



Curriculum Map 2019-20

Subject: Science

B = Biology

C = Chemistry

P = Physics

End Game:

- To develop students who are inquisitive about science and able to apply their scientific knowledge to everyday scenarios.
- To develop competent technical scientists with the relevant laboratory skills.
- To instil a sense of awe and wonder about the world

Challenge:

- Apply understanding to everyday scenarios
- Develop the BIG IDEAS of Science through spiral learning

Skills Developed:

- HSW and Scientific numeracy
- ANALYSE- analyse patterns, discuss limitations, draw conclusions, present data
- COMMUNICATE- communicate ideas, construct explanations, critique claims, justify opinions
- ENQUIRE- collect data, devise questions, plan variables, test hypotheses
- SOLVE- estimate risks, examine consequences, review theories, interrogate sources



	AP1	AP2	AP3
<p>Year 7</p> <p>(groups with work through the topics in rotation to ensure there are no clashes with equipment)</p>	<p>INVESTIGATION HSW INTRO UNIT</p> <p>Cells</p> <ul style="list-style-type: none"> cells as the fundamental unit of living organisms, including how to observe interpret and record cell structure using a light microscope the functions of the cell wall, cell membrane, cytoplasm, nucleus, vacuole, mitochondria and chloroplasts the similarities and differences between plant and animal cells the role of diffusion in the movement of materials in and between cells the structural adaptations of some unicellular organisms the hierarchical organisation of multicellular organisms: from cells to tissues to organs to systems to organisms <p>Movement</p> <ul style="list-style-type: none"> the structure and functions of the human skeleton, to include support, protection, movement and making blood cells biomechanics – the interaction between skeleton and muscles, including the measurement of force exerted by different muscles the function of muscles and examples of antagonistic muscles <p>Speed</p> <ul style="list-style-type: none"> speed and the quantitative relationship between average speed, distance and time ($speed = distance \div time$) the representation of a journey on a distance-time graph relative motion: trains and cars passing one another 	<p>Interdependence</p> <ul style="list-style-type: none"> the interdependence of organisms in an ecosystem, including food webs how organisms affect, and are affected by, their environment, including the accumulation of toxic materials <p>Plant reproduction</p> <ul style="list-style-type: none"> insect pollinated crops the importance of plant reproduction through insect pollination in human food security <p>Voltage + resistance</p> <ul style="list-style-type: none"> potential difference, measured in volts, battery and bulb ratings; resistance, measured in ohms, as the ratio of potential difference (p.d.) to current differences in resistance between conducting and insulating components (quantitative) <p>Current</p> <p>electric current, measured in amperes, in circuits, series and parallel circuits, currents add where branches meet and current as flow of charge</p> <p>Metals and non-metals</p> <ul style="list-style-type: none"> the order of metals and carbon in the reactivity series the use of carbon in obtaining metals from metal oxides the Periodic Table: periods and groups; metals and non-metals the properties of metals and non-metals the chemical properties of metal and non-metal oxides with respect to acidity reactions of acids with metals to produce a salt plus hydrogen <p>Acids and alkalis</p>	<p>Variation</p> <ul style="list-style-type: none"> differences between species the variation between individuals within a species being continuous or discontinuous, to include measurement and graphical representation of variation <p>Human reproduction</p> <ul style="list-style-type: none"> reproduction in humans (as an example of a mammal), including the structure and function of the male and female reproductive systems, menstrual cycle (without details of hormones), gametes, fertilisation, gestation and birth, to include the effect of maternal lifestyle on the foetus through the placenta reproduction in plants, including flower structure, wind and insect pollination, fertilisation, seed and fruit formation and dispersal, including <p>Energy transfers + costs</p> <ul style="list-style-type: none"> energy as a quantity that can be quantified and calculated: the total energy has the same value before and after a change comparing the starting with the final conditions of a system and describing increases and decreases in amounts of energy associated with movements, temperatures, changes in positions in a field, in elastic distortions and in chemical compositions using physical processes and mechanisms, rather than energy, to explain the intermediate steps that bring about such changes



Gravity + Universe

- *gravity force, weight = mass x gravitational field strength (g)*
- *on Earth $g=10 \text{ N/Kg}$*
- *different g on other planets and stars*
- *gravity forces between Earth and Moon,*
- *gravity forces between Earth and Sun (qualitative only)*
- *our Sun as a star, other stars in our galaxy, other galaxies*
- *the seasons and the Earth's tilt, day length at different times of the year, in different hemispheres*
- *the light year as a unit of astronomical distance*

Particle model

- *the properties of the different states of matter (solid, liquid and gas) in terms of the particle model including gas pressure changes of state in terms of the particle model*
- *the difference in arrangements, in motion and in closeness of particles explaining changes of state, shape and density, the anomaly of ice-water transition*
- *conservation of material and of mass, and reversibility, in melting, freezing, evaporation, sublimation, condensation, dissolving*
- *similarities and differences, including density differences, between solids, liquids and gases*
- *Brownian motion in gases*
- *diffusion in liquids and gases driven by differences in concentration*
- *the difference between chemical and physical changes*

Separating mixtures

- *the concept of a pure substance*
- *mixtures, including dissolving*
- *simple techniques for separating mixtures: filtration, evaporation,*

- *defining acids and alkalis in terms of neutralisation reactions*
- *the pH scale for measuring acidity/alkalinity; and indicators*
- *reactions of acids with alkalis to produce a salt plus water*

- *Calculation of fuel uses and costs in the domestic context*
- *comparing energy values of different foods (from labels) (kJ)*
- *comparing power ratings of appliances in watts (W, kW)*
- *comparing amounts of energy transferred (J, kJ, kW hour)*
- *domestic fuel bills, fuel use and costs*
- *fuels and energy resources*

Earth structure

- *Earth*
- *the structure of the Earth*
- *the rock cycle and the formation of igneous, sedimentary and metamorphic rocks*

Sound

- *frequencies of sound waves, measured in hertz (Hz); echoes, reflection and absorption of sound*
- *sound needs a medium to travel, the speed of sound in air, in water, in solids*
- *sound produced by vibrations of objects, in loud speakers, detected by their effects on microphone diaphragm and the ear drum; sound waves are longitudinal*
- *auditory range of humans and animals*

Light

- *the similarities and differences between light waves and waves in matter*
- *light waves travelling through a vacuum; speed of light*
- *the transmission of light through materials: absorption, diffuse scattering and specular reflection at a surface*



	<i>distillation and chromatography the identification of pure substances</i>		<ul style="list-style-type: none">• <i>use of ray model to explain imaging in mirrors, the pinhole camera, the refraction of light and action of convex lens in focusing (qualitative); the human eye</i>• <i>light transferring energy from source to absorber leading to chemical and electrical effects, photo-sensitive material in the retina and in cameras</i>• <i>colours and the different frequencies of light, white light and prisms (qualitative only); differential colour effects in absorption and diffuse reflection</i>
Skills	<ul style="list-style-type: none">- ANALYSE- analyse patterns, discuss limitations, draw conclusions, present data- COMMUNICATE- communicate ideas, construct explanations, critique claims, justify opinions- ENQUIRE- collect data, devise questions, plan variables, test hypotheses- SOLVE- estimate risks, examine consequences, review theories, interrogate sources		
Challenge	<ul style="list-style-type: none">- Apply understanding to everyday scenarios- Develop the BIG IDEAS of Science through spiral learning		
Assessment	<ul style="list-style-type: none">- SOLO assessment for each topic- Open book assessment for each topic to allow students to focus on exam technique- Written assessments for each assessment point which will be synoptic and build knowledge and skills		



<p>Year 8</p> <p>(groups with work through the topics in rotation to ensure there are no clashes with equipment)</p>	<p>Topic(s): INVESTIGATION HSW INTRO UNIT</p> <p>Breathing</p> <ul style="list-style-type: none">the structure and function of the gas exchange system in humans, including adaptations to functionthe mechanism of breathing to move air in and out of the lungs, using a pressure model to explain the movement of gases, including simple measurements of lung volumethe impact of exercise, asthma and smoking on the human exchange system <p>Digestion</p> <ul style="list-style-type: none">content of a healthy human diet: carbohydrates, lipids (fats and oils), proteins, vitamins, minerals, dietary fibre and water, and why each is neededcalculations of energy requirements in a healthy daily dietthe consequences of imbalances in the diet, including obesity, starvation and deficiency diseasesthe tissues and organs of the human digestive system, including adaptations to function and how the digestive system digests food (enzymes simply as biological catalysts)the importance of bacteria in the human digestive systemplants making carbohydrates in their leaves by photosynthesis and gaining mineral nutrients and water from the soil via their roots <p>Contact forces</p>	<p>Topic(s): Respiration</p> <ul style="list-style-type: none">aerobic and anaerobic respiration in living organisms, including the breakdown of organic molecules to enable other chemical processes necessary for lifea word summary for aerobic respirationthe process of anaerobic respiration in humans and micro-organisms, including fermentation, and a word summary for anaerobic respirationthe differences between aerobic and anaerobic respiration in terms of the reactants, the products formed and the implications for the organism <p>Photosynthesis</p> <ul style="list-style-type: none">the reactants in, and products of, photosynthesis, and a word summary for photosynthesisthe dependence of almost all life on Earth on the ability of photosynthetic organisms, such as plants and algae, to use sunlight in photosynthesis to build organic molecules that are an essential energy store and to maintain levels of oxygen and carbon dioxide in the atmosphere <p>the adaptations of leaves for photosynthesis</p> <p>Electromagnetism and Magnetism</p> <ul style="list-style-type: none">magnetic poles, attraction and repulsionmagnetic fields by plotting compass, representation by field linesEarth's magnetism, compass and navigationthe magnetic effect of a current, electromagnets, D.C. motors (principles only) <p>Chemical Energy</p>	<p>Topic(s): Evolution</p> <ul style="list-style-type: none">the variation between species and between individuals of the same species means some organisms compete more successfully, which can drive natural selectionchanges in environment may leave individuals within a species, and some entire species, less well adapted to compete successfully and reproduce, which in turn may lead to extinctionthe importance of maintaining biodiversity and the use of gene banks to preserve hereditary material <p>Inheritance</p> <ul style="list-style-type: none">heredity as the process by which genetic information is transmitted from one generation to the nexta simple model of chromosomes, genes and DNA in heredity, including the part played by Watson, Crick, Wilkins and Franklin in the development of the DNA model <p>Work</p> <ul style="list-style-type: none">simple machines give bigger force but at the expense of smaller movement (and vice versa): product of force and displacement unchanged <p>Heating + cooling</p> <ul style="list-style-type: none">heating and thermal equilibrium: temperature of difference between two objects leading to energy transfer from the hotter to the cooler one, through contact (conduction) or radiation; such transfers tending to reduce the temperature difference: use of insulatorsother processes that involve energy transfer: changing motion, dropping
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	<ul style="list-style-type: none">forces as pushes or pulls, arising from the interaction between two objectsusing force arrows in diagrams, adding forces in one dimension, balanced and unbalanced forcesforces being needed to cause objects to stop or start moving, or to change their speed or direction of motion (qualitative only)change depending on direction of force and its sizemoment as the turning effect of a forceforces: associated with deforming objects; stretching and squashing – springs; with rubbing and friction between surfaces, with pushing things out of the way; resistance to motion of air and waterforces measured in Newtons, measurement of stretch or compression as force is changedforce-extension linear relation; Hooke's Law as a special casework done and energy changes on deformationnon-contact forces: gravity forces acting at a distance on Earth and in space, forces between magnets and forces due to static electricity <p>Pressure</p> <ul style="list-style-type: none">atmospheric pressure, decreases with increase of height as weight of air above decreases with heightpressure in liquids, increasing with depth, upthrust effects, floating and sinkingpressure measured by ratio of force over area – acting normal to any surface <p>Periodic table and Elements</p>	<ul style="list-style-type: none">energy changes on changes of state (qualitative)exothermic and endothermic chemical reactions (qualitative)what catalysts do <p>Types of reaction</p> <ul style="list-style-type: none">chemical reactions as the rearrangement of atomsrepresenting chemical reactions using formulae and using equationscombustion, thermal decomposition, oxidation and displacement reactions	<p>an object, completing an electrical circuit, stretching a spring, metabolism of food, burning fuels</p> <ul style="list-style-type: none">changes with temperature in motion and spacing of particlesinternal energy stored in materials <p>Climate</p> <ul style="list-style-type: none">the carbon cyclethe composition of the atmospherethe production of carbon dioxide by human activity and the impact on the climate <p>Earth resources</p> <ul style="list-style-type: none">Earth as a source of limited resources and the efficacy of recyclingthe composition of the atmospherethe production of carbon dioxide by human activity and the impact on the climate <p>Wave effects</p> <ul style="list-style-type: none">pressure waves transferring energy; use for cleaning and physiotherapy by ultra-sound; waves transferring information for conversion to electrical signals by microphone <p>Wave properties</p> <ul style="list-style-type: none">waves on water as undulations which travel through water with transverse motion; these waves can be reflected, and add or cancel - superposition
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	<ul style="list-style-type: none"> the varying physical and chemical properties of different elements the principles underpinning the Mendeleev Periodic Table the Periodic Table: periods and groups; metals and non-metals how patterns in reactions can be predicted with reference to the Periodic Table a simple (Dalton) atomic model differences between atoms, elements and compounds chemical symbols and formulae for elements and compounds conservation of mass changes of state and chemical reactions 		
Skills	<ul style="list-style-type: none"> ANALYSE- analyse patterns, discuss limitations, draw conclusions, present data COMMUNICATE- communicate ideas, construct explanations, critique claims, justify opinions ENQUIRE- collect data, devise questions, plan variables, test hypotheses SOLVE- estimate risks, examine consequences, review theories, interrogate sources 		
Challenge	<ul style="list-style-type: none"> Apply understanding to everyday scenarios Develop the BIG IDEAS of Science through spiral learning 		
Assessment	<ul style="list-style-type: none"> SOLO assessment for each topic Open book assessment for each topic to allow students to focus on exam technique Written assessments for each assessment point which will be synoptic and build knowledge and skills 		
Year 9 (groups with work through the topics in rotation to ensure there are no clashes with equipment)	<p>Topic(s): GCSE Introduction unit HSW + Scientific Numeracy (10 lessons) B- Cells and Transport (13 lessons)</p> <ul style="list-style-type: none"> Prokaryotic and eukaryotic cells Transport systems in multicellular organisms Growth and development of cells Transport in cells <p>Additional triple- bacterial growth, plant defences and diseases, monoclonal antibodies</p> <p>Atomic Structure + periodic table (12 lessons)</p> <ul style="list-style-type: none"> A simple model of the atom, relative atomic mass, electronic charge and isotopes The modern Periodic Table <p>Additional triple- transition elements</p>	<p>Topic(s): Chemistry of the Atmosphere (10 lessons)</p> <ul style="list-style-type: none"> The composition and evolution of the Earth's atmosphere since its formation Carbon dioxide and methane as greenhouse gases Common atmospheric pollutants and their sources <p>Forces 1+2 (10/16 lessons)</p> <ul style="list-style-type: none"> Forces and their interactions <p>Additional triple- moments, levers, gears</p> <p>Organisation 1 (17 lessons)</p> <ul style="list-style-type: none"> Digestion Enzymes <p>Using Resources (7/16 lessons)</p>	<p>Topic(s): Organisation 2 (17 lessons)</p> <ul style="list-style-type: none"> Human circulatory system Transport systems in plants <p>Waves (8/16 lessons)</p> <ul style="list-style-type: none"> Waves in air, fluids and solids Frequency range of the spectrum Interactions of electromagnetic radiation with matter and their applications <p>Additional triple- sound waves, uses of ultrasound, seismic waves, reflection, refraction, lenses</p> <p>Organic Chemistry (5/16 lessons)</p> <ul style="list-style-type: none"> Carbon compounds both as fuels and feedstock



	<p>Matter (9/13 lessons)</p> <ul style="list-style-type: none">- States of matter and change of state in terms of particle kinetics, energy transfers and the relative strength of chemical bonds and intermolecular forces- Changes of state and the particle model <p>Additional triple- gas pressure and volume</p>	<ul style="list-style-type: none">- Life cycle assessment and recycling- The Earth's water resources and obtaining potable water <p>Additional triple- rusting, alloys, properties of polymers, glass, ceramics, composites, Haber process, making fertilisers in the lab and in industry</p>	<ul style="list-style-type: none">- Fractional distillation of crude oil and cracking <p>Additional triple- alkenes, alcohols, carboxylic acids, esters and their reactions, polymers, natural polymers, polymerisation</p> <p>Bioenergetics (12 lessons)</p> <ul style="list-style-type: none">- Cell metabolism- Importance of photosynthesis <p>Energy (13 lessons)</p> <ul style="list-style-type: none">- Energy transfers- Internal energy, energy transfers and particle motions- Energy changes in a system, and in the ways energy is stored before and after such changes- Conservation, dissipation and national and global energy sources. <p>Work done as force x distance, energy transfer</p> <p>Additional triple- infrared radiation</p> <p>Ecology (17/28 lessons)</p> <ul style="list-style-type: none">- Levels of organisation within an ecosystem- The principle of material cycling- Biodiversity <p>Additional triple- rates of decomposition, trophic levels + biomass, food security, sustainable food production</p>
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Year 10	<p>Topic(s):</p> <p>Infection (16/18 lessons)</p> <ul style="list-style-type: none">- Communicable diseases- Treating, curing and preventing disease- Non-communicable diseases in humans- Health and disease <p>Chemical Analysis (6/15 lessons)</p> <ul style="list-style-type: none">- Assessing purity and separating mixtures- Identification of common gases <p>Additional triple- tests for positive and negative ions, instrumental analysis</p> <p>Rates (10 lessons)</p> <ul style="list-style-type: none">- Factors that influence the rate of reaction, including catalysts- Reversible reactions and the concept of dynamic equilibrium <p>Energy Changes (5/7 lessons)</p> <ul style="list-style-type: none">- Exothermic and endothermic reactions, including reaction profiles <p>Additional triple- chemical cells and batteries, fuel cells</p>	<p>Topic(s):</p> <p>Electricity (20/27 lessons)</p> <ul style="list-style-type: none">- Series and parallel circuits- Domestic uses and safety- Current, potential difference and resistance <p>Additional triple- electrical charges and fields</p> <p>Chemical Changes (18/20 lessons)</p> <ul style="list-style-type: none">- Chemistry of acids- A reactivity series of metals as the tendency of a metal to form its positive ion- Redox reactions(reduction and oxidation)- Electrolysis of various molten ionic liquids and aqueous ionic solutions- Different methods of extracting and purifying metals with reference to a reactivity series with oxygen and the position of carbon within it <p>Reproduction (8/14 lessons)</p> <ul style="list-style-type: none">- The genome and gene expression- Inheritance <p>Additional triple- protein synthesis, mutations</p> <ul style="list-style-type: none">-	<p>Topic(s):</p> <p>Radiation (6/10 lessons)</p> <ul style="list-style-type: none">- Nuclear atom and isotopes- Absorption and emission of ionizing radiations and of electrons and nuclear particles <p>Additional triple- nuclear radiation in medicine, nuclear fusion and fission, nuclear issues</p> <p>Bonding (14/15 lessons)</p> <ul style="list-style-type: none">- Structure and bonding of carbon- Different kinds of chemical bonds: ionic, covalent and metallic bonding <p>Additional triple- nanoparticles</p> <p>Homeostasis (15/22 lessons)</p> <ul style="list-style-type: none">- Nervous coordination and control in humans- Hormonal coordination and control in humans- Homeostasis in Humans <p>Additional triple- brain, eye, problems with the eye, plant hormones, controlling body temperature, removing waste products, kidney, kidney failure</p> <p>Space (0/6 lessons)</p> <p>Additional triple- formation of the solar system, history of a star, planets, satellites and orbits, expanding universe, beginning and future of the universe</p>
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<p>Year 11</p>	<p>Topic(s): Forces 3- motion (20 lessons) - Speed and velocity, speed as distance over time; acceleration; distance-time and velocity-time graphs - Forces, accelerations and Newton’s laws of motion - Safety in public transport Additional triple- using conservation of momentum, impact forces, safety first Variation and Evolution (7/9 lessons) - Selective breeding and gene technology - Variation and evolution Additional triple- cloning, history of genetics, Darwin, evolution and speciation Quantitative Chemistry (9/13 lessons) - Conservation of mass and the quantitative interpretation of balanced equations - Use of amount of substances in relation to masses of pure substances Additional triple- yield, titrations, calculations Magnetism (8/13 lessons) - Permanent and induced magnetism, magnetic forces and fields - Magnetic effects of currents and the motor effect Additional triple- electromagnets in devices, generator effect, ac generator, transformers</p>	<p>Topic(s): Biology Threshold Concepts (20 Lessons) - Cells - Transport - Homeostasis Chemistry Threshold Concepts (20 Lessons) - Atoms - Elements - Periodic table - Reaction Physics Threshold Concepts (20 Lessons) - Forces - Energy - Movement</p>	<p>Topic(s):</p>
<p>Skills</p>	<ul style="list-style-type: none"> - Complete REQUIRED PRACTICALS which will be assessed in the GCSE exam - HSW and Scientific numeracy - ANALYSE- analyse patterns, discuss limitations, draw conclusions, present data - COMMUNICATE- communicate ideas, construct explanations, critique claims, justify opinions - ENQUIRE- collect data, devise questions, plan variables, test hypotheses - SOLVE- estimate risks, examine consequences, review theories, interrogate sources 		
<p>Challenge</p>	<ul style="list-style-type: none"> - Apply understanding to everyday scenarios - Develop the BIG IDEAS of Science through spiral learning 		
<p>Assessment</p>	<ul style="list-style-type: none"> - Fortnightly AO1 quizzes - SOLO assessment for each topic - Open book assessment for each topic to allow students to focus on exam technique - Written assessments for each assessment point which will be synoptic and build knowledge and skills 		