitative interpretation of balanced equations. Concentrations of solutions in relation to mass of solute and volume of solvent.

				chemical reactions.			

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10	P3- The particle model of matter CS- 11 hours SS- 13 hours	Energy Heat transfer JJ Thomson Plum pudding Internal energy Specific heat capacity Specific latent heat Density	**WS-** Applying the cycle of collecting, presenting and analysing data Experimental skills and strategies **Maths-** substitute values into equations, use standard form and appropriate SI units **Communication & Literacy-** Using scientific vocabulary, terminology and definitions	Understand how the particle model is used to predict the behaviour of solids, liquids and gases and this has many applications in everyday life. How it helps us to explain a wide range of observations and used to explain how objects withstand high pressures and temperatures, such as submarines and spacecraft.	6-mark mid-topic assessment	Studying the work of Scientists throughout history and their impact on current understanding The development of scientific thinking and changing ideas over time.	Relating models of arrangements and motions of the molecules in solid, liquid and gas phases to their densities melting, evaporation, and sublimation as reversible changes. Calculating energy changes involved on heating, using specific heat capacity; and those involved in changes of state, using specific latent heat. Links between pressure and temperature of a gas at constant volume, related to the motion of its particles (qualitative).

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10	P4- Atomic structure CS- 8 hours SS- 11 hours	Protons Neutrons Isotope Ionisation Absorption Electron Radioactive Alpha Beta Gamma rays Nuclear Radioactive Half-life Irradiation Contamination Nuclear fission Nuclear fusion	**WS-** Applying the cycle of collecting, presenting and analysing data Experimental skills and strategies **Maths-** substitute values into equations **Communication & Literacy-** Using scientific vocabulary, terminology and definitions	Understand how the atomic model was developed as scientific understanding and experiment design improved. How Ionising radiation is hazardous but can be very useful. Rules for radiological protection were first introduced in the 1930s and subsequently improved. Recognise how, today, radioactive materials are widely used in medicine, industry,	6-mark mid-topic assessment	Acquiring public awareness around radioactivity. Making informed choices about exposure and being aware of risk-benefit formulae which also inform policy. Studying radioactivity over time looking at the contributions of Marie Curie, Becquerel and Ernest Rutherford. STEM careers.	The nuclear model and its development in the light of changing evidence. Masses and sizes of nuclei, atoms and small molecules. Differences in numbers of protons, and neutrons related to masses and identities of nuclei, isotope characteristics and equations to represent changes. Ionisation; absorption or emission of radiation related to changes in electron orbits. Radioactive nuclei: emission of alpha or beta particles, neutrons, or gamma-rays, related to changes in the nuclear mass and/or charge. Radioactive materials, half-life, irradiation, contamination and their associated hazardous effects, waste disposal. Nuclear fission, nuclear fusion and our sun's energy.

				agriculture and electrical power generation.			

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10	B4- Bioenergetics CS- 11 hours SS- 11 hours	Photosynthesis Glucose Starch Cellulose biomass Respiration	**WS-** Applying the cycle of collecting, presenting and analysing data Experimental skills and strategies **Maths-** plot data on suitable graphs **Communication & Literacy-** Using scientific vocabulary, terminology and definitions	Understand how plants harness the Sun's energy in photosynthesis to make glucose. How this is then used as a reactant in aerobic respiration which transfers the energy that the organism needs to perform its functions. Recognise that anaerobic respiration occurs during vigorous exercise. This process will supply energy	6-mark mid-topic assessment RP: Investigating the effect of light intensity on rate of photosynthesis	Wider awareness of the importance of symbiotic relationships between animals and plants. Discussion on the importance of plants and the need for conservation and biodiversity.	Photosynthesis as the key process for food production and therefore biomass for life. The process of photosynthesis. Factors affecting the rate of photosynthesis. The importance of cellular respiration; the processes of aerobic and anaerobic respiration.

				but also causes the build-up of lactic acid in muscles which causes fatigue.			

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10	C4- Chemical changes CS- 19 hours SS- 19 hours	State Acids Reaction Metals Carbonates pH Hydrogen ion Concentration Electrolysis Molten Ionic liquids, Aqueous Reduction Oxidation Oxygen	**WS-** Applying the cycle of collecting, presenting and analysing data Experimental skills and strategies **Maths-** calculate suitable data from appropriate equations to draw conclusions **Communication & Literacy-** Using scientific vocabulary,	How to make predictions about what new substances are formed in chemical reactions. Use knowledge of chemical changes to understand how important resources are extracted from the earth.	6-mark mid-topic assessment RP: Preparation of pure, dry soluble salt RP: Titrations RP: Investigating electrolysis	Learning about the value of ratios using Applying the reactivity series to make informed choices for metals and suitability for different purposes. Exploring extraction and reasons for choosing certain methods for gaining metals from the Earth including Iron.	Determination of empirical formulae from the ratio of atoms of different kinds. Balanced chemical equations, ionic equations and state symbols. Identification of common gases the chemistry of acids; reactions with some metals and carbonates. pH as a measure of hydrogen ion concentration and its numerical scale. Electrolysis of molten ionic liquids and aqueous ionic solutions. Reduction and oxidation in terms of loss or gain of oxygen.

			terminology and definitions				

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10	C5- Energy changes CS- 5 hours SS- 7 hours	Energy Chemical reaction Bonds Exothermic Endothermic Energy level diagram Activation energy Enthalpy	**WS-** Applying the cycle of collecting, presenting and analysing data Experimental skills and strategies **Maths-** analyse data from graphical information **Communication & Literacy-** Using scientific vocabulary,	Recognise that energy changes are an important part of chemical reactions. The interaction of particles often involves transfers of energy due to the breaking and formation of bonds. Understand the interactions between particles to produce heating or cooling effects that are used in a	6-mark mid-topic assessment RP: Investigate variables effecting temperature change	Applying numeracy skills Enhancing problem-solving to draw conclusions Using examples of reactions in different industrial contexts	Measurement of energy changes in chemical reactions (qualitative) Bond breaking, bond making, activation energy and reaction profiles (qualitative)

			terminology and definitions	range of everyday applications.			