

Year 7: Curriculum Intent		
The intent of the Year 7 curriculum is to build on knowledge acquired in Key Stage 2 and introduce pupils to the different areas of science at the Kingsway school: - in Biology - Cells and Systems, Plants and the Environment, and Variation and Inheritance. - in Chemistry - Particles and Matter, Chemical reactions, and Earth and Atmosphere. - in Physics - Forces and Motion, Energy, and Waves. - and across all three sciences - how to Work Scientifically. Pupils will be taught key knowledge and skills in both theory and practical science. They will learn about the scientific method, how to keep safe and how to draw valid conclusions from data.		
Year 7 Biology Essential Knowledge Summary		
Schemata 1: Cells and Systems	Schemata 2: Cells and Systems	Schemata 3: Plants and the environment
Composite Knowledge: Pupils will gain a fundamental understanding of the structure of animal and plant cells, the structures they contain, the function of each of those parts and how they can look different as specialised cells. Component Knowledge: Foundational Knowledge: Declarative Knowledge: - Label the parts of an animal cell and explain what the parts do. - Label parts of a plant cell and explain what the parts do. - Recall given specialised cells. - Recall the hierarchy of organisation in multicellular organisms. - Label the parts of a light microscope - Define diffusion - Explain the difference between unicellular and multicellular organisms. Procedural Knowledge: - Describe how to set up a light microscope to observe plant and animal cells. - Describe how to prepare a microscope slide - Follow a method to observe cells under the microscope to identify the different parts. Upper Hierarchical Knowledge Structure and function: Explain how the structures of plant and animal cells are related to their functions, identifying similarities and differences. Systems: Explain how cells are organised as systems containing specialised structures that work together. Structure and function: Explain how specialised cell structures are adapted to enable specific functions. Cause and effect: Explain how changes in cell structures result in differences in their ability to carry out particular functions. Scale: Calculate magnification to compare the size of biological structures across different scales, from cells to larger organisms. Systems and interdependence: Describe diffusion as a process that allows substances to move between cells and their environment, supporting the functioning of living systems. Cause and effect: Explain how differences in concentration cause particles to move and how this affects gas exchange. Stability and equilibrium: Explain how diffusion helps maintain balanced conditions within cells and organisms. Working Scientifically Making a microscope slide: To make a specimen slide and observe under a light microscope. WSAN 1 make and record observations and measurements and present data using appropriate methods including tables with repeat measurements.	Composite Knowledge: Pupils will gain a fundamental understanding of the reproductive systems in humans. Component Knowledge: Foundational Knowledge: Declarative Knowledge: - Label the parts of the male reproductive system. - Label the parts of the female reproductive system. - Define puberty. - Define fertilisation and explain where it takes place. - Define the menstrual cycle. - Define gestation and birth Procedural Knowledge: - Explain why the changes happen during puberty. - Describe the functions of different parts of the reproductive systems. - Explain what happens during the different stages of the menstrual cycle and why it happens. - Explain what fertilisation is and why it happens - Explain what is happening during the different stages of birth and why they happen . - Explain whether substances are passed from the mother to the foetus or not. - Use a diagram to show stages in development of a foetus from the production of sex cells to birth. Upper Hierarchical Knowledge. Change over time: Explain how changes during the menstrual cycle affect the likelihood of pregnancy at different stages. Systems: Explain how interactions between reproductive hormones and reproductive organs control the menstrual cycle and fertility. Cause and effect: Explain how changes in hormone levels cause changes in ovulation and the probability of fertilisation. Structure and function: Explain how the structures and functions of the male and female reproductive systems are linked to fertility. Cause and effect: Explain how changes or disruptions to reproductive structures and processes can affect fertility. Systems: Describe how multiple organs and hormones work together as a reproductive system. Change over time: Identify and describe the sequence of events that occur during the menstrual cycle. Systems: Explain how hormonal changes coordinate events within the reproductive system over time.	Composite Knowledge: Pupils will gain a fundamental understanding of the reproductive system in plants and the interdependence within an ecosystem. Component Knowledge: Foundational Knowledge: Declarative Knowledge: - Recall that plants have adaptations to disperse seeds using wind, water or animals. - Identify parts of the flower and link their structure to their function. - Recall that plants reproduce sexually to produce seeds, which are formed following fertilisation in the ovary. - Recall that organisms in a food web (decomposers, producers and consumers) depend on each other for nutrients. So, a change in one population leads to changes in others. - Recall that the population of a species is affected by the number of its predators and prey, disease, pollution and competition between individuals for limited resources such as water and nutrients. Procedural Knowledge: - Describe the main steps that take place when a plant reproduces successfully. - Suggest how a plant carried out seed dispersal based on the features of its fruit or seed. - Explain why seed dispersal is important to survival of the parent plant and its offspring. - Describe how a species' population changes as its predator or prey population changes. - Explain effects of environmental changes and toxic materials on a species' population. - Combine food chains to form a food web. Explain issues with human food supplies in terms of insect pollinators. Upper Hierarchical Knowledge Structure and function: Explain how differences in the structures of wind and insect pollinated plants are adaptations linked to their method of pollination. Interdependence: Explain how plant structures are related to interactions between plants and their pollinators or environment. Cause and effect: Explain how selecting plants with desirable characteristics and controlling pollination can cause changes in the characteristics of future generations. Change over time: Explain how selective breeding changes populations over multiple generations. Interdependence: Explain how reproduction and inheritance influence the characteristics of plant populations. Structure and function: Explain how specific plant structures are adapted to increase the success of reproduction.

Modelling diffusion: 1. Using skittles to model the movement of colour in water. 2. Agar Jelly and acid. WSAN 1 make and record observations and measurements and present data using appropriate methods including tables with repeat measurements. To be revisited in Year 9, to look at surface area to volume ratio and diffusion. Observing specimen under a microscope- Observe amoeba under the microscope. Making observational drawings. WSAN 1 make and record observations and measurements and present data using appropriate methods including tables with repeat measurements.	Cause and effect: Explain how contraception and fertility treatments influence reproductive processes by changing specific biological factors. Systems: Explain how interventions affect interactions between hormones, reproductive organs and reproductive processes. Stability and equilibrium: Explain how contraception can maintain conditions that prevent pregnancy and how fertility treatments can restore successful reproductive processes. Interdependence: Explain how the health of a developing foetus depends on interactions between the foetus, placenta and mother's body. Cause and effect: Predict how harmful substances can affect foetal development. Systems: Explain how substances absorbed by the mother can affect the developing reproductive system of the foetus. Working Scientifically Interpretation of a graph detailing the menstrual cycle: WS12 interpret observations and data, including identifying patterns and using observations, measurements and data to draw conclusions. RSE Link The main changes which take place in males and females, and the implications for emotional and physical health. The key facts about puberty, the changing adolescent body, including brain development. About menstrual and gynaecological health, including what is an average period, period problems such as premenstrual syndrome, heavy menstrual bleeding, endometriosis, and polycystic ovary syndrome (PCOS), and when to seek help from healthcare professionals. The facts about reproductive health, including fertility and menopause, and the potential impact of lifestyle on fertility for men and women. The facts about the full range of contraceptive choices, efficacy and options available. There are choices in relation to pregnancy. Pupils should be given medically and legally accurate and impartial information on all options, including keeping the baby, adoption, abortion and where to get further help. How to get further advice, including how and where to access confidential sexual and reproductive health advice and treatment.	Cause and effect: Develop an argument linking structural adaptations to successful pollination, fertilisation and offspring production. Interdependence: Explain how organisms depend on interactions within food webs and how introducing a new species can disrupt existing relationships. Systems: Explain how changes to one part of a food web can affect other parts of the ecosystem. Stability and equilibrium: Predict how ecosystems may respond to disturbances and whether populations may become balanced at a new level. Interdependence: Explain how toxic substances can move through food chains and affect organisms at different trophic levels. Scale: Explain how concentrations of substances can increase from microscopic processes within organisms to impacts on whole populations and ecosystems. Cause and effect: Explain how exposure to toxic substances can lead to harmful effects on organisms. Cause and effect: Use evidence from data to explain factors that may have caused changes in species populations. Change over time: Explain how populations change over time due to environmental factors, competition, predation or human activity. Systems: Explain how changes within ecosystems can affect populations through interconnected relationships. Working Scientifically Observing abiotic and biotic factors (Woodlice behaviour within a choice chamber): WSAN 1 make and record observations and measurements and present data using appropriate methods including tables with repeat measurements select appropriate apparatus and techniques based on accuracy and precision for an investigation within the laboratory. Plant Dissection: Applying the understanding of the structure of a plant, to label a plant specimen: WS8 make and record observations Helicopter seed dispersal investigation: WSAN 1 make and record observations and measurements and present data using appropriate methods including tables with repeat measurements. The use of quadrats to estimate the abundance of plant species: WSSK 4 select and use appropriate apparatus and sampling techniques for field and laboratory work
Year 7 (biology) Final Composite Knowledge End Point		
- Label the structures found in animal and plant cells. - Explain the functions of the structures in animal and plant cells. - Compare the structures in animal and plant cells. - Explain how the roles of the specialised cells- sperm, egg, muscle, ciliated cells and how they are adapted to their function. - Label the parts of the male and female reproductive system. - Explain where fertilisation takes place in the female reproductive system and where a foetus develops. - Describe each stage of the menstrual cycle. - Label the parts of a plant. - Explain how reproduction takes place in a plant. - Interpret a food chain. - Interpret a food web.		

Year 7 Chemistry Essential Knowledge Summary		
Schemata 1: Particles and Matter 1	Schemata 2: Particles and Matter 2	Schemata 3: Chemical Reactions

Composite Knowledge: Pupils will gain fundamental knowledge about particles and matter. They will be able to apply the particle model to explain or describe properties of different states of matter Component Knowledge: Foundational Knowledge: Declarative Knowledge: - Name the states of matter. - Give examples of solids, liquids and gases. - Know the of pure substance. - Name the different changes of state. - Draw particle arrangements of solids, liquids and gases Procedural Knowledge: - Recognise changes of state from particle diagrams and be able to name changes of state from diagrams - Label a Bunsen burner - Describe how to turn a Bunsen burner on safely - Collect data from practical - Plot a graph - Draw before and after diagrams of particles to explain observations about changes of state, gas pressure and diffusion. Upper Hierarchical Knowledge Structure and function: Explain how the arrangement and movement of particles determine the properties of solids, liquids and gases. Cause and effect: Explain why differences in particle arrangement and spacing cause materials to have different properties, such as the ability of gases to be compressed. Scale: Explain how observations at the macroscopic scale can be explained by the movement of particles at the microscopic scale. Cause and effect: Explain how random particle motion causes diffusion. Systems: Explain diffusion as the movement of particles within and between systems until they are evenly distributed. Cause and effect: Explain how particle collisions with the walls of a container cause gas pressure and predict how changes in temperature or volume affect pressure. Energy: Explain how changes in particle energy influence the frequency and force of collisions. Structure and function: Explain how the arrangement, spacing and movement of particles determine the observable properties of each state of matter. Scale: Use the particle model to explain macroscopic properties by considering microscopic particle behaviour. Energy: Explain how energy transferred to or from particles causes changes of state. Change over time: Explain how substances change state as particle energy changes over time. Cause and effect: Explain how changes in particle energy result in melting, freezing, boiling and condensation. Working Scientifically Boiling experiment: WSAT 2 identify hazards and risks and suggest appropriate ways to reduce the risks Modelling the Particle model WSSK 1 develop a line of enquiry based on observations of the real world, and make predictions based on their prior knowledge and scientific understanding	Composite Knowledge: Pupils will gain fundamental knowledge about particles and matter. They will be able to apply the particle model to explain or describe properties of different states of matter Component Knowledge: Foundational Knowledge: Declarative Knowledge: - Know the concept of pure substance. - Define filtration - Define Evaporation - Know what a mixture is - Define separation - Identify chromatography from a diagram - Define solute, solvent, solution and saturated solution Procedural Knowledge: - Carry out simple separation techniques such as chromatography - Carry out filtration - Carry out evaporation Upper Hierarchical Knowledge Systems: Explain how distillation separates substances within a mixture by exploiting differences in boiling points. Energy: Explain how energy transfer causes evaporation and condensation during distillation. Cause and effect: Explain how heating and cooling lead to the separation of different substances. Systems: Plan investigations that use appropriate separation techniques to isolate substances from mixtures. Cause and effect: Explain how the physical properties of substances determine the effectiveness of different separation methods. Structure and function: Select equipment based on its role in carrying out the separation process. Structure and function: Explain how the magnetic properties of iron allow it to be separated from sulfur. Cause and effect: Explain how differences in physical properties determine whether substances can be separated using a magnet. Scale: Use chromatograms to infer the composition of mixtures by interpreting evidence that represents particle-level differences in solubility and attraction. Cause and effect: Explain how differences in the properties of substances cause them to travel different distances during chromatography. Cause and effect: Select and justify the most appropriate separation technique based on the physical properties of the substances in the mixture. Systems: Explain how different separation methods are designed to isolate components within a mixture. Working Scientifically Separating Mixtures (iron filings and sand) WSSK 1 develop a line of enquiry based on observations of the real world, and make predictions based on their prior knowledge and scientific understanding Separating mixtures (chromatography, filtration and evaporation): WSSK 3 select appropriate apparatus and techniques based on accuracy and precision for an investigation within the laboratory	Composite Knowledge: Pupils will gain a fundamental understanding of the range of chemical reactions, chemical analysis and apply this to predict the products of a reaction. Component Knowledge: Foundational Knowledge: Declarative Knowledge: - Hazard symbols and their importance - defining acids and alkalis in terms of neutralisation reactions - Identifying household acids and alkalis - the pH scale for measuring acidity/alkalinity; and indicators - reactions of acids with alkalis to produce a salt plus water - displacement reactions - reactions of acids with metals to produce a salt plus hydrogen - the properties of metals and non-metals - the order of metals and carbon in the reactivity series Procedural Knowledge: - Identify the hazards from a range of substances - Test and identify a range of household acids and alkalis - Use indicators and pH meter to identify substances - Make an indicator (red cabbage) - Make a salt - Use patterns of reactivity to make predictions for chemical reactions - Predict the formulae for products of reactions between acids and metals, or acids and bases - Describe in detail what happens to particles in a chemical reaction, compare and contrast physical and chemical reactions Upper Hierarchical Knowledge Cause and effect: Explain how recognising hazards and applying appropriate safety precautions reduces the likelihood and consequences of chemical risks. Systems: Explain how laboratory safety procedures work together to minimise risk during practical investigations. Structure and function: Explain how indicators are designed to reveal differences in acidity and alkalinity through colour changes. Cause and effect: Explain how changes in pH cause indicators to change colour. Scale: Use the pH scale to compare the relative acidity and alkalinity of substances. Cause and effect: Explain how differences in hydrogen ion concentration affect pH values and chemical behaviour. Cause and effect: Explain how reactions between acids and metals or bases result in hydrogen ions being replaced to form salts. Systems: Explain salt formation as part of a system of predictable chemical reactions. Cause and effect: Predict the products of chemical reactions by applying patterns of chemical behaviour. Systems: Explain how atoms are rearranged into new substances during reactions while conserving matter. Energy: Explain how chemical reactions involve energy being transferred to or from the surroundings. Cause and effect: Explain how different reaction types produce different products. Systems: Represent reactions using symbol equations that show conservation of atoms. Structure and function: Explain how the properties of metals determine their uses and
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		are related to their position in the reactivity series. ● Cause and effect: Explain how a metal's reactivity influences its suitability for different applications. ● Scale: Explain chemical and physical changes using the particle model. ● Systems: Explain how atoms are rearranged during chemical reactions but remain unchanged in physical changes. ● Cause and effect: Explain why chemical reactions produce new substances whereas physical changes do not. ● Cause and effect: Use evidence to distinguish between physical and chemical changes by identifying whether new substances are formed. ● Change over time: Explain how materials undergo reversible or irreversible changes. ● Scale: Relate observable changes to particle-level processes. Working Scientifically Red cabbage indicator: House acids and alkalis: ● WSAN 1 make and record observations and measurements and present data using appropriate methods including tables with repeat measurements Properties of metals ● WSSK 3 select appropriate apparatus and techniques based on accuracy and precision for an investigation within the laboratory Reactivity of metals with acid: ● WSSK 2 identify independent, dependent and control variables and use these to plan and carry out a range of investigations to test a prediction, considering [repeatability and reproducibility within their plan Making salts WSSK 3 select appropriate apparatus and techniques based on accuracy and precision for an investigation within the laboratory
Year 7 (Chemistry) Final Composite Knowledge End Point		
● Name the states of matter and changes of state. ● Apply the particle model to explain or describe properties of different states of matter ● Be able to describe examples of the range of chemical reactions. Carry out various types of chemical analysis. ● Apply this to predict the products of a reaction. ● Collect data from practical ● Categorise substances as strong or weak acids and alkalis using pH values ● Predict the formulae for products of reactions between acids and metals, or acids and bases		

Year 7 Physics Essential Knowledge Summary		
Schemata 1: Forces & Motion	Schemata 2: Energy	Schemata 3: Waves
Composite Knowledge: Pupils will gain fundamental knowledge about forces and forces affect motion. They will be able to use graphs to analyse motion and calculate speed. Component Knowledge: Foundational Knowledge: Declarative Knowledge: ● What does a force cause ● State the difference between mass and weight. ● Examples of contact forces. ● Example of non-contact forces. ● The equation for speed. Procedural Knowledge: ● Calculate the resultant force on an object ● Calculate speed. ● Calculate weight.	Composite Knowledge: Pupils will gain a fundamental understanding of energy stores and transfers and how energy is transferred by heating. Component Knowledge: Foundational Knowledge: Declarative Knowledge: ● Name and describe energy stores. ● Name and describe energy transfers. ● Define conduction. ● Define convection. ● Define thermal radiation. ● State the law of conservation of energy. Procedural Knowledge: ● Describe changes to energy stores.	Composite Knowledge: Pupils will gain fundamental knowledge on the different types of waves; how sound waves travel and how sound waves interact with matter. Component Knowledge: Foundational Knowledge: Declarative Knowledge: ● Name the types of waves. ● State how sound travels. ● State the human range of hearing. ● Define ultrasound. ● State uses of ultrasound. Procedural Knowledge: ● Compare types of waves. ● Use the terms pitch and volume to describe sounds.

• Draw free body diagrams. • Describe the motion from free body diagrams. • Interpret distance/time graphs. Upper Hierarchical Knowledge • Change over time: Analyse motion by interpreting how distance, speed and position change over time using graphs. • Cause and effect: Explain how changes in the gradient of a graph represent changes in motion. • Scale: Interpret motion across different spatial and temporal scales using appropriate units and graphical representations. • Systems: Apply the mathematical relationship between speed, distance and time to describe motion within a physical system. • Cause and effect: Use the relationship between speed, distance and time to predict how changing one variable affects the others. • Scale: Calculate and compare motion using appropriate units and conversions. Working Scientifically Friction / drag experiment: • WSSK 1 develop a line of enquiry based on observations of the real world, and make predictions based on their prior knowledge and scientific understanding Distance/time graphs: • WSAN 2 use basic data analysis to calculate means, plot graphs with line of best fit and use this data to draw conclusions	• Describe how to increase or decrease the transfer of energy by heating. Upper Hierarchical Knowledge • Stability and equilibrium: Explain how thermal equilibrium is reached when there is no net transfer of energy between objects at different temperatures. • Energy: Explain how energy is transferred from hotter objects to cooler objects until thermal equilibrium is established. • Cause and effect: Explain how temperature differences cause energy to be transferred between objects. • Scale: Relate the macroscopic observation of temperature change to microscopic changes in particle energy. • Energy: Explain how energy is transferred between stores through pathways such as heating, mechanical work and electrical work. • Systems: Explain energy transfers within and between systems while recognising that energy is conserved. • Cause and effect: Explain how differences in temperature, force or electrical potential cause energy to be transferred. Working Scientifically Energy in food experiment: • WSSK 3 select appropriate apparatus and techniques based on accuracy and precision for an investigation within the laboratory Conduction (demo – metal rod): • WSAN 3 relate results to predictions and hypotheses, giving reasoned explanations, and identify further questions from their results Convection (demo – convection current): • WSAN 3 relate results to predictions and hypotheses, giving reasoned explanations, and identify further questions from their results Radiation / colour: • WSAN 1 make and record observations and measurements and present data using appropriate methods including tables with repeat measurements	• Interpret oscilloscope traces. Upper Hierarchical Knowledge • Structure and function: Explain how the properties and characteristics of waves, including frequency, wavelength and amplitude, determine their behaviour and effects. • Cause and effect: Explain how changes in frequency, wavelength and amplitude cause changes in observable wave properties, such as pitch and energy transfer. • Energy: Explain how waves transfer energy without transferring matter. • Scale: Relate measurements of wavelength and frequency at the wave scale to the effects observed in everyday situations. Working Scientifically Human range of hearing: • WSAN 4 evaluate the reliability of methods and data, suggesting possible improvements for the method to minimize sources of random and systematic error
Year 7 (physics) Final Composite Knowledge End Point • Describe and give examples of forces and state how forces affect motion. • Analyse motion graphs and discuss the forces involved and they affect motion. • Calculate speed, distance or time using the relevant equation. • Name and give examples of energy stores & transfers and describe simple energy transfers. • Describe how energy is transferred by heating. • Name and give examples of different types of waves. • Describe how sound waves travel and how they interact with matter.		

Year 8: Curriculum Intent			
The intent of the Year 8 curriculum is to build on knowledge acquired in Year 7 and both broaden and deepen pupil knowledge in the different areas of science at the Kingsway school: • in Biology - Cells and Systems, Plants and the Environment, and Variation and Inheritance. • in Chemistry - Particles and Matter, Chemical reactions, and Earth and Atmosphere. • in Physics - Forces and Motion, Energy, and Waves. • and across all three sciences - how to Work Scientifically. Pupils will be taught key knowledge and skills in both theory and practical science. They will learn about the scientific method, how to keep safe and how to draw valid conclusions from data.			
Year 8 Biology Essential Knowledge Summary			
Schemata 1: Cells and Systems	Schemata 2: Cells and Systems	Schemata 3a: Plants and the environment	Schemata 3b: Cells and Systems
<u>Composite Knowledge:</u> Pupils will gain fundamental knowledge about diet and the human digestive system and how food can be tested experimentally. <u>Component Knowledge:</u> Foundational Knowledge: Declarative Knowledge: • Recall the components that make up a balanced diet. • Evaluate how different lifestyles • Recall issues related to unhealthy diets. • Label the parts of the digestive system. • Explain the structure and function of each part of the digestive system. • Describe the role of bacteria and enzymes in the digestive system. Procedural Knowledge: • Describe possible health effects of unbalanced diets from data provided. • Calculate food requirements for a healthy diet, using information provided. • Describe how organs and tissues involved in digestion are adapted for their role. • Describe the events that take place in order to turn a meal into simple food molecules inside a cell. <u>Upper Hierarchical Knowledge</u> • Critique claims for a food product or diet by analysing nutritional information. • Make deductions from medical symptoms showing problems with the digestive system. <u>Working Scientifically</u> Testing food for starch, proteins and glucose: • WSAN 1 make and record observations and measurements and present data using appropriate methods including tables with repeat measurements. Modelling the path of digestion from gum to bum: - WS5 make predictions using scientific knowledge and understanding Modelling the small intestine using visking tubing:	<u>Composite Knowledge:</u> Pupils will gain an understanding of the structure of the human body, the role of the respiratory system considering health implications. <u>Component Knowledge:</u> Foundational Knowledge: Declarative Knowledge: • Recall the parts of the skeletal system. • Describe the role of joints and muscles. • Recall the components of inhaled and exhaled air. • Recall the parts of the gas exchange system. • Define diffusion. • Define the process of respiration. • Recall the word equation for aerobic respiration. • Recall the products of anaerobic respiration. • Recall the word equation for anaerobic respiration. • Explain what an antagonistic muscle is. Procedural Knowledge: • Describe how parts of gas exchange system are adapted to their function. • Use word equations to describe aerobic and anaerobic respiration. • Explain how specific activities involve aerobic or anaerobic respiration. <u>Upper Hierarchical Knowledge</u> • Suggest how organisms living in different conditions use respiration to get their energy. • Describe similarities and differences between aerobic and anaerobic respiration. <u>Working Scientifically</u> Investigating antagonistic muscles in worms. • WSSK 3 select appropriate apparatus and techniques based on accuracy and precision for an investigation within the laboratory Investigating breathing rate- Huff and Puff investigation. • WSSK 2 identify independent, dependent and control variables and use these to plan and carry out a range of investigations to test a prediction, considering repeatability and reproducibility within their plan.	<u>Composite Knowledge:</u> Pupils will gain an understanding of the process of photosynthesis that takes place in a plant and how the structure of the leaf is adapted to support this. <u>Component Knowledge:</u> Foundational Knowledge: Declarative Knowledge: • Recall where photosynthesis takes place in a plant. • Recall the function of the chloroplast. • Recall the products produced by photosynthesis • Recall the photosynthesis word equation. • Label the parts of a leaf. • Recall the minerals required by a plant for healthy growth. Procedural Knowledge: • Explain the function of the stomata in a leaf. • Describe ways in which plants obtain resources for photosynthesis. • Explain why other organisms are dependent on photosynthesis. • Sketch a line graph to show how the rate of photosynthesis is affected by changing conditions, including limiting factors. • Use a word equation to describe photosynthesis in plants and algae. <u>Upper Hierarchical Knowledge</u> • Suggest how particular conditions could affect plant growth. • Suggest reasons for particular adaptations of leaves, roots and stems. • Compare the movement of carbon dioxide and oxygen through stomata at different times of day. <u>Working Scientifically</u> Testing a leaf for starch: • WSAT 2 identify hazards and risks and suggest appropriate ways to reduce the risks. Investigating plant mass and gas exchange in a plant. (Washing line and vaseline): - WSSK 2 identify independent, dependent and control variables and use these to plan and carry out a range of investigations to test a prediction, considering	<u>Composite Knowledge:</u> Pupils will gain fundamental knowledge of how microbes cause disease, how disease can be prevented and how drugs affect the body. <u>Component Knowledge:</u> Foundational Knowledge: Declarative Knowledge: • Recall the difference between medicinal and recreational drugs. • State the 3 types of pathogens and give examples • State how the body prevents microbes from entering • Pupils will be able to identify uses of microbes in the real world Procedural Knowledge: • Describe the effect of alcohol and smoking on behaviour, health and the effect on conception and pregnancy. • Describe how communicable diseases can be spread • Explain how microbes cause illness. • Describe how the immune system and medical treatments prevent disease <u>Upper Hierarchical Knowledge</u> • Explain how recreational drugs might affect different body systems. • Explain how vaccinations prevent infections • Explain the role of anaerobic respiration in the production of beer and bread • Explain how white blood cells produce antibodies to fight off infection • Describe how antibiotic resistance develops due to the overuse of antibiotics <u>Working Scientifically</u> Fermentation of yeast: • WSAN 3 relate results to predictions and hypotheses, giving reasoned explanations, and identify further questions from their results Investigating the effect of washing your hands with soap: • WSSK 2 identify independent, dependent and control variables and use these to plan and carry out a range of investigations to test a prediction, considering

- WSS make predictions using scientific knowledge and understanding RSE Link How to maintain healthy eating and the links between a poor diet and health risks, including tooth decay and cancer. Eating disorders (additional content).	Investigating the effect of exercise on heart rate: WSAN 1 make and record observations and measurements and present data using appropriate methods including tables with repeat measurements Anaerobic respiration in yeast: WSSK 3 select appropriate apparatus and techniques based on accuracy and precision for an investigation within the laboratory RSE Link The characteristics of a healthy lifestyle, including physical activity and maintaining a healthy weight, including the links between an inactive lifestyle and ill health, including cancer and cardiovascular ill-health. Factual information about the prevalence and characteristics of more serious health conditions. Physical activity can promote wellbeing and combat stress.	repeatability and reproducibility within their plan. Investigating photosynthesis: Comparing different sizes of leaves and the production of oxygen: WSSK 3 select appropriate apparatus and techniques based on accuracy and precision for an investigation within the laboratory	repeatability and reproducibility within their plan. RSE Link How the different sexually transmitted infections (STIs), including HIV/AIDs, are transmitted, how risk can be reduced through safer sex (including through condom use) and the importance of and facts about testing. The prevalence of STIs, the impact they can have on those who contract them and key facts about treatment. How the use of alcohol and drugs can lead people to take risks in their sexual behaviour. The facts about which drugs are illegal, the risks of taking illegal drugs, and potential health implications including the link to mental health. The law relating to the supply and possession of illegal substances. The physical and psychological risks associated with alcohol consumption and what constitutes low risk alcohol consumption in adulthood. The physical and psychological consequences of addiction, including alcohol dependency. The dangers of drugs which are prescribed but still present serious health risks. The facts about the multiple serious harms from smoking tobacco (particularly the link to lung cancer), the benefits of quitting and how to access support to do so. The facts about the risks of nicotine and non-nicotine vaping, including potential harm to the developing adolescent brain. Personal hygiene, germs including bacteria, viruses, how they are spread, treatment and prevention of infection, and about antibiotics. The facts and science relating to immunisation, vaccination and antimicrobial resistance.
Year 8 (biology) Final Composite Knowledge End Point			
- Recall the parts of a balanced diet. - Describe the journey of food along the digestive system. - Describe how villi in the small intestine is adapted to it’s function. - Describe how enzymes break down food in simple steps. - Explain the importance of bacteria in breaking down food. - Define diffusion - Label the parts of the breathing system - Recall the aerobic word equation - Recall the anaerobic word equation. - Label joints, ligaments, muscles and bone on a given diagram. - Define an antagonistic muscle. - Recall the function of the chloroplast. - Recall the photosynthesis equation. - Describe the optimum conditions needed for photosynthesis. - Label the structure of a leaf.			

- Describe how smoking and alcohol affects human behaviour and the effect on conception and pregnancy. - Recall the difference between medicinal and recreational drugs. - State the 3 types of pathogens and give examples - State how the body prevents microbes from entering - Recall 3 uses of microbes.	
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Year 8 Chemistry Essential Knowledge Summary		
Schemata 1: Earth and Atmosphere 1	Schemata 2: Particles and Matter	Schemata 3: Earth and Atmosphere 2
Composite Knowledge: Pupils will learn how the earth is structured and how the atmosphere evolved. Pupils will link increasing levels of carbon dioxide to the greenhouse effect and climate change Component Knowledge: Foundational Knowledge: Declarative Knowledge: - the composition of the Earth - the composition of the atmosphere - the rock cycle and the formation of igneous, sedimentary and metamorphic rocks - the carbon cycle - the production of carbon dioxide by human activity and the impact on climate. - properties of ceramics, polymers and composites (qualitative).. Procedural Knowledge: - Compare the different layers of the Earth in terms of their properties - Testing the properties of all three types of rock - Testing the properties of ceramics, polymers and composites - Investigating crystal formation of igneous rocks Upper Hierarchical Knowledge - Describe the composition of the atmosphere in terms of abundance of components. - Explain the properties of all types of rocks and how they’re linked to their formation - Explain changes in the levels of carbon dioxide using stages of the carbon cycle - State the impacts of increasing carbon dioxide levels in the atmosphere. - Explain the properties of ceramics, polymers and composites Working Scientifically Igneous rock crystal formation experiment: WSSK 1 develop a line of enquiry based on observations of the real world, and make predictions based on their prior knowledge and scientific understanding comparing properties of rocks: WSAN 1 make and record observations and measurements and present data using appropriate methods including tables with repeat measurements	Composite Knowledge: Pupils learn the fundamentals of the periodic table and be able to start to use the periodic table to predict element properties Component Knowledge: Foundational Knowledge: Declarative Knowledge: - Differences between atoms, elements and compounds - chemical symbols and formulae for elements and compounds - the varying physical and chemical properties of different elements - the Periodic Table: periods and groups; metals and non-metals - how patterns in reactions can be predicted with reference to the Periodic Table - the principles underpinning the Mendeleev Periodic Table Procedural Knowledge: - Demo of alkali metal reactions - Investigating properties of elements, mixtures and compounds Upper Hierarchical Knowledge - explain why certain elements are used for a given role in terms of its properties and compare the properties and uses of different elements. - Differentiate elements from compounds when given names and properties. - Use particle diagrams to explain why a compound has different properties to the elements in it - explain how the position of an element in the periodic table can be used to predict its properties Working Scientifically Demo of alkali metals in water: WSAN 3 relate results to predictions and hypotheses, giving reasoned explanations, and identify further questions from their results metals and non metals: WSSK 1 develop a line of enquiry based on observations of the real world, and make predictions based on their prior knowledge and scientific understanding History and development of periodic table: WSAT 1 explain how scientific methods and theories have developed, as new evidence and ideas are taken into account by the scientific community (e.g. the development of the periodic table)	Composite Knowledge: Pupils will learn how the earth is structured and how the atmosphere evolved. Pupils will link increasing levels of carbon dioxide to the greenhouse effect and climate change Component Knowledge: Foundational Knowledge: Declarative Knowledge:. - properties of ceramics, - properties of polymers - Properties of composites (qualitative). - Recall the 8 planets in the solar system - Recall objects and entities found in the solar system - Recall the seasons on earth - Name the phases of the moon Procedural Knowledge: - Testing the properties of ceramics, polymers and composites - Explaining how we get summer and winter on earth - Ordering the size of objects in the universe - Describing night and day Upper Hierarchical Knowledge - Explain the properties of ceramics, polymers and composites - Explaining why we get phases of the moon - Describe the appearance of planets or moons from diagrams showing their position in relation to the Earth and Sun. - Explain why places on the Earth experience different daylight hours and amounts of sunlight during the year. - Describe how space exploration and observations of stars are affected by the scale of the universe. - Explain the choice of particular units for measuring distance Working Scientifically comparing data of planets: WSAN 1 make and record observations and measurements and present data using appropriate methods including tables with repeat measurements
Year 8 (Chemistry) Final Composite Knowledge End Point		
- Define Element, compound and mixtures - Know symbols for common elements on the periodic table - Know the difference between a period and group - Link Mendeleev’s ideas to the modern periodic table - Use knowledge of the periodic table to make predictions about different elements. - Will have knowledge of displacement reactions - Know the properties of metals and non metals - Know what combustion and oxidation reactions are - Know and describe the layered structure of the earth - Know what sedimentary, igneous and metamorphic rocks are - Be able to carry out investigations into properties of different rocks. - Begin to explain how the earth's atmosphere has developed - Know what the solar system consists of - Order objects in size in our universe		

- Know how we get night and day on the earth
- Know how we get seasons on earth
- Be able to explain why we see phases of the moon

Year 8 Physics Essential Knowledge Summary		
Schemata 1: Energy Composite Knowledge: Pupils learn the fundamental parts of electricity (current, potential difference, resistance) and how they work together to produce energy changes. Component Knowledge: Foundational Knowledge: Declarative Knowledge: • Name / draw circuit symbols. • Define current and state how to measure it. • Define potential difference and state how to measure it. • State the difference between series and parallel circuits. Procedural Knowledge: • Measure current and potential difference. • Calculate resistance. • Predict the current in a circuit. • Predict the potential difference in a circuit Upper Hierarchical Knowledge • Use series and parallel circuit diagrams to predict current and potential difference. Working Scientifically Building circuits: • WSAN 1 make and record observations and measurements and present data using appropriate methods including tables with repeat measurements. • Investigating resistance of a wire	Schemata 2: Forces & Motion Composite Knowledge: Pupils will learn how magnets work and how they are used. Pupils will apply knowledge of particle theory to explain pressure and changes in density. Pupils will be able to calculate pressure and density using both primary and secondary data. Component Knowledge: Foundational Knowledge: Declarative Knowledge: • Draw magnetic fields. • Identify magnetic materials. • State useful features of an electromagnet. • Define pressure. • Describe the motion of particles in solids, liquids, and gases. • State the equation for density. Procedural Knowledge: • Describe how to change the strength of an electromagnet. • Describe how magnets and magnetic materials interact. • Calculate pressure. • Describe how the motion and energy of particles changes during changes of state. • Compare the density of different materials. Upper Hierarchical Knowledge • Link the features of an electromagnet to its properties. Working Scientifically Shape of magnetic field: • WSSK 3 select appropriate apparatus and techniques based on accuracy and precision for an investigation within the laboratory Strength of an electromagnet: • WSSK 2 identify independent, dependent and control variables and use these to plan and carry out a range of investigations to test a prediction, considering repeatability and reproducibility within their plan Calculate pressure: • WSAN 1 make and record observations and measurements and present data using appropriate methods including tables with repeat measurements Measuring density: • WSSK 3 select appropriate apparatus and techniques based on accuracy and precision for an investigation within the laboratory	Schemata 3: Waves Composite Knowledge: Pupils will learn how light waves travel and how light waves interact with matter. Component Knowledge: Foundational Knowledge: Declarative Knowledge: • Label a ray diagram. • Measure angles with a protractor. • State the law of reflection. • Define the terms: ‘transparent’, ‘translucent’ & ‘opaque’. • State the seven colours of the visible spectrum. • State the three primary colours of light. • State the three secondary colours of light. Procedural Knowledge: • Draw ray diagrams to show reflection and refraction. • Use ray diagrams to show how images are formed. • Explain why objects appear a particular colour in white light, in coloured light or when using a filter. Upper Hierarchical Knowledge • Gain knowledge of refraction to predict how lenses affect light. Working Scientifically Reflection & refraction: • WSAN 1 make and record observations and measurements and present data using appropriate methods including tables with repeat measurements
Year 8 (physics) Final Composite Knowledge End Point		
• Use measurements of current and potential difference to find the resistance of a component. • Explain how the shape of the magnetic field affects forces of attraction or repulsion. • Describe how magnetic fields interact. • Link features of an electromagnet to its properties. • Use knowledge of the arrangement and motion of particles in states of matter and during changes of state to properties of the material including density and pressure. • Use measurements to find the density of an object. • Use measurements to find the pressure exerted by an object. • Predict the current in series and parallel circuits • Predict the potential difference in series and parallel circuits. • Explain refraction and predict how lenses affect light using knowledge of refraction. • Explain the appearance of objects in different coloured light.		

Year 9: Curriculum Intent			
The intent of the Year 9 curriculum is to build on knowledge acquired in both Year 7 and Year 8 and prepare pupils for the final steps before undertaking GCSE science. They will increase the depth and breadth of their knowledge and build strong links in learning to consolidate prior learning and secure the foundations for GCS science. Pupils will continue to study the different areas of science: • in Biology - Variation and Inheritance. • in Chemistry - Chemical reactions. • in Physics - Forces and Motion and Energy. • and across all three sciences - how to Work Scientifically. Pupils will be taught key knowledge and skills in both theory and practical science. They will learn about the scientific method, how to keep safe and how to draw valid conclusions from data.			
Year 9 Biology Essential Knowledge Summary			
Schemata 1: Variation and Inheritance	Schemata 2: Cells and Systems B1 Cell Structure and Cell Division	Schemata 3: Cells and Systems B1 Cell Transport	Schemata 4: Plants and the Environment- B4 Bioenergetics
Composite Knowledge: Pupils will be able to describe how a species varies and the genetic involvement of this at a cellular level. Component Knowledge: Foundational Knowledge: Declarative Knowledge: • Recall the definition of variation (within a species). • Recall the two causes of variation within a species. • Recall the definition of inheritance. • Describe DNA. • Recall the 4 Scientists involved in the discovery of DNA. • Recall adaptations in animals. • Recall that variation in a species is important for the survival of a species, helping it to avoid extinction in an always changing environment. • Recall the definition of natural selection. • Recall the definition of biodiversity. • Recall where genetic material is found within a cell. • Recall what a chromosome is. • Recall the definition of a gamete. Procedural Knowledge: • Determine whether characteristics are inherited, environmental or both. • Plot bar charts or line graphs to show discontinuous or continuous variation data. • Research the work on the 4 Scientists involved in the discovery of DNA. • Explain how variation helps a particular species in a changing environment. • Explain how characteristics of a species are adapted to particular environmental conditions. • Use evidence to explain why a species has become extinct or changed over time. • Explain how a lack of biodiversity affects an ecosystem. Upper Hierarchical Knowledge • Use the ideas of variation to explain why one species may adapt better than another to environmental change. • Critique a claim that a particular characteristic is inherited or environmental. • Determine animal adaptations as structural, functional and behavioural. • Predict and explain the changes in a population over time due to natural selection.	Composite Knowledge: Pupils will gain a further understanding of cells and cell division and how cells can be visualised effectively under a microscope. Component Knowledge: Foundational Knowledge: Declarative Knowledge: • Define the term eukaryotes and prokaryotes. • Describe the structure and function of organelles found in animals and plant cells. • Describe the structure of a bacterial cell. • Identify parts of a light microscope. • Explain why a cell is specialised and give examples. • Recall the definition of a stem cell. • Recall where stem cells are found. • Recall the definition of cell differentiation. • Recall what undifferentiated cells are. • Describe what plant meristem are and where they are found. • Recall why cell division takes place. • Recall the definitions of the words: DNA, chromosomes, genes, mitosis. • Recall the definition of magnification and resolution. • Recall the magnification (IAM) formula. Procedural Knowledge: • Use knowledge of cells to arrange order of magnitude. • Compare the two types of microscopes in terms of resolution and magnification. • Describe what cell differentiation is. • Describe the differences between embryonic and adult stem cells and give their uses. • Compare eukaryotic and prokaryotic cells. • Describe the process of binary fission. • Calculate bacterial growth. • Describe the steps involved in mitosis. • Explain the process of therapeutic cloning. • Explain how surface area to volume ratio varies depending on the size of an organism. • Rearrange the IAM equation to find magnification or actual size of a cell. • Make a specimen slide safely, view a slide, draw accurate observations and calculate the magnification used.	Composite Knowledge: Pupil will gain a further understanding of cell transport methods; diffusion, osmosis and active transport and apply these methods to unfamiliar situations. Component Knowledge: Foundational Knowledge: Declarative Knowledge: • Define osmosis • Define diffusion. • Define isotonic, hypertonic and hypertonic solutions. • Give examples of substances that diffuse into and out of cells. • Define active transport. Procedural Knowledge: • Explain the factors that effect the rate of diffusion. • Apply understanding of osmosis to movement of water in animal and plant cells. • Calculate and compare surface area: volume ratios. • Explain how the small intestine and roots and leaves in plants, are adapted for exchange of substances. • Describe and explain how an exchange surface is made more effective. • Apply knowledge of osmosis to unfamiliar situations and make predictions. Upper Hierarchical Knowledge • Use a microscope with graticule to measure cells and calculate their real size. • Interpret graphs to explain what the compensation point means. • Explain how particles move across the cell membrane by carrier proteins. Working Scientifically Building on knowledge from Year 7: Modelling diffusion: 1. Using skittles to model the movement of colour in water. 2. Agar Jelly and acid. • WSAN 1 make and record observations and measurements and present data using appropriate methods including tables with repeat measurements. Investigate osmosis- calculating difference in mass and percentage difference in mass (including the calculation of a mean): • WSAN 2 use basic data analysis to calculate means, plot graphs with line of best fit and use this data to draw conclusions.	Composite Knowledge: Pupils will gain an understanding of photosynthesis in plants, the process where they use light to make sugar from carbon dioxide and water. You will also look at respiration and how all living organisms use respiration to transfer the energy they need to carry out the reactions required for life. Component Knowledge: Foundational Knowledge: Declarative Knowledge: • Recall the part of the cell where photosynthesis takes place. • Recall the word equation for photosynthesis. • Explain the factors that effect photosynthesis. • Recall the 5 uses of glucose (CROPS). • Recall the word equation for aerobic and anaerobic respiration in animal and plants. • Understand how breathing rate and heart rate increase with exercise. • Define and give examples of metabolic reactions. Procedural Knowledge: • Explain where the energy for the cell reactions comes from, and how proteins and fats are made. • Explain the gases released from a plant at different times of the day. • Explain graphs describing limiting factors and how these factors effect photosynthesis. • Understand the importance of fermentation in baking. • Calculate cardiac output. Upper Hierarchical Knowledge • Recall the balanced symbol equation for photosynthesis. • How humans can manipulate the environments of which plants can grow. • Describe oxygen debt and recovery time. • Understand how the liver is involved in repaying oxygen debt. • Calculate inverse square law. Working Scientifically Testing a leaf for starch • WSAT 2 identify hazards and risks and suggest appropriate ways to reduce the risks. Investigate the rate of photosynthesis using pondweed (required practical). • WSSK 2 identify independent, dependent and control variables and use these to plan and carry

- Suggest an explanation, based on data, for how a particular evolutionary change occurred. - Evaluate ways of preserving plant or animal material for future generations. - Explain how a change in the DNA (mutation) may affect an organism and its future offspring. - Explain why offspring from the same parents look similar but are not usually identical. Working Scientifically Height vs. Foot size (graph skills): WS11 present observations and data using appropriate methods, including tables and graphs. DNA Extraction: The extraction of DNA from a kiwi: WSAT 2 identify hazards and risks and suggest appropriate ways to reduce the risks. Fossil making- Making trace fossils looking at the quality of evidence: WSAT 2 identify hazards and risks and suggest appropriate ways to reduce the risks.	Upper Hierarchical Knowledge - Describe in detail the functions of cell organelles. - Argue the advantages of medical uses of stem cell. Working Scientifically Making an onion slide- Make a specimen slide safely, view a slide, draw accurate observations and calculate the magnification used: WSME 1 apply mathematical concepts to use and rearrange equations in order to calculate results, using appropriate SI units RSE Link The science relating to blood, organ and stem cell donation.		out a range of investigations to test a prediction, considering repeatability and reproducibility within their plan ○
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Year 9 (biology) Final Composite Knowledge End Point			
KS3 (Term 1) - Define the definition of variation (within a species). - Define the two causes of variation within a species. - Define variation in a species and why it is important for the survival of a species, helping it to avoid extinction in an always changing environment. - Define the definition of natural selection. - Define the definition of biodiversity. - Explain where genetic material is found within a cell. - Define what a chromosome is. - Define the definition of a gamete. KS4 (Term 2 & 3) - Explain the difference between a eukaryotic and prokaryotic cell. - Recall the parts of an animal cell and explain what each part does. - Recall the parts of a plant cell and explain what each part does. - Recall the parts of a bacterial cell and explain what the part does. - Describe the steps in the cell cycle. - Compare magnification and resolution, in a light and electron microscope. - Define diffusion - Define osmosis - Define active transport. - Recall the word equation for photosynthesis. - Recall the uses of glucose (CROPS). - Recall the word equation for respiration. - Recall the word equation for anaerobic respiration. - Define metabolism - Recall examples of metabolic reactions.			

Year 9 Chemistry Essential Knowledge Summary	
Schemata 1: Chemical Reactions	Schemata 2: C1 Atomic Structure & Periodic Table
Composite Knowledge: Pupils will learn the differences between exothermic and endothermic reactions in terms of energy changes and then bond energy. They will calculate overall energy change and describe a reaction as endothermic or exothermic. Pupils will also describe the factors that affect the rate of reaction Component Knowledge: Foundational Knowledge: Declarative Knowledge: - Define exothermic reactions - Define endothermic reactions	Composite Knowledge: Pupils will learn fundamentals of atomic structure including the structure of an atom and where subatomic particles are found and how electrons are arranged on shells. Pupils will be able to define materials as elements, compound, mixtures and will be able to describe separation techniques Component Knowledge: Foundational Knowledge: Declarative Knowledge: The names and properties of subatomic particle and working out numbers of subatomic particles

- Define rate of reaction - Name the factors which affect rate Procedural Knowledge: - Draw and label reaction profiles graphs for exothermic and endothermic reactions including overall energy change and activation energy - Know that bond breaking is endothermic - Know that bond forming is exothermic - Write sentences to explain how different factors affect rate of reaction - Complete and analyse required practical on energy changes Upper Hierarchical Knowledge - Explain reactions in terms of bond breaking and bond forming - Use bond energies to calculate overall energy change - Draw rate graphs from given data - Calculate rate from data - Use collision theory to explain why factors affect rate of reaction Working Scientifically WSSK 1 develop a line of enquiry based on observations of the real world, and make predictions based on their prior knowledge and scientific understanding WSAN 2 use basic data analysis to calculate means, plot graphs with line of best fit and use this data to draw conclusions	- Electron structure and how shells are filled up - Separation methods and techniques - Know what a group is. - Know what a period is. - Know the separation between metals and nonmetals on the periodic table Procedural Knowledge: - Draw diagrams with correctly labelled parts of atom - Draw diagrams with correctly filled shells for atoms and ions - Write clear descriptions of how mixtures are separated - Describe the properties of groups of elements, group 1, 7 and 0 - Demo of alkali metals in water and descriptions of reactions Upper Hierarchical Knowledge - Explain why elements are grouped - Explain why we have isotopes - Calculate RAM from isotopic abundance - Explain the properties of group 1 and 7 by linking to electronic structure. - Explain evolution of atomic models and periodic table Working Scientifically Alkali Metals demo WSAN 1 make and record observations and measurements and present data using appropriate methods including tables with repeat measurements
Year 9 (chemistry) Final Composite Knowledge End Point	
- Be able to label a diagram of the atom - Be able to work out the number of protons, neutrons and electrons in a given atom - Know how to draw and work out the electron structure for the first 20 elements - Know the properties and reactivity of group 1 and 7 elements. - Evaluate atomic models - Evaluate periodic tables suggested in history - Define exothermic and endothermic reactions - Draw and label reaction profiles graphs for exothermic and endothermic reactions including overall energy change and activation energy - Know that bond breaking is endothermic - Know that bond forming is exothermic - Define rate of reaction - Name the factors which affect rate	

Year 9: Curriculum Intent		
The intent of the Year 9 curriculum is to build on knowledge acquired in both Year 7 and Year 8 and prepare pupils for the final steps before undertaking GCSE science. They will increase the depth and breadth of their knowledge and build strong links in learning to consolidate prior learning and secure the foundations for GCSE science. Pupils will continue to study the different areas of science: - in Biology - Variation and Inheritance. - in Chemistry - Chemical reactions. - in Physics - Forces and Motion and Energy. - and across all three sciences - how to Work Scientifically. Pupils will be taught key knowledge and skills in both theory and practical science. They will learn about the scientific method, how to keep safe and how to draw valid conclusions from data.		
Year 9 Physics Essential Knowledge Summary		
Schemata 1: Energy	Schemata 2: Forces & Motion	Schemate 3: P1 Energy
Composite Knowledge: Pupils will be able to describe the pros and cons of a variety of energy resources. Component Knowledge: Foundational Knowledge: Declarative Knowledge: - Can name the eleven different energy resources used to generate electricity. - Can simply describe how the energy resources can be used to provide electricity. - Can state pros and cons of each energy resource. Procedural Knowledge: - How to write an evaluation of energy resources. Upper Hierarchical Knowledge - Compare different energy resources. - Evaluate the use of energy resources in different contexts. Working Scientifically Solar panels: WSSK 2 identify independent, dependent and control variables and use these to plan and carry out a range of investigations to test a prediction, considering repeatability and reproducibility within their plan Wind turbines::	Composite Knowledge: Pupils will gain knowledge on the links between energy and forces. Pupils will understand how forces can cause rotation motion or extension of an object. Component Knowledge: Foundational Knowledge: Declarative Knowledge: - State the equation that links: force, distance and work done, - Define the term centre of mass. - Find the centre of mass of a regularly shaped 2D object. - Define the term moment. - State how a force affects the extension of a spring. Procedural Knowledge: - Calculate the extension of a spring after a force is applied. - Describe how to find the centre of mass of an irregularly shaped 2D object. - Estimate and explain the location of mass in a 3D object. - Use primary data to find the link between force applied and extension.	Composite Knowledge: Pupils will understand the different forms of energy and how energy can be transferred between them. They will be able to give examples of energy transfers. Pupils will gain knowledge of both renewable and non-renewable energy resources and understand their advantages and disadvantages. They will be able to evaluate the use of different energy resources and understand the trends in usage of various energy resources. Pupils will gain knowledge of the concept of efficiency. They will be able to describe the methods of heat transfer and explain how energy losses can be reduced in buildings. Pupils will be able to calculate changes in multiple energy stores. Component Knowledge: Foundational Knowledge: Declarative Knowledge: - Name the 5 energy stores - Name the 4 energy pathways / transfers - Recall the kinetic energy equation - Recall the units for energy, mass, velocity, spring constant, extension, height, specific heat capacity, temperature, power, & time. - Recall the equation for gravitational potential - Define specific heat capacity

● WSAN 1 make and record observations and measurements and present data using appropriate methods including tables with repeat measurements	<u>Upper Hierarchical Knowledge</u> ● Apply the principle of conservation of energy to work done. ● Manipulate equations. <u>Working Scientifically</u> Moments: ● WSSK 1 develop a line of enquiry based on observations of the real world, and make predictions based on their prior knowledge and scientific understanding Hooke’s law: ● WSAN 2 use basic data analysis to calculate means, plot graphs with line of best fit and use this data to draw conclusions	● Recall the equation $P=E/t$ ● Define power ● State that work done = energy transferred ● Recall the law of conservation of energy ● Define closed system ● State how energy can be dissipated ● State how unwanted energy transfers can be reduced ● Define thermal conductivity ● Recall the equations for efficiency ● Name the main energy resources available to use on Earth ● Define renewable resource ● State the uses of energy resources ● Recognise the main energy source available in a given situation ● Name renewable and non-renewable energy resources ● State the environmental impacts of energy resources Procedural Knowledge: ● Use an equation to find an unknown variable ● Apply the principle of conservation of energy to qualitative descriptions of energy transfers ● Write methods for experiments. ● Accurately plot axes & graphs ● Draw lines of best fit and use them to find tangents and gradients. ● Describe how to experimentally find the specific heat capacity of a substance (RP1) <u>Upper Hierarchical Knowledge</u> ● Describe how to experimentally find the specific heat capacity of a substance (RP1) ● Describe an experiment to investigate the effectiveness of thermal insulators (RP2) ● Manipulate and use the equations for: ○ kinetic energy ○ elastic potential energy ○ gravitational potential energy ○ specific heat capacity ○ power ○ efficiency ● Compare and evaluate different energy resources <u>Working Scientifically</u> Bungee jump ● WS 2.6 Make and record observations and measurements using a range of apparatus and methods. ○ Read measurements off a scale in a practical context and record appropriately. Specific Heat Capacity (w. joule metres) (RP1) ● WS 3.3 Carrying out and represent mathematical and statistical analysis. ○ use an appropriate number of significant figures ○ change the subject of an equation substitute numerical values into algebraic ○ equations using appropriate units for physical quantities ○ determine the slope and intercept of a linear graph Insulation (RP2) ● WS 2.2 Plan experiments or devise procedures to make observations, produce or characterise a substance, test hypotheses, check data or explore phenomena. ○ Describe a practical procedure for a specified purpose. ○ Identify in a given context: ■ the independent variable as the one that is changed or selected by the investigator ■ the dependent variable that is measured for each change in the independent variable ■ control variables and be able to explain why they are kept the same.
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		Investigating the absorption & radiation of infrared radiation (RP 10) ● WS 3.5 Interpreting observations and other data (presented in verbal, diagrammatic, graphical, symbolic or numerical form), including identifying patterns and trends, making inferences and drawing conclusions. ○ Use data to make predictions. ○ Recognise or describe patterns and trends in data presented in a variety of tabular, graphical and other forms. ○ Draw conclusions from given observations.
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Year 9 (physics) Final Composite Knowledge End Point

KS3 (Term 1) ● Discuss the advantages and disadvantages of the energy resources we use to generate electricity. ● Understand how force and energy are linked. ● Describe how to find the centre of mass of various objects. ● Calculate moment, force or distance using the appropriate equation. ● Calculate force, work done or distance using the appropriate equation. KS4 (Term 2 & 3) ● Understand the different forms of energy and how energy can be transferred between them. ● Give examples of energy transfers. ● Knowledge of both renewable and non-renewable energy resources and understand their advantages and disadvantages. ● Evaluate the use of different energy resources and understand the trends in usage of various energy resources. ● Knowledge of the concept of efficiency. ● Describe the methods of heat transfer and explain how energy losses can be reduced in buildings. ● Calculate changes in multiple energy stores.
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Year 10: Curriculum Intent		
The intent of the Year 10 curriculum is to build on knowledge acquired in Key Stage 3 and prepare pupils for their GCSEs in science. They will continue to increase the depth and breadth of their knowledge and build strong links in learning to consolidate prior learning and secure the knowledge and skills required to excel in GCSE Science.. Pupils will continue to study the different areas of science: • in Biology - Organisation, Infection & Response and Ecology.. • in Chemistry - Chemical Bonding & Structures, Quantitative Chemistry, Chemical Change and Energy Changes. • in Physics - Particle Model of Matter, Atomic Structure & Radioactivity, Electricity and Waves. • and across all three sciences - how to Work Scientifically. Pupils will be taught key knowledge and skills in both theory and practical science. They will learn about the scientific method, how to keep safe and how to draw valid conclusions from data.		
Year 10 Biology Essential Knowledge Summary		
Schemata 1: B2 Organisation	Schemata 2: B3: Infection and Response	Schemata 3: B7 Ecology
Composite Knowledge: Pupils will gain an understanding of the organisation of the human digestive system and circulatory system. Students will gain an understanding of the structure of a plant and the movement of water gases and minerals. Component Knowledge: Foundational Knowledge: Declarative Knowledge: Recall the terms definition of cell, tissue, organ, organ system and organism, and be able to give examples of each. State the order of size and scale of cells, tissues, organs, organ systems and organisms.. Describe the functions of the digestive system. Identify the positions of the main organs on a diagram of the digestive system. Recall that food molecules must be small and soluble in order to be absorbed into the blood. Describe the functions of the organs in the system. Define the terms ‘catalyst’ and ‘enzyme’. Describe the properties of enzymes. Explain why foods need to be digested into small, soluble molecules. Describe the three types of enzymes involved in digestion, including the names of the substrates, products and where the enzymes are produced. Describe the functions of the heart and circulatory system. Describe and label a diagram of the heart showing four chambers, vena cava, pulmonary artery, pulmonary vein and aorta. Describe the flow of blood from the body, through the heart and lungs and back to the body. Explain how the heart is adapted for its function. Describe the heart as a double pump and explain why this is efficient. Label the main structures in the gas exchange system – trachea, bronchi, alveoli and capillary network around alveoli. Recall the three blood vessels. Recall the four main components of blood. Identify pictures of the different blood cells. Recall examples of communicable and non-communicable diseases. Give risk factors associated with cardiovascular disease, Type 2 diabetes, lung diseases and cancers. Describe some causes of cancer, eg viruses, smoking, alcohol, carcinogens and ionising radiation. Recall the definition of cancer.	Composite Knowledge: Pupils will gain an understanding of how we protect ourselves from pathogens that attack us. How we can treat symptoms of disease if these first line defences do not work. Component Knowledge: Foundational Knowledge: Declarative Knowledge: • Recall the term pathogen and state the four main groups of pathogen. • Recall how pathogens can be spread to plants or animals and cause infection. • Recall how the spread of disease can be reduced or prevented. • Recall the safety precautions you must take when growing microorganisms. • Recall safety precautions for microbial investigations. • Recall the optimum conditions for bacterial growth. • Recall the symptoms, mode of transmission, prevention and treatment for measles, HIV and AIDS, salmonella and gonorrhoea. • Describe colds and flu as viral diseases. • Describe athlete’s foot as a fungal disease. • Describe the body’s first line defences. • Describe what white blood cells do. • Describe what a vaccine contains. • Give examples of painkillers and other medicines used to treat symptoms. • Explain why drugs need to be tested before they can be prescribed. • Recall which drugs come from plants and microorganisms. • Explain the terms placebo and double-blind trial. Biology Only: • Recall what MABs are. • Recall the the uses of MABs. • Explain why MABs are not yet widely used in the body. • Recall the symptoms and effects of Tobacco mosaic virus and its effects. • Recall the symptoms and effects of Rose black spot fungal infection • Recall methods that gardeners and scientists can use to identify the disease causing pathogen. • Recall the physical and chemical ways plants can resist microorganisms. • Recall mechanical adaptations to deter animals. Procedural Knowledge:	Composite Knowledge: Pupils will gain an understanding of the relationship of organisms between living and the non-living environment. Pupils will gain an understanding of how the balance of nature maintains the health of the earth. Component Knowledge: Foundational Knowledge: Declarative Knowledge: Define the terms ecosystem, community, competition, habitat, interdependence. Describe factors that affect the survival of organisms in their habitat. Define a stable community. Recall an example of a stable community. Recall resources that plants and animals compete for in a given habitat. Recall structural, behavioural and functional adaptations, in a range of organisms. Define the term extremophile and give general examples. Identify producers, primary, secondary and tertiary consumers in a food chain. Classify organisms based on their similarities. Recall the Linnaean classification system. Use the binomial system to name organisms. Explain how modern technologies have affected how organisms are classified today. Recall Carl Woese’s system of classification and classify organisms into the three domains. Recall biotic factors in a habitat. Recall abiotic factors in a habitat. Explain how a change in a biotic factor might affect a community. Recall how to carry out random sampling of organisms using a quadrat. Recall when and how a transect should be used. Recall the parts of the carbon, water and decay cycle. Define biodiversity Recall examples of the reduction in biodiversity. Recall the types of water pollution. Recall examples of air pollutants and where they come from. Recall the effects of smoke on buildings, humans and plant photosynthesis. Recall how acid rain is formed and the effects of acid rain on living organisms. Recall what herbicides and pesticides are used for.

Label the main organs of a plant and describe their functions. Identify the tissues in a leaf and describe their functions. Recall the organs that make up the plant transport system. Recall the role of xylem; phloem and root hair cells. Define the terms ‘transpiration’ and ‘translocation’. Define the term ‘active transport’. Procedural Knowledge: Explain how the small intestine is adapted for its function. Explain why enzymes are specific and are denatured by high temperatures and extremes of pH. Explain how bile helps in the digestion of fats. Describe the function of the pacemaker cells and coronary arteries. Explain how the alveoli are adapted for efficient gas exchange. Describe problems associated with the heart and explain how they can be treated. Evaluate the use of drugs, mechanical devices and transplants to treat heart problems, including religious and ethical issues. Explain how the blood vessels are adapted for their function. Explain how each component is adapted for its function. Explain how diet, stress and life situations can affect physical and mental health. Describe examples of how diseases may interact. Describe the effects of diet, smoking, alcohol and exercise on health. Explain how and why the Government encourages people to lead a healthy lifestyle. Describe the difference between benign and malignant tumours. Explain why there are more stomata on the lower surface of a leaf. Describe the role of stomata and guard cells to control water loss and gas exchange. Relate the structure of each tissue in a plant to its function in photosynthesis. Describe the role of xylem, phloem and root hair cells and explain how they are adapted for their functions. Describe where active transport occurs in humans and plants and what is transported. Explain why active transport requires energy. <u>Upper Hierarchical Knowledge</u> ● Use the lock and key theory and collision theory to explain enzyme action. ● Explain how cancer may spread from one site in the body to form a secondary tumour in another part of the body. ● Calculate stomatal density. ● Explain how active transport enables cells to absorb ions from very dilute solutions.	● Recognise bacterial and fungal colonies growing on agar plates. ● Describe the main differences between bacteria and viruses. ● Explain why cultures are incubated at a maximum temperature of 25°C in schools. ● Describe the life cycle of the malarial protist ● Describe the symptoms, mode of transmission, prevention and treatment for malaria. ● Explain how microbes make us feel ill and how viruses damage cells. ● Explain why antibodies are specific for one pathogen/ antigen. ● Explain how vaccines prevent disease. ● Describe the problems associated with antibiotic resistance. ● Describe Fleming’s discovery and explain its importance. ● Explain how antibiotics treat only bacterial diseases and how this has saved lives. ● Explain the difficulty in developing drugs that kill viruses without damaging body tissues. ● Describe the main steps in the development and testing of a new drug. ● Give reasons for the different stages in drug testing. Biology only: ● Describe how MABs are produced. ● Describe how the uses of MABs work with given information. ● Evaluate the advantages and disadvantages of MABs. ● Explain how aphids affect plant growth. ● Describe visual indications of plant disease, as described in the specification. <u>Upper Hierarchical Knowledge</u> ● Explain the idea of ‘herd immunity’. ● Calculate the cross-sectional areas of clear zones around disinfectant/ antibiotic discs using . ● Explain the difference between Tobacco Mosaic Virus in plants and Measles in animals. <u>Working Scientifically</u> Calculate the number of bacteria in a population after a given time, when given the mean division time: ● WSME 1 apply mathematical concepts to use and rearrange equations in order to calculate results, using appropriate SI unit Describe how microorganisms can be safely grown on agar plates: ● WSAT 2 identify hazards and risks and suggest appropriate ways to reduce the risks Required Practical: The effect of disinfectants or antibiotics on bacterial growth: ● WSSK 2 identify independent, dependent and control variables and use these to plan and carry out a range of investigations to test a prediction, considering repeatability and reproducibility within their plan Calculate the cross-sectional areas of clear zones around disinfectant/ antibiotic discs using . ● WSME 1 apply mathematical concepts to use and rearrange equations in order to calculate results, using appropriate SI units Interpret data about painkillers and other medicines.	Recall what peat is and why it is important to preserve areas of peat. Recall why peat should not be burnt. Recall the term deforestation. Recall the terms greenhouse effect and global warming. Recall the possible effects of global warming. Recall measures to maintain biodiversity. Biology Only Define the term biogas. Recall the term factory farming and give examples of animals farmed in this way. Recall why some fish stocks are declining and why this is a problem. Recall ways that fish stocks can be conserved. Recall how the fungus Fusarium can be grown to produce mycoprotein that can be eaten. Procedural Knowledge: Explain how structural, behavioural and functional adaptations help an organism survive. Explain what a food chain shows. Explain that photosynthetic organisms are the producers of biomass for life on Earth. Calculate area, mean, median, mode and range. Explain why sample size is important to obtain valid results. Interpret and explain population curves. Explain the carbon cycle Explain the water cycle Interpret graphs showing human population. Analyse and interpret data about water pollution. Analyse and interpret data about air pollution. Evaluate the use of fertiliser on plant growth and oxygen levels. Explain why vast tropical areas have been cleared of trees. Explain how deforestation increases the amount of carbon dioxide in the atmosphere and leads to a reduction in biodiversity. Biology only Recall the factors which affect the rate of decay. Interpret data showing how factors affect the rate of decay. Describe how gardeners and farmers try to provide optimum conditions for rapid decay of wastes. Explain the difference between aerobic and anaerobic decay. Evaluate the use of biogas generators. Evaluate the necessity and effectiveness of recycling organic kitchen or garden wastes. Explain why the output from a biogas generator is affected by climatic conditions. Explain how factors affect food production and food security locally and globally. Interpret population and food production statistics to evaluate food security. Evaluate modern farming techniques.
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- Explain the relationship between active transport and oxygen supply and numbers of mitochondria in cells. Working Scientifically Recap KS3- Modelling the path of digestion from gum to bum: WS5 make predictions using scientific knowledge and understanding Recap KS3- Modelling the small intestine using visking tubing: WS5 make predictions using scientific knowledge and understanding Required practical: Food tests: - WS7 use appropriate techniques, apparatus, and materials during fieldwork and laboratory work, paying attention to health and safety Investigate the rate of reaction by measuring the volume of gas given off from the catalase reactions from boiled, liver, celery, potato and hydrogen peroxide: WSSK 2 identify independent, dependent and control variables and use these to plan and carry out a range of investigations to test a prediction, considering repeatability and reproducibility within their plan Calculate rate, using gas given off over time. WSME 1 apply mathematical concepts to use and rearrange equations in order to calculate results, using appropriate SI units Investigate the effect of temperature on amylase activity – measure time taken for starch to disappear: WSAN 2 use basic data analysis to calculate means, plot graphs with line of best fit and use this data to draw conclusions Calculate the rate of enzyme controlled reactions: WSME 1 apply mathematical concepts to use and rearrange equations Prepared slides: of xylem, phloem and root hair cells, microscopes, in order to calculate results, using appropriate SI units Dissection of a heart. Observe prepared slides of the different vessels, or use bio-viewers. Compare their size and structure: WSAN 1 make and record observations and measurements and present data using appropriate methods including tables with repeat measurements. Measure pulse rate and blood pressure – lying down, sitting and standing. WSAN 1 make and record observations and measurements and present data using appropriate methods including tables with repeat measurements. Demo: Model of blood vessels. Calculate the rate of water flow through different widths of tubing. - WS10 apply mathematical concepts and calculate results. Observe prepared blood smears under the microscope: WSAN 1 make and record observations and measurements and present data using	WS12 interpret observations and data, including identifying patterns and using observations, measurements and data to draw conclusions.	Describe how microorganisms can be grown in large vats to produce useful products. Explain how the conditions in the vat are monitored and controlled for optimal growth. Evaluate the use of mycoprotein as a food. Describe the process of genetic engineering to produce better crops. Describe what Golden rice is and how it was produced. Interpret information about genetic engineering techniques. Make informed judgements about the economic, social and ethical issues concerning genetic engineering. Upper Hierarchical Knowledge Consider how mathematical models will help predict changes in carbon dioxide levels over time. Explain and evaluate conflicting pressures on maintaining biodiversity. Explain the possible impact of each environmental change on the distribution of species in an ecosystem. Calculate the rate of decay Working Scientifically Required Practical- Measure abundance and distribution of a plant species. WSSK 4 select and use appropriate apparatus and sampling techniques for field and laboratory work Required Practical- Measure the rate of the decay of milf at different pH levels. WSSK 2 identify independent, dependent and control variables and use these to plan and carry out a range of investigations to test a prediction, considering repeatability and reproducibility within their plan. Calculate the efficiency of biomass. - WS12 interpret observations and data, including identifying patterns and using observations, measurements and data to draw conclusions
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appropriate methods including tables with repeat measurements. Calculate BMI and evaluate the use of this type of measurement. - WS10 apply mathematical concepts and calculate results Observing stomata under the microscope: WSAN 1 make and record observations and measurements and present data using appropriate methods including tables with repeat measurements. Measuring stomatal density (HT):: - WS10 apply mathematical concepts and calculate results Plant stalks: celery of plant stalk in beaker of coloured water. WSAN 1 make and record observations and measurements and present data using appropriate methods including tables with repeat measurements. Observing prepared slides under a microscope- xylem, phloem and root hair cells. WSAN 1 make and record observations and measurements and present data using appropriate methods including tables with repeat measurements.		
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Year 10 (biology) Final Composite Knowledge End Point

Schemata 1 B2 Organisation - Recall the order of size and scale of cells, tissues, organs, organ systems and organisms - Name the parts of the human digestive system, what does each part do? - Describe the role of enzymes in the break down of food. - Describe the structure of the heart. - Recall the parts of the gas exchange and explain what each part does. - Recall the three blood vessels and what they do. - Recall the parts of the blood and what they do. - Explain the difference between benign and malignant tumours. - Describe the role of the stomata in a leaf. - Recall xylem, phloem and root hair cells and what they do. - Explain the process of active transport. Schemata 2 Infection and Response - Recall the definition of a pathogen. - Recall how pathogens are spread. - Recall the - Describe the optimum conditions for bacterial growth. - Describe how bacteria make you ill. - Describe how virus’s make you ill. - Describe what antibiotics treat and how they should be used. - Recall the lifecycle of Malaria and how Malaria can be prevented. - Recall what a vaccine is. - Describe how a vaccine works. - Recall the symptoms, mode of transmission, prevention and treatment for measles, HIV and AIDS, salmonella and gonorrhoea. - Recall why drugs are tested. - Recall each stage of drug testing - Explain what happens of each stage of drug testing. Biology only: - Recall what a MAB is and how it is produced. - Recall the symptoms and effects of Rose Black Spot and Tobacco Mosaic Virus. Schemata 3 B5 Homeostasis and Response - Recall what homeostasis is and why it is important. - Recall examples of conditions that need to be controlled. - Recall the roles of the nervous system and the endocrine system in homeostasis. - Recall the main components of a control system and their functions. - Recall the functions of the main structures in the nervous system. - Recall the differences between voluntary and reflex actions. - Recall the stages of a reflex action - Describe the endocrine system - Recall the term hormone. - Recall the locations of organs in the endocrine system. - Recall why the pituitary gland is often called the master gland. - Recall how blood glucose concentration is monitored and controlled. - Recall when insulin is produced and how it helps to control blood glucose levels. - Define what glycogen is. - Recall the cause, treatment and problems associated with Type 2 diabetes.

- Recall the terms hormonal and non-hormonal methods of contraception.
- Recall where and when adrenaline is released and its target organs.
- Recall the effects of adrenaline on the body.
- Recall where thyroxine is produced and its effects on the body.

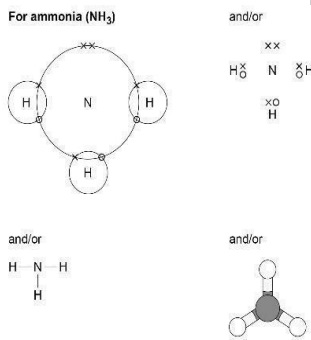
Biology only:

- Describe how the eye changes to focus on near and distant objects.
- Draw simple ray diagrams to show normal vision, long-sightedness and short-sightedness
- Describe and explain the changes that happen when body temperature is too high or too low.
- Explain why we drink more fluid during hot weather.
- Explain why there is no control over water, ion and urea loss by the lungs and skin.
- Explain when cells might gain or lose too much water, in terms of osmosis (links to B1).
- Describe the effect of too much or too little water on cells.
- Explain how the body responds to different temperature and osmotic challenges in terms of sweat and urine release.
- Describe how urine is produced.
- Describe the absorption of glucose and ions by diffusion and active transport (link to B1).
- Explain why dialysis fluid contains sugar and ions at the same concentration as normal blood, but no urea.
- Evaluate the use of kidney transplants and dialysis to treat kidney failure.
- Explain the role of auxin in plant responses in terms of unequal distribution in shoots and roots.
- Describe the use of ethene to control the ripening of fruit during storage and transport.
- Describe the use of gibberellins to end seed dormancy, promote flowering and to increase fruit size.

Year 10 Chemistry Essential Knowledge Summary

Schemata 1: C2 Bonding, Structure and Properties of matter	Schemata 2: C3 Quantitative Chemistry	Schemata 3: C4 Chemical Changes	Schemata 4: The Rate and extent of Chemical Change
Composite Knowledge: Students will gain a fundamental understanding of the range of different types of chemical bonding and how structure links to properties. Students will build on from knowledge of atomic structure to explain why bonding takes place between atoms. Component Knowledge: Foundational Knowledge: Declarative Knowledge: • State there are three types of strong chemical bonds: • Define Ionic bonding • Define Covalent bonding • Define Metallic bonding • Recognise for ionic bonding the particles are oppositely charged ions. • Recognise for covalent bonding the particles are atoms which share pairs of electrons. • Recognise in metallic bonding the particles are atoms which share delocalised electrons. • State that ionic bonding occurs in compounds formed from metals combined with non-metals. • State that Covalent bonding occurs in non-metallic elements and in compounds of non-metals. • State that Metallic bonding occurs in metallic elements and alloys • Identify chemical bonding in terms of electrostatic forces and the transfer or sharing of electrons. • Identify when a metal atom reacts with a non-metal atom, electrons in the outer shell of the metal atom are transferred.	Composite Knowledge: Students will gain a fundamental understanding of quantitative chemistry and how chemists work with amounts of substances. They will use a variety of different chemical equations to complete a variety of ‘amount of substance’ questions. Component Knowledge: Foundational Knowledge: Declarative Knowledge: • Explain the meaning of the law of conservation. • Write simple word equations. • Write simple symbol equations. • Balance symbol equations. • Describe the equations given in terms of number of moles, reactants and products • .Review the definition of relative atomic mass. • Recall how to find the relative atomic mass from the Periodic Table. • Define the relative molecular mass. • Be able to calculate the relative formula mass (M_r) of a compound from its formula, given the relative atomic masses • Explain any observed changes in mass in non-enclosed systems during a chemical reaction. • Use the balanced symbol equation for a reaction to recognise changes in terms of the particle model • use measurements of mass before and after an experiment to explain what has happened to the mass during the experiment and why it has happened. • Know that whenever a measurement is made there is always some uncertainty about the result obtained. • Represent the distribution of results and make estimations of uncertainty. • Use the range of a set of measurements about the mean as a measure of uncertainty • Understand that the measurement of amounts in	Composite Knowledge: Students will gain a fundamental understanding of the range of different types of chemical changes involving metals and non metals. They will use reactivity of metals to explain and develop different ideas including extraction of metals and electrolysis. Component Knowledge: Foundational Knowledge: Declarative Knowledge: • Define the following terms: oxidation reduction. • Write word and balanced symbol equations for the reactions of metals with oxygen to produce metal oxides. • identify where reduction and oxidation has taken place. • Recall and describe the reactions, if any, of potassium, sodium, lithium, calcium, magnesium, zinc, iron and copper with water or dilute acids, where appropriate, to place these metals in order of reactivity. • State why metals such as gold are found in the Earth as the metal itself but most metals are found as compounds that require chemical reactions to extract the metal. • know why Metals less reactive than carbon can be extracted from their oxides by reduction with carbon. • Know Reduction involves the loss of oxygen • Identify the substances which are oxidised or reduced in terms of gain or loss of oxygen • Know that Oxidation is the loss of electrons and reduction is the gain of electrons. • Know that acids react with some metals to produce salts and hydrogen. • Define the term neutralisation. • Know that acids are neutralised by alkalis. • Know that acids and bases (metal oxides) produce salts and water • Know that metal carbonates and acid produce salts, water and carbon dioxide. • Know that metals reacting with acid produce hydrogen and salts • Know that the salt produced in any reaction between an acid and a base or alkali depends on: the acid used • Know that hydrochloric acid produces chlorides	Composite Knowledge: Students will gain a fundamental understanding of how external conditions and factors can affect both rate of reaction and position of equilibrium. Students will analyse graphs to show how rates proceed and will evaluate conditions to maximise rate and equilibrium. Component Knowledge: Foundational Knowledge: Declarative Knowledge: • Calculate the mean rate of a reaction from given information about the quantity of a reactant used or the quantity of a product formed and the time taken. • Draw and interpret graphs showing the quantity of product formed or quantity of reactant used up against time. • Use graphical data to explain each part of the graph ie: initially rate is fast slows down reaction completes. • Explain what is meant by the units: g/s cm³/s mol/s. • Know the Factors which affect the rates of chemical reactions including The concentrations of reactants in solution The pressure of reacting gases, The surface area of solid reactants The temperature of reactants The presence of a catalyst. • recall how changing these factors affects the rate of chemical reactions. • Predict and explain using collision theory the effects of changing conditions of concentration, pressure and temperature on the rate of a reaction. • Predict and explain the effects of changes in the size of pieces of a reacting solid in terms of surface area to volume ratio. • Use simple ideas about proportionality when using collision theory to explain the effect of a factor on the rate of a reaction. • Know what Collision theory is • Know how According to collision theory, chemical reactions can occur. • Recognise when reacting particles collide with each other and with sufficient energy a reaction is possible. • Know that the minimum amount of energy that particles must have to react is called the activation energy. • Recognise that increasing the concentration of reactants in solution, the pressure of reacting gases, and the surface area of solid reactants increases

- state metal atoms lose electrons to become positively charged ions.
- State Non-metal atoms gain electrons to become negatively charged ions
- Recall the ions produced by metals in Groups 1 and 2
- Recall the ions produced by Groups 6 and 7.
- Draw dot and cross diagrams for ionic compounds formed by metals in Groups 1 and 2 with non-metals in Groups 6 and 7
- State how electrons transfer during the formation of an ionic compound.
- State how ionic compounds are held together by strong electrostatic forces of attraction between oppositely charged ions.
- Know that forces act in all directions
- Know that an ionic compound is a giant structure in the lattice.
- Know when atoms share pairs of electrons, they form covalent bonds.
- State these bonds between atoms are strong.
- Know that covalently bonded substances may consist of small molecules.
- Know that some covalently bonded substances have very large molecules, such as polymers.
- Know that some covalently bonded substances have giant covalent structures,
- State that diamond, graphite and silicon dioxide are giant structures
- Know that the covalent bonds in molecules and giant structures can be represented in the following forms:



- Know that Polymers can be represented in the form:
- $$\left(\begin{array}{cc} \text{H} & \text{H} \\ | & | \\ -\text{C} & - & \text{C}- \\ | & | \\ \text{H} & \text{H} \end{array} \right)_n$$
- poly(ethene)
 - State that n is a large number.
 - Recognise substances as small molecules, polymers or giant structures from diagrams showing their bonding.
 - recognise common substances that consist of small molecules from their chemical formula.

- moles can apply to atoms, molecules, ions, electrons, formulae and equations.
- Know for example that in one mole of carbon (C) the number of atoms is the same as the number of molecules in one mole of carbon dioxide (CO₂).
- Understand that the number of atoms, molecules or ions in a mole of a given substance is the Avogadro constant. The value of the Avogadro constant is 6.02 x 10²³ per mole.
- Define one mole in terms of M_r and A_r
- Calculate the number of moles in a substance using the relative formula mass.
- Define the term limiting reactant.
- Link the limiting reactant to the number of moles.
- Link the limiting reactant to the masses in grams.
- Calculate the mass of solute in a given volume of solution of known concentration in terms of mass per given volume of solution.
- convert cm³ into dm³.
- Use the equation: $C = m / v$ to calculate the concentration of a solution.
- Calculate the percentage yield of a product from the actual yield of a reaction.
- Describe how atoms are lost or gained in a chemical reaction.
- Explain why atoms can be lost or gained in a chemical reaction.
- Calculate the theoretical yield for simple examples
- Calculate the atom economy for simple examples.
- Explain the meaning of concentration and the unit mol per dm³.
- Be able to convert cm³ into dm³.
- Use the equation $C = n / v$ to calculate the concentration of a solution.
- Including reasons for using a burette instead of other measuring equipment.
- Recall the equation:
$$\frac{\text{number of moles}}{\text{relative formula mass}} =$$
- Use the equation: volume of gas at rtp = number of moles x molar gas volume (24 dm³) for simple examples.
- Calculate the volume of a gas at room temperature and pressure from its mass and relative formula mass
- Calculate volumes of gaseous reactants and products from a balanced equation and a given volume of a gaseous reactant or product.

Procedural Knowledge:

- Use the relative formula mass of a substance to calculate the number of moles in a given mass of that substance and vice versa.
- Calculate the masses of substances shown in a balanced symbol equation.
- Calculate the masses of reactants and products from the

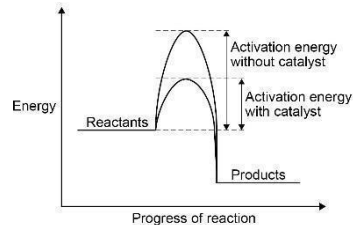
- Know that Nitric acid produces nitrates
- Know that sulfuric acid produces sulfates
- Define the terms: soluble insoluble.
- Explain what is meant by a soluble salt.
- Explain why reactants are often used in excess.
- Know that salt solutions can be crystallised to produce solid salts.
- Define the following terms: acid base alkali neutral.
- Recall the pH numbers for the following solutions: acidic alkaline neutral.
- Describe the use of universal indicator or a wide range indicator to measure the approximate pH of a solution.
- Use the pH scale to identify acidic or alkaline solutions.
- State that Acids produce hydrogen ions (H⁺) in aqueous solutions.
- State aqueous solutions of alkalis contain hydroxide ions (OH⁻).
- Know that In neutralisation reactions between an acid and an alkali, hydrogen ions react with hydroxide ions to produce water.
- Know this reaction can be represented by the equation: $\text{H}^+ (\text{aq}) + \text{OH}^- (\text{aq}) \rightarrow \text{H}_2\text{O} (\text{l})$
 - Use and explain the terms dilute and concentrated (in terms of amount of substance), and
 - Use the terms weak and strong (in terms of the degree of ionisation) in relation to acids.
- Explain the meaning of the following terms: dilute concentrated weak strong.
- Recall examples of strong and weak acids.
- Describe neutrality in terms on hydrogen ion concentration.
- Describe relative acidity in terms of hydrogen ion concentration.
- Define the term electrolyte.
- Describe how an electric current can pass through an ionic compound.
- Know why solid ionic compounds cannot conduct electricity.
- Know why ionic compounds can conduct electricity when melted or dissolved in water.
- Predict the products of the electrolysis of binary ionic compounds in the molten state
- Recall the reactivity series.
- Give reasons why some metals have to be extracted by electrolysis.
- Know Aluminium is manufactured by the electrolysis of a molten mixture of aluminium oxide and cryolite
- Know that carbon is used for positive electrode (anode).
- Know how aluminium is extracted from its ore.
- Write balanced half equations for the reactions that occur at both electrodes for aluminium extraction
- State why a mixture is used as the electrolyte.
- State why the positive electrode must be continually replaced.
- Define the term aqueous.
- Know how an aqueous solution is electrolysed.

- the frequency of collisions and so increases the rate of reaction.
- Know that increasing the temperature increases the frequency of collisions and makes the collisions more energetic, and so increases the rate of reaction.
- identify catalysts in reactions from their effect on the rate of reaction and because they are not included in the chemical equation for the reaction.
- Explain catalytic action in terms of activation energy.
- Define the term activation energy.
- Identify advantages of using catalysts in industrial reactions eg reducing costs.
- Know that enzymes act as catalysts in biological systems.
- Know that catalysts increase the rate of reaction by providing a different pathway for the reaction that has lower activation energy.
- Know that In some chemical reactions, the products of the reaction can react to produce the original reactants.
- Know that reversible reactions are represented in the following way:



Procedural Knowledge:

- Draw tangents to the curves on graphs and use the slope of the tangent as a measure of the rate of reaction.
- Calculate the gradient of a tangent to the curve on these graphs as a measure of rate of reaction at a specific time.
- Explain the effect on the rate of reaction of the following factors: concentration pressure surface area temperature catalyst.
- A reaction profile for a catalysed reaction can be drawn in the following form:



- Explain what is meant by a reversible reaction.
- Explain the difference between: reactions and reactions.
- Explain the term equilibrium
- Know how equilibrium is reached when the forward and reverse reactions occur at exactly the same rate
- Describe the effects of temperature on a reversible reaction
- Be able to interpret appropriate given data to predict the effect of a change in concentration of a reactant or product on given reactions at equilibrium.
- Use data to predict the effect of concentration on equilibrium.
- Interpret appropriate given data to predict the effect of a change in temperature on given reactions at equilibrium.
- Use data to predict the effect of temperature on equilibrium
- interpret appropriate given data to predict the effect of pressure changes on given reactions at equilibrium.

• Draw dot and cross diagrams for the molecules of hydrogen, chlorine, oxygen, nitrogen, hydrogen chloride, water, ammonia and methane • Represent the covalent bonds in small molecules, in the repeating units of polymers and in part of giant covalent structures, using a line to represent a single bond • State that metals consist of giant structures of atoms arranged in a regular pattern. • know that the electrons in the outer shell of metal atoms are delocalised and so are free to move through the whole structure. • Know that the sharing of delocalised electrons gives rise to strong metallic bonds. • State the three states of matter are solid, liquid and gas. • Know that Melting and freezing take place at the melting point, boiling • Know that condensing takes place at the boiling point. • State that the three states of matter can be represented by a simple model. • Know in this model, particles are represented by small solid spheres. • Know that Particle theory can help to explain melting, boiling, freezing and condensing. • Know that the amount of energy needed to change state from solid to liquid and from liquid to gas depends on the strength of the forces between the particles of the substance. • Know that the stronger the forces between the particles, the higher the melting point and boiling point of the substance. • State in chemical equations, the three states of matter are shown as (s) solid • know that Liquid (l) and (g) gas are state symbols • Know that Aqueous solutions have the symbol (aq) • Know that Ionic compounds have regular structures (giant ionic lattices) in which there are strong electrostatic forces of attraction in all directions between oppositely charged ions. • State that compounds have high melting points and high boiling points • Know that Large amounts of energy are needed to break the many strong bonds. • Know that when melted or dissolved in water, ionic compounds conduct electricity. • Recognise that ions are free to move and so charge can flow. • Know that substances that consist of small	balanced symbol equation and the mass of a given reactant or product • Rearrange the equation $C = m / v$ to make number of moles the subject. • Know the method on how to carry out a titration. • Use the masses of substances present in a reaction to write a balanced equation. • Explain how the mass of a solute and the volume of a solution is related to the concentration of the solution. • Explain the meaning of concentration and the unit grams per dm³ • Explain how the concentration of a solution in mol/dm³ is related to the mass of the solute and the volume of the solution. • Rearrange the equation: $C = m / v$ to make mass the subject. • explain why indicators eg methyl orange and phenolphthalein are used instead of Universal indicator. • Change the subject of a mathematical equation. Upper Hierarchical Knowledge • Balance complex equations and add state symbols. • Balance chemical equations and use these to calculate the masses of substances present. • Be able to balance an equation given the masses of reactants and products. • Change the subject of a mathematical equation. • Explain the effect of a limiting quantity of a reactant on the amount of products it is possible to obtain in terms of amounts in moles or masses in grams. • Calculate the theoretical amount of a product from a given amount of reactant and the balanced equation for the reaction. • Calculate the atom economy of a reaction to form a desired product from the balanced equation. • Explain why a particular reaction pathway is chosen to produce a specified product given appropriate data such as atom economy (if not calculated), yield, rate, equilibrium position and usefulness of by-products. • Use balanced equations and known volume of reactant/product to calculate the volumes of gaseous reactants/ products. Working Scientifically Teacher Demo • Model the law of conservation using molecular model kits. Lego or Duplo bricks can be used to good effect. • Teacher demonstration. The precipitation reaction: <i>lead nitrate + potassium iodide</i> • Model compounds with different sized and coloured lego bricks pre-marked with symbol and A_r of different elements. Sum the A_rs marked on the bricks to obtain the M_r • Use magnesium ribbon to produce magnesium oxide.	• Predict the products of the electrolysis of aqueous solutions containing a single ionic compound • Know that at the negative electrode (cathode), hydrogen is produced if the metal is more reactive than hydrogen • Know that at the positive electrode (anode), oxygen is produced unless the solution contains halide ions when the halogen is produced. • Know that in the aqueous solution water molecules break down. • Know that hydrogen ions and hydroxide ions are discharged from this breakdown • Know that the cathode is the negative electrode • Know that positively charged ions gain electrons at the cathode. • Know that reduction takes place at the cathode • Know the anode is the positive electrode • Know that negatively charged ions lose electrons at the anode. • Know that oxidation takes place at the anode • Know that oxidation is loss of electrons • Know that reduction is gain of electrons. Procedural Knowledge: • Draw the atomic structure of metals and the ion formed. Use these to describe how the ion has been formed. • Explain reduction and oxidation in terms of loss or gain of oxygen • Make links between the ability to form ions and the reactivity with water and acid. • Explain the trends in reactivity of Group 1 in terms of atomic structure. • Describe what occurs in a displacement reaction, using suitable examples. • Deduce an order of reactivity of metals based on experimental results. • Write ionic equations for displacement reactions. • Identify in a given reaction, symbol equation or half equation which species are oxidised and which are reduced. • Explain in terms of gain or loss of electrons, that these are redox reactions. • Identify which species are oxidised and which are reduced in given chemical equations. • Predict products from given reactants. • Use the formulae of common ions to deduce the formulae of salts. • Describe how to make pure, dry samples of named soluble salts from information provided. • Describe how to carry out titrations using strong acids and strong alkalis only (sulfuric, hydrochloric and nitric acids only) to find the reacting volumes accurately. • Calculate the chemical quantities in titrations involving concentrations in mol/dm³ and in g/dm³. • Explain why strong acids are completely ionised in aqueous solutions but a weak acid is only partially ionised. • Explain what happens to positive and negative ions during electrolysis and how elements form from their ions. • Explain why the following atoms could be produced: hydrogen oxygen. • Reactions at electrodes can be represented by half equations, for example:	• Use data to predict the effect of pressure on equilibrium Upper Hierarchical Knowledge • Use graphs of data obtained from concentration reactions to explain what occurs as the reaction proceeds • Be able to make qualitative predictions about the effect of changes on systems at equilibrium when given appropriate information • Describe Le Chatelier's principle. • Explain the effects on equilibrium of changing conditions using suitable examples. • Explain how the effects of changing conditions on a system at equilibrium can be predicted using Le Chatelier's Principle. • Explain if the temperature of a system at equilibrium is increased: the relative amount of products at equilibrium increases for an endothermic reaction the relative amount of products at equilibrium decreases for an exothermic reaction. • If the temperature of a system at equilibrium is decreased: the relative amount of products at equilibrium decreases for an endothermic reaction the relative amount of products at equilibrium increases for an exothermic reaction. • For gaseous reactions at equilibrium: Explain how an increase in pressure causes the equilibrium position to shift towards the side with the smaller number of molecules Explain how a decrease in pressure causes the equilibrium position to shift towards the side with the larger number of molecules. Working Scientifically • React CaCO₃ with dilute HCl and measure the volume of CO₂ evolved against time. • Required practical 5: investigate how changes in concentration affect the rates of reactions by a method involving measuring the volume of a gas produced and a method involving a change in colour or turbidity. • Investigate changing temperature and surface area of reactants and use of catalysts. • Investigate the catalytic effect of adding different metal salts to a reaction such as the decomposition of hydrogen peroxide. • Practical: hydrate or dehydrate copper sulfate. • Heat ammonium chloride in a test tube. Use mineral wool to support a piece of damp pH paper half way up the tube and observe the colour change. • Investigate the temperature changes for: <i>hydrated copper sulfate (Blue)</i> $\rightleftharpoons$ <i>anhydrous copper sulfate (White)</i> + water
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molecules are usually gases or liquids. • Recognise that small molecules have low melting points and boiling points. • Know that these substances have only weak forces between the molecules (intermolecular forces). • Recognise that intermolecular forces are overcome, not the covalent bonds, when the substance melts or boils. • Know that intermolecular forces increase with the size of the molecules, • Identify larger molecules as having higher melting and boiling points. • Know that these substances do not conduct electricity because the molecules do not have an overall electric charge. • Identify polymers as very large molecules. • know that atoms in the polymer molecules are linked to other atoms by strong covalent bonds. • Know that the intermolecular forces between polymer molecules are relatively strong and so these substances are solids at room temperature. • Know that substances that consist of giant covalent structures are solids with very high melting points. • Know that all of the atoms in these structures are linked to other atoms by strong covalent bonds. • Recognise that these bonds must be overcome to melt or boil these substances. • Identify that Diamond and graphite (forms of carbon) and silicon dioxide (silica) are examples of giant covalent structures. • Know that metals have giant structures of atoms with strong metallic bonding. • Identify that most metals have high melting and boiling points. • Know that in pure metals, atoms are arranged in layers. • Know that metals can be bent and shaped. • Know that Pure metals are too soft for many uses and so are mixed with other metals to make alloys which are harder. • State that Metals are good conductors of electricity • Know that the delocalised electrons in the metal carry electrical charge through the metal. • State that metals are good conductors of thermal energy because energy is transferred by the delocalised electrons.	Measure the mass of the ribbon at the start of the experiment, burn the ribbon in a strong Bunsen flame (SAFETY required) and measure the mass of the ribbon at the end of the experiment. • Use HCl acid in a conical flask with CaCO₃. Measure the mass of the reaction on a top pan balance as the reaction proceeds over two minutes. • Demonstrate combustion of paper in a large beaker to show mass may decrease because products are released to the air as gases. • Try balancing iron wool on a pair of scales (a makeshift one can be set up using a carefully balanced metre rule). Heat the iron wool strongly to observe the increase in mass of the oxide. • Class thiosulfate 'disappearing cross' experiment at a single fixed concentration using (a) pre-printed computer generated crosses (b) hand drawn crosses using different pens/pencils • Measure out and compare 1 mole of elements like iron, sulfur, magnesium, copper, aluminium and so on. • Use a small strip of magnesium ribbon in 20 ml HCl acid. Identify which reactant is the limiting reactant and state the reason for this choice. • Measure out and compare one mole of common compounds, water, sodium chloride, calcium carbonate and so on. • To demonstrate the idea of concentration students could make different concentrations of tea, coffee or a dark squash like blackcurrant. • • Identify a chemical reaction that has a high atom economy and research the positives to industry of producing a high yield of useful product. • Identify a chemical reaction that has a low atom economy and research the negatives to industry of producing a low yield of useful product and ways the reactions has been improved to increase the yield of useful product RP Titration • Titrate HCl with NaOH using an indicator of methyl orange. Use the titre results and know volumes of NaOH and concentration, to calculate the concentration of the HCl.	$2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$ and $4\text{OH}^- \rightarrow \text{O}_2 + 2\text{H}_2\text{O} + 4\text{e}^-$ or $4\text{OH}^- - 4\text{e}^- \rightarrow \text{O}_2 + 2\text{H}_2\text{O}$ Upper Hierarchical Knowledge • Explain how the reactivity of metals with water or dilute acids is related to the tendency of the metal to form its positive ion. • Explain why displacement occurs. • Describe how carbon is used to reduce metal oxides. Explain how this takes place in terms of movement of electrons. • Identify which products have been oxidised in extraction examples. Explain how this takes place in terms of movement of electrons • Write balanced symbol equations/half equations for the displacement of metal oxides. Use these to identify which species has been oxidised or reduced. Give reasons for your answers. • Write the symbol equation for the neutralisation of an acid and an alkali. • Describe neutrality and relative acidity in terms of the effect on hydrogen ion concentration and the numerical value of pH • Write half equations for the reactions occurring at the electrodes during electrolysis. • Balance supplied half equations. • Explain thoroughly what happens at the following electrodes using suitable examples and half equations: cathode anode Working Scientifically • Demo, and where appropriate practically investigate, the reactivity of some of the metals with water and acid. • Carry out displacement reactions • Reduce iron oxide using carbon: • Research different methods for extraction metals from their oxides. • Investigate the reactions of the following metals with sulfuric acid: magnesium zinc iron. • Investigate the following reactions: acids + soluble metal hydroxide acid + insoluble metal hydroxide acids + metal carbonates. Required practical 1: • Preparation of a pure, dry sample of a soluble salt from an insoluble oxide or carbonate using a Bunsen burner to heat dilute acid and a water bath or electric heater to evaporate the solution. • Measure the pH of a variety of the following solutions: acidic alkaline neutral. • Practical: measure the pH change when a strong acid neutralises a strong alkali. Required practical 2: • Determination of the reacting volumes of solutions of a strong acid and a strong alkali by titration. Determination of the concentration of one of the solutions in mol/dm³ and g/dm³ from the reacting volumes and the known concentration of the other solution. • Use universal indicator or a pH probe to measure the pH of	
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• Know that in diamond, each carbon atom forms four covalent bonds with other carbon atoms. • Know that diamond exists in a giant covalent structure. • State that diamond is very hard • State that diamond has a very high melting point. • State that diamond does not conduct electricity. • Know that in graphite, each carbon atom forms three covalent bonds with three other carbon atoms, • Recognize that graphite forms layers of hexagonal rings which have no covalent bonds between the layers. • Know that in graphite, one electron from each carbon atom is delocalised. • Identify that graphene is a single layer of graphite • Know that Graphene has properties that make it useful in electronics and composites. • Know that fullerenes are molecules of carbon atoms with hollow shapes. • Recognise that the structure of fullerenes is based on hexagonal rings or tubes of carbon atoms • State that the first fullerene to be discovered was Buckminsterfullerene (C₆₀) which has a spherical shape. • Know that carbon nanotubes are cylindrical fullerenes • Recognise the properties that nanotubes useful for nanotechnology, electronics and materials. <u>Chemistry ONLY</u> • State that nanoscience refers to structures that are 1–100 nm in size • State that Nanoparticles are smaller than fine particles (PM_{2.5}), which have diameters between 100 and 2500 nm • Identify Coarse particles (PM₁₀) as having diameters between 1 x 10⁻⁵ m and 2.5 x 10⁻⁶ m. • State that coarse particles are often referred to as dust. • • Know that nanoparticles may have properties different from those for the same materials in bulk. • Identifying this is because of their high surface area to volume ratio. • State that smaller quantities of nanoparticles are needed to be effective than for materials with normal particle sizes. • Know that nanoparticles have many applications in medicine, in electronics, in cosmetics and sun creams, as		hydrochloric acid, ethanoic acid, sodium hydroxide and ammonium hydroxide • Measure the pH of different acids at different concentrations. • Compare the rate of reaction when magnesium is dipped in hydrochloric acid and ethanoic acid of the same concentration. • Carry out the electrolysis of solutions • Demo the electrolysis of lead bromide. A safer alternative for practical work is anhydrous zinc chloride. Required practical 3: • Investigate what happens when aqueous solutions are electrolysed using inert electrodes. This should be an investigation involving developing a hypothesis	
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deodorants, and as catalysts. ● Recognise that new applications for nanoparticulate materials are an important area of research. Procedural Knowledge: ● Work out the charge on the ions of metals and non-metals from the group number of the element ● Limited to the metals in Groups 1 and 2, and non-metals in Groups 6 and 7. ● Deduce that a compound is ionic from a diagram of its structure in one of the specified forms ● Describe the limitations of using dot and cross, ball and stick, two and three dimensional diagrams to represent molecules or giant structures ● Explain intermolecular forces are weak compared with covalent bonds to explain the bulk properties of molecular substances. ● Recognise graphene and fullerenes from diagrams and descriptions of their bonding and structure. ● Explain the properties of graphite in terms of its structure and bonding. ● Know that graphite is similar to metals in that it has delocalised electrons. ● Explain the properties of diamond in terms of its structure and bonding. ● Know that the side of the cube decreases by a factor of 10 the surface area to volume ratio increases by a factor of 10. Upper Hierarchical Knowledge ● Be able to translate data between diagrammatic and numeric forms. ● Describe the limitations of using dot and cross, ball and stick, two and three dimensional diagrams to represent a giant ionic structure ● State and describe limitations of the particle model ● Work out the empirical formula of an ionic compound from a given model or diagram that shows the ions in the structure. ● Deduce the molecular formula of a substance from a given model or diagram. ● Explain why alloys are harder than pure metals in terms of distortion of the layers of atoms in the structure of a pure metal. ● Compare ‘nano’ dimensions to typical dimensions of atoms and molecules. ● Evaluate the use of nanoparticles for a specified purpose. ● Working Scientifically ● Demo the formation of sodium chloride in a fume cupboard. ● Use magnesium ribbon to produce magnesium oxide. Draw the dot and			
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cross diagram for this reaction. • Model the sodium chloride lattice using molecular model kits. • Demo the formation of hydrogen chloride. Draw the dot and cross diagram for this reaction. • Model simple covalent substance using molecular model kits. • Demo giant covalent structures using molecular model kits. • Use copper wire and silver nitrate solution to grow silver crystals. • Practically test the conductivity of ionic compounds, eg sodium chloride and potassium chloride. • Practically test the conductivity of simple covalent substances using ethanol and solid wax pieces. • Model the structure of diamond using model kits • Model the structure of graphite using model kits.			
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Year 10 (Chemistry) Final Composite Knowledge End Point
<u>Schemata 1 – Structure and Bonding</u> Students will learn about different types of bonding • Ionic Bonding: - o Transfer of electrons between metals and non-metals. - o Formation of ions and ionic compounds. - o Properties of ionic compounds: high melting points, conductivity when molten or dissolved. • Covalent Bonding: - o Sharing of electrons between non-metals. - o Formation of molecules. - o Properties of simple molecular substances: low melting and boiling points, poor conductivity. • Metallic Bonding: - o Sea of delocalized electrons. - o Properties of metals: conductivity, malleability, ductility. Students will learn about structure and properties • Giant Ionic Structures: - o Lattice structure of ionic compounds. - o High melting and boiling points. • Simple Molecular Structures: - o Weak intermolecular forces. - o Low melting and boiling points. • Giant Covalent Structures: - o Diamond, graphite, and silicon dioxide. - o High melting points and unique properties (e.g., hardness of diamond, conductivity of graphite). • Metallic Structures: - o Layers of atoms and delocalized electrons. - o Explanation of metal properties in terms of structure and bonding. Students will about states of matter • Particle Model: - o Solid, liquid, gas: particle arrangement and movement. - o Changes of state and energy transfer: melting, boiling, condensation, freezing. Students will learn about Nanoscience • Nanoparticles: - o Definition and scale of nanoparticles. - o Unique properties and applications. - o Potential risks and benefits of nanotechnology. <u>Schemata 2 – Quantitative Chemistry</u> Students will learn about Atomic and Molecular Mass • Relative Atomic Mass (Ar): - o Definition and calculation based on isotopic abundance. • Relative Formula Mass (Mr): - o Calculation for compounds using relative atomic masses of constituent elements.

Students will learn about The Mole and Avogadro's Constant

- **The Mole:**
 - o Definition of the mole as a unit of amount of substance.
 - o Avogadro's constant: 6.022×10^{23} particles per mole.
 - o Use of the mole in converting between mass, particles, and moles.
- **Molar Mass:**
 - o Definition and calculation from relative atomic and formula masses.
 - o Use in converting between mass and moles.

Students will about Chemical Calculations

- **Balanced Equations:**
 - o Interpretation of balanced chemical equations in terms of moles.
 - o Use of stoichiometry to calculate reacting masses.
- **Reacting Masses:**
 - o Calculations involving masses of reactants and products.
 - o Limiting reactants: identification and calculations.

Students will learn about Concentrations of Solutions

- **Concentration:**
 - o Definition and calculation in terms of mass per unit volume (g/dm^3) and moles per unit volume (mol/dm^3).

Chemistry Only

Students will learn Volumes of Gases

- **Gas Volumes:**
 - o Molar volume of gases at room temperature and pressure (RTP): $24 \text{ dm}^3/\text{mol}$.
 - o Use of molar volume in calculations involving gaseous reactants and products.

Students will learn about Percentage Yield and Atom Economy

- **Percentage Yield:**
 - o Calculation from actual yield and theoretical yield.
 - o Factors affecting percentage yield in reactions.
- **Atom Economy:**
 - o Definition and calculation.
 - o Importance of atom economy in sustainable chemistry.

Students will learn about Titrations

- **Acid-Base Titrations:**
 - o Procedure and calculations for determining concentrations.
 - o Use of indicators and understanding of end-point.
- **Calculations:**
 - o Using titration data to calculate unknown concentrations.

Students will learn about Uncertainties and Errors

- **Measurement Uncertainties:**
 - o Understanding and calculating uncertainties in measurements.
 - o Reporting and reducing uncertainties in experimental results.

Schemata 3 – Chemical Change

Students will learn about Chemical Reactions

- **Chemical Reactions:**
 - o Definition and identification of chemical reactions.
 - o Evidence of a chemical reaction: color change, gas production, precipitate formation, temperature change.
- **Chemical Equations:**
 - o Writing word equations for common reactions.
 - o Writing and balancing simple symbol equations.
 - o Use of state symbols: (s), (l), (g), (aq).

Students will learn about Acids, Bases, and Neutralization

- **Acids and Bases:**
 - o Definition and properties of acids and alkalis (bases).
 - o The pH scale: understanding pH values and their significance.
 - o Use of indicators (litmus, universal indicator) and pH meters.
- **Neutralization Reactions:**
 - o General equation for acid-base neutralization: $\text{acid} + \text{base} \rightarrow \text{salt} + \text{water}$.
 - o Practical applications: everyday examples like antacids and soil treatment.

Students will about Reactions of Acids

- **With Metals:**
 - o General reaction: $\text{acid} + \text{metal} \rightarrow \text{salt} + \text{hydrogen gas}$.
 - o Observations and simple tests for hydrogen gas (pop test).
- **With Bases:**
 - o General reaction: $\text{acid} + \text{base} \rightarrow \text{salt} + \text{water}$.
 - o Formation and naming of salts based on the acid and base used.
- **With Carbonates:**
 - o General reaction: $\text{acid} + \text{carbonate} \rightarrow \text{salt} + \text{water} + \text{carbon dioxide}$.

- o Observations and tests for carbon dioxide gas (limewater test).

Students will learn about Electrolysis

- **Basic Principles:**
 - o Definition of electrolysis and its purpose.
 - o Key components: electrolyte, anode (positive electrode), cathode (negative electrode).
- **Electrolysis of Molten Compounds:**
 - o Simple examples such as the electrolysis of molten lead bromide.
 - o Understanding ion movement and products at each electrode.
- **Electrolysis of Aqueous Solutions:**
 - o Differences when electrolyzing aqueous solutions.
 - o Example: electrolysis of sodium chloride solution producing hydrogen and chlorine.

Students will learn about the Reactivity Series

- **Reactivity Series:**
 - o Arrangement of metals in order of reactivity.
 - o Comparison of reactivity based on reactions with water, acids, and oxygen.
 - o Placement of carbon and hydrogen in the reactivity series for comparison.
- **Displacement Reactions:**
 - o Explanation and examples of displacement reactions.
 - o Use of displacement reactions to determine the reactivity of metals.

Students will learn about Extraction of Metals

- **Ores and Minerals:**
 - o Definition of ores and their economic importance.
 - o Common ores of metals like iron, aluminum, and copper.
- **Methods of Extraction:**
 - o Extraction of metals below carbon in the reactivity series (e.g., iron) using reduction with carbon.
 - o Extraction of metals above carbon (e.g., aluminum) using electrolysis.
- **Reduction with Carbon:**
 - o Example: extraction of iron from iron ore in a blast furnace.
 - o Chemical equations for the reduction process.
- **Electrolysis:**
 - o Extraction of aluminum from bauxite using electrolysis.
 - o Chemical equations for the electrolysis process.

Students will learn about Oxidation and Reduction

- **Definitions:**
 - o Oxidation: loss of electrons, gain of oxygen.
 - o Reduction: gain of electrons, loss of oxygen.
 - o Redox reactions: simultaneous oxidation and reduction processes.
- **Examples of Redox Reactions:**
 - o Reactions of metals with oxygen (e.g., rusting of iron).
 - o Displacement reactions as redox reactions

Schemata 4 - The Rate and Extent of Chemical Change

Students will learn about Rate of Reaction

- **Definition of Rate of Reaction:**
 - o The speed at which reactants are converted to products.
 - o Calculation of reaction rate: change in quantity of reactant/product over time.
- **Factors Affecting Rate of Reaction:**
 - o Concentration: higher concentration increases rate.
 - o Temperature: higher temperature increases rate.
 - o Surface Area: greater surface area increases rate.
 - o Catalysts: substances that increase rate without being consumed.
 - o Pressure (for gases): higher pressure increases rate.
- **Collision Theory:**
 - o Explanation of how reactions occur when particles collide with sufficient energy.
 - o Activation energy: minimum energy needed for a reaction to occur.
- **Measuring Rates of Reaction:**
 - o Monitoring changes in mass, volume of gas produced, or color change.
 - o Practical methods such as gas syringe or precipitation methods.

Students will learn about Graphical Representation of Reaction Rates

- **Rate Graphs:**
 - o Interpreting graphs of concentration vs. time.
 - o Determining rate from the gradient of the graph.
 - o Understanding different shapes of rate graphs for different reactions.

Students will learn about Catalysts

- **Function of Catalysts:**
 - o Definition and role of catalysts in increasing reaction rate.
 - o How catalysts lower activation energy.
 - o Examples of catalysts in industry (e.g., enzymes in biological processes).

Students will learn about Reversible Reactions and Dynamic Equilibrium

- **Reversible Reactions:**
 - o Definition and characteristics of reversible reactions.

- o Examples of reversible reactions (e.g., the Haber process). • Dynamic Equilibrium: - o Definition and conditions for dynamic equilibrium in a closed system. - o Characteristics of dynamic equilibrium: rates of forward and reverse reactions are equal. - o Understanding that concentration of reactants and products remain constant. Students will learn about Le Chatelier's Principle • Le Chatelier's Principle: - o Explanation of how changes in concentration, temperature, and pressure affect the position of equilibrium. - o Predicting the effect of changing conditions on the yield of products. • Applications of Le Chatelier's Principle: - o Industrial processes such as the Haber process for ammonia production. - o Effect of pressure, temperature, and concentration changes on equilibrium position and product yield. Students will learn about Calculations Involving Reaction Rates • Quantitative Aspects: - o Calculations involving rate of reaction (e.g., rate = amount of reactant used / time). - o Interpretation and calculation of data from rate experiments.
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Year 10 Physics Essential Knowledge Summary			
Schemata 1: P3 Particle Model of Matter	Schemata 2: P4 Atomic Structure	Schemata 3: P2 Electricity	Schemata 4: P6 Waves
Composite Knowledge: Pupils will be able to discuss the changes to particle arrangement, movement, energy and force in relation to states of matter and changes of state. Pupils will be able to calculate density with both their primary data and secondary data. Pupils will learn how changes to the internal energy of a substance affect the substance. Pupils will be able to define and distinguish between specific heat capacity and latent heat. Pupils will learn about Boyle’s law and (Triple only) Charles’s Law. Component Knowledge: Foundational Knowledge: Declarative Knowledge: - Recall the equation that links: density, mass, and volume - Recall the units for density, mass, volume, energy changes, specific heat capacity, temperature change, latent heat, pressure - Recall the three states of matter - Draw simple diagram to represent the three state of matter - Describe the particle arrangement and particle movement in each state of matter - Describe how density changes when changing state - State the law of conservation of mass in relation to changing state - Name the changes of state - Describe how the forces between particles and energy of particle changes during changes of state - Define internal energy - Apply the equation for specific heat capacity - Define specific heat capacity - Define latent heat, latent heat of fusion, and latent heat of vaporisation - Apply the latent heat equation - State how particles in a gas move - Relate the temperature, pressure and volume of a gas - Apply the equation for gas $pV=const$ (Triple only)	Composite Knowledge: Understand and describe the structure of the atom and use evidence to explain how this has changed over time. Understand the concept of the random nature of radioactive decay and the properties of the different types of nuclear radiation. Understand how the penetrating power and ionising ability differentiates the different types of nuclear radiation. Describe the applications and hazards of nuclear radiation. Complete, interpret and balance decay equations. Understand the concept and application of half-life. (Triple only) Understand and compare the processes of nuclear fission and nuclear fusion. Understand the effect of nuclear radiation on living things and how we take precaution to make ourselves and the environment safe. Understand the difference between contamination and irradiation. Component Knowledge: Foundational Knowledge: Declarative Knowledge: - State the approximate radius of an atom - State the approximate size of the nucleus compared to the size of an atom - Name the three subatomic particles - State the relative charge and relative mass of the three subatomic particles - Simply describe the location of the three subatomic particles. - State what is meant by mass number and atomic number - Define isotope - Name historic models of the atoms in chronological order - Describe different models of the atom - State the evidence used for changing between atomic models. - Name the three types of nuclear radiation. - State what the different types of nuclear decay are made of. - Name the unit for radioactivity - Define count-rate and activity	Composite Knowledge: Pupils will learn about the relationship between current, potential difference, and resistance. They will learn about circuit components, how to interpret circuit diagrams and how to apply the rules for current, potential difference, and resistance in both series and parallel circuits. Pupils will investigate resistance in various components and circuits. They will practise and become confident in using and manipulating many equations. Pupils will learn about our domestic supply, how it is transferred and how we keep ourselves safe when using it. Component Knowledge: Foundational Knowledge: Declarative Knowledge: - Recall the units for: current, charge, time, resistance, potential difference, power - Name and draw circuit symbols - Define electrical current - Recall the equation that links: charge, current and time - State Ohm’s law - Recall the Ohm’s law equation - Recognise the V-I graph for a fixed value resistor, filament lamp, diode, thermistor & LDR. - State how the resistance of thermistors and LDRs change with change in the environment - State the difference between a series and parallel circuit - State the rules for current, potential difference and resistance in both series and parallel circuits. - State the frequency and potential of the UK domestic supply - State what is meant by both direct and alternating potential differences. - State the colour of the insulation in a three pin plug - State the names of the pins in a three pin plug - State the role of each wire / component in a three pin plug.	Composite Knowledge: Pupils will understand the difference between longitudinal and transverse waves. Pupils will become familiar with the terms amplitude, wavelength, frequency, time period and wave speed. Pupils will learn and be able to use the wave speed equation. They will recognise the waves in the electromagnetic spectrum, their properties, uses and dangers. In triple science pupils will learn about sound waves and seismic waves, their properties and uses. Pupils will learn about light, how it is reflected and refracted. In triple science they will discuss wave fronts and also be able to understand how lenses work. Component Knowledge: Foundational Knowledge: Declarative Knowledge: - Recall the units of: wave speed, frequency, wavelength, period - Recognise, define and label transverse and longitudinal waves. - Define terms: ‘frequency’, ‘wavelength’ & ‘amplitude’. - Recall and use the wave equation and period-frequency equations. - Describe how to measure the speed of sound in air - Recognise that waves can be reflected, transmitted and absorbed at the boundary of different materials (triple only) - Describe the effect of reflection, transmission or absorption of waves at a boundary (triple only) - Know how sound waves travel (triple only) - Describe how the structure of the ear restricts the human range of hearing (triple only) - State the range of human hearing (triple only) - Define ultrasound (triple only) - State the properties of different seismic waves (triple only) - Describe how echo-sounding is used to measure depth (triple only) - Define ‘electromagnetic wave’

- State how work done on a gas affects pressure / temperature (Triple only) Procedural Knowledge: - Use an equation to find an unknown variable - Write methods for experiments. - Accurately plot axes & graphs - Draw lines of best fit and use them to find tangents and gradients. Upper Hierarchical Knowledge - Describe how to experimentally find the density of a regular solid, irregular solid, and a liquid (RP5) - Describe how to experimentally find the specific heat capacity of a substance (RP1) - Manipulate and use the equations for: - Density - Specific heat capacity - Latent heat - Explain how adding or removing heat from a substance changes the arrangement and movement of particles and the density of the substance. - Use the concepts of specific heat capacity and latent heat to interpret heating and cooling curves - Explain the relationship between gas pressure and volume - Explain the relationship work on a gas and temperature Working Scientifically Density (RP5) - WS 2.2 Plan experiments or devise procedures to make observations, produce or characterise a substance, test hypotheses, check data or explore phenomena. - Describe a practical procedure for a specified purpose. - Describe a practical procedure for a specified purpose. - Assess whether sufficient, precise measurements have been taken in an experiment. Specific Heat Capacity (w. joule metres) (RP1) - WS 3.3 Carrying out and represent mathematical and statistical analysis. - use an appropriate number of significant figures - change the subject of an equation substitute numerical values into algebraic - equations using appropriate units for physical quantities - determine the slope and intercept of a linear graph Air pressure / can crush demo - WS 3.5 Interpreting observations, making inferences and drawing conclusions. - Draw conclusions from given observations. Boyle's law demo - WS 3.1 Presenting observations and other data using appropriate methods.	- Know that radioactive decay is random - State the penetrating power & ionising power of the different types of nuclear decay - Name the equipment used to detect radioactive decay - Give uses of nuclear radiation - Complete decay equation - State what happens in the nucleus of an atom that undergoes radioactive decay - Define half-life - Define radioactive contamination - Define irradiation - Describe the precautions taken to stay safe in the presence of nuclear radiation - Define background radiation (triple only) - Give examples of background radiation (triple only) - Define nuclear fission (triple only) - Draw a diagram to represent a nuclear fission chain reaction (triple only) - State the role of control rods in a chain reaction (triple only) - Define nuclear fusion Procedural Knowledge: - Use mass number and atomic number to state the number of subatomic particles in an atom. - Complete decay equations - Determine the half-life of a radioactive source - Calculate net decline as a ratio (higher tier only) Upper Hierarchical Knowledge - Describe how the absorption or emission of EM radiation affects electrons. - Explain, in depth, the changes to the atomic model. Working Scientifically Radioactive source demo - WS 3.5 Interpreting observations and other data (presented in verbal, diagrammatic, graphical, symbolic or numerical form), including identifying patterns and trends, making inferences and drawing conclusions. - Draw conclusions from given observations. None practical based: Atomic structure / atoms - WS 1.2 Use a variety of models such as representational, spatial, descriptive, computational and mathematical to solve problems, make predictions and to develop scientific explanations and understanding of familiar and unfamiliar facts. - Use models in explanations, or match features of a model to the data from experiments or observations that the model describes or explains. History of the atom	- State the expected potential difference between the live and neutral wires in a three pin plug. - Recall the equation that links: power, current, and potential difference - Recall the equation that links: power, current, and resistance - Recall the equation that links: power, energy, and time - Recall the equation that links: charge, energy, and potential difference - State the components of the National Grid - State how step-up and step-down transformers affect potential difference and current. - State that objects become charged because of the transfer of electrons (Triple only) - State that electrons have a negative electrical charge (Triple only) - Know that like charges repel and unlike charges attract (triple only) Procedural Knowledge: - Use an equation to find an unknown variable - Write methods for experiments. - Accurately plot axes & graphs - Draw lines of best fit and use them to find tangents and gradients. Upper Hierarchical Knowledge - Describe how to experimentally find the resistance of an electrical component (RP3/4) - Compare the resistance of electrical components and explain how this changes as potential difference and/or the environment changes - Manipulate and use the equations for: - charge - Ohm's law - Potential difference - Power - Energy - Resistance - Compare and evaluate different energy resources Working Scientifically Ohm's Law - WS 3.2 Translating data from one form to another. - Translate data between graphical and numeric form. Resistance of a wire (RP3) - WS 3.3 Carrying out and represent mathematical and statistical analysis. - use an appropriate number of significant figures - find the arithmetic mean and range of a set of data - substitute numerical values into algebraic equations using appropriate units for physical quantities Resistors in series & parallel (RP3) - WS 3.5 Interpreting observations and other data (presented in verbal, diagrammatic, graphical, symbolic or numerical form),	- State the names of the wave in the electromagnetic spectrum in order (in terms of frequency and wavelength) - Describe how EM waves can be produced by changes in an atom - Define 'radiation dose' - Recall uses of EM waves - Recognise a concave and convex lens (triple only) - Understand the terms: principal focus, focal length, real image and virtual image. - Name the colours of the visible spectrum in order - Understand the terms: specular reflection & diffuse scattering (triple only) - Describe how colour filters work in terms of reflection & transmission (triple only) - Understand the colour of opaque object in terms of reflection & absorption (triple only) - Use the terms transparent, translucent and opaque appropriately (triple only) - Understand the term 'black body' and how wavelength and frequency of emission depends on temperature (triple only) Procedural Knowledge: - Write methods for experiments - Construct a ray diagram to show reflection (triple only) - Construct a ray diagram to show refraction at a boundary - Construct a ray diagram to show the images formed by concave and convex lenses (triple only) - Calculate magnification (triple only) - Write methods for experiments. - Accurately plot axes & graphs - Draw lines of best fit and use them to find tangents and gradients. Upper Hierarchical Knowledge - Describe how changes in wave speed, frequency & wavelength of sound waves are related as they move from one medium to another. - Describe how the properties of waves are used for detection & exploration (triple only) - Use the idea of wave front diagrams to explain refraction - Describe how radio waves can be produced and transmitted. - Draw conclusions about the risks of exposure to EM waves - Explain why a particular EM wave is suitable for a specific application - Explain temperature of Earth and other bodies in terms of absorption & emission of energy (triple only) Working Scientifically Ripple tank & Waves on a string (RP8) - WS 2.3 Apply a knowledge of a range of techniques, instruments, apparatus, and materials to select those appropriate to the experiment. - Describe/suggest/select the technique, instrument, apparatus or material that should be
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○ Plot two variables from experimental or other data. Charles's Law / Hyman Fire Piston demo ● WS 3.5 Interpreting observations, making inferences and drawing conclusions. ○ Draw conclusions from given observations.	● WS 1.1 Understand how scientific methods and theories develop over time. ○ Give examples to show how scientific methods and theories have changed over time. ○ Explain, with an example, why new data from experiments or observations led to changes in models or theories. ●	including identifying patterns and trends, making inferences and drawing conclusions. ○ Use data to make predictions. ○ Recognise or describe patterns and trends in data ○ Draw conclusions from given observations. V-I characteristics of filament lamp, diode, and a resistor at constant temperature (RP4) ● WS 3.3 Carrying out and represent mathematical and statistical analysis. ○ draw and use the slope of a tangent to a curve as a measure of rate of change Series and parallel circuits ● WS 2.1 Use scientific theories and explanations to develop hypotheses. ○ Suggest a hypothesis to explain given observations or data.	used for a particular purpose, and explain why. Reflection & refraction of light (RP 9) (triple only) ● WS 2.2 – Plan experiments or devise procedures to make observations, produce or characterise a substance, test hypotheses, check data or explore phenomena. ○ Describe a practical procedure for a specified purpose. Investigating the absorption & radiation of infrared radiation (RP 10) ● WS 3.5 Interpreting observations and other data (presented in verbal, diagrammatic, graphical, symbolic or numerical form), including identifying patterns and trends, making inferences and drawing conclusions. ○ Use data to make predictions. ○ Recognise or describe patterns and trends in data presented in a variety of tabular, graphical and other forms. ○ Draw conclusions from given observations.
Year 10 (physics) Final Composite Knowledge End Point (May ½ term)			
● Learn about electrical circuits and explain the behaviour of components such as filament bulbs, thermistors and LDRs. ● Understand current, potential difference, resistance and their relationships. ● Understand how electricity is transmitted to consumers and the difference between ac/dc. ● Explore ideas of density and pressure, relating this to states of matter and changes of state. ● Understand both specific heat capacity and specific latent heat. ● Describe the structure of an atom and explain how our ideas about atoms have changed. ● Describe the random nature of radioactive decay and the properties of alpha, beta and gamma radiation. ● Understand radioactive decay in terms of isotopes, half-life and decay chains.			

Year 11: Curriculum Intent

The intent of the Year 11 curriculum is to learn the final parts of their science curriculum and consolidate this and prepare them for the next stage of education. They will continue to increase the depth and breadth of their knowledge and build strong links in learning to consolidate prior learning and secure the knowledge and skills required to excel in GCSE Science. Pupils will continue to study the different areas of science:

- in Biology - Homeostasis and Inheritance, Variation & Evolution.
- in Chemistry - Chemical Analysis, Chemistry of the Atmosphere and Using Resources.
- in Physics - Forces, Magnets & Electromagnets and, in triple science only, Space Physics..
- and across all three sciences - how to Work Scientifically.

Pupils will be taught key knowledge and skills in both theory and practical science. They will learn about the scientific method, how to keep safe and how to draw valid conclusions from data.

Year 11 Biology Essential Knowledge Summary

Schemata 1: B5 Homeostasis and Response

Composite Knowledge: Pupils will gain an understanding of both the endocrine and nervous system. With a particular focus on glucose control and the negative feedback systems involved in thyroxine release and the female menstrual cycle.

Component Knowledge:
Foundational Knowledge:
Declarative Knowledge:

Recall what homeostasis is and why it is important.

Recall examples of conditions that need to be controlled.

Recall the roles of the nervous system and the endocrine system in homeostasis.

Recall the main components of a control system and their functions.

Recall the functions of the main structures in the nervous system.

Recall the differences between voluntary and reflex actions.

Recall the stages of a reflex action

Schemata 2: B6: Inheritance, Variation and Evolution

Composite Knowledge: Pupils will gain an understanding of how the information in your genetic code controls the chemicals that make up your cells, tissues and organs. Students will consider some of the new gene technologies that scientists are using. Students will gain an understanding of how knowledge of the genome allows us to classify organisms in different ways and make sense of global diversity.

Component Knowledge:
Foundational Knowledge:
Declarative Knowledge:

Recall sexual reproduction produces variation in the offspring, but asexual reproduction does not.

Recall sexual reproduction in animals and plants.

Recall the term clone.

Recall cuttings as clones of plants.

Define meiosis.

Describe the endocrine system Recall the term hormone. Recall the locations of organs in the endocrine system. Recall why the pituitary gland is often called the master gland. Recall how blood glucose concentration is monitored and controlled. Recall when insulin is produced and how it helps to control blood glucose levels. Recall glycogen as a stored carbohydrate. Recall the cause, treatment and problems associated with Type 2 diabetes. Recall the terms hormonal and non-hormonal methods of contraception. Recall the use of fertility drugs in women with low FSH levels. Recall where and when adrenaline is released and its target organs. Recall the effects of adrenaline on the body. Recall where thyroxine is produced and its effects on the body. Biology Only Identify the cerebral cortex, cerebellum and medulla on a diagram and recall the function of each. Label a diagram of the eye and describe the function of each structure. Define the term ‘accommodation’. Recall different methods to measure body temperature. Recall how body temperature is monitored and controlled. Describe where water, ions and urea are lost from the body. Label a diagram of the excretory system. Recall the advantages and disadvantages of a kidney transplant. Recall how a kidney machine works. Recall how plant shoots and roots respond to light and gravity. Recall the role of auxin in plant responses in terms of unequal distribution in shoots and roots. Recall how auxins are used as weedkillers and rooting powders, and to promote growth in tissue culture. Procedural Knowledge: Explain the importance of being able to respond to environmental changes and coordinate behaviour. Explain how the nervous system is adapted for its functions. Explain the role of chemicals at synapses. Describe and use different methods to measure reaction time. Explain the importance of reflex actions and give examples. Compare the actions of the nervous and endocrine systems. Compare the causes, and treatments of Type 1 and Type 2 diabetes. Recall secondary sexual characteristics of boys and girls. Recall the cause of these changes in boys and girls and their relevance in reproduction. Describe the menstrual cycle and fertility including the role of hormones. Explain how hormonal and non-hormonal contraceptives work. Explain the process of In Vitro Fertilisation (IVF).	Describe the process of meiosis to include the number of chromosomes at each stage. Define fertilisation. Describe using a Punnett square and genetic diagram how sex is determined in humans. Define the term gametes and describe their genetic material. Draw diagrams to explain how gametes are formed in meiosis. Recall the number of chromosomes in the gametes during meiosis and fertilisation. Recall that plants can reproduce sexually to produce seeds and asexually by runners. Recall the structure of chromosomes, DNA and genes. Recall that a gene is a small section of DNA that codes for a particular sequence of amino acids to make a specific protein. Define the term genome. Recall what a mutation is. Give examples of characteristics controlled by a single gene and describe their alleles. Give examples of characteristics controlled by multiple genes. Define and use the terms: gametes, genotype, phenotype, dominant recessive, homozygous and heterozygous. Describe the inherited disorders polydactyly and cystic fibrosis. Define the term genetic engineering. Recall the process of genetic engineering and its advantages. Recall plant cloning techniques to include: · taking plant cuttings · tissue culture. Explain why identical twins are clones. Describe animal cloning techniques to include: · embryo transplants · adult cell cloning. Recall classification of characteristics as being due to genetic, environmental or a combination of these causes. Recall examples of continuous and discontinuous variation. Recall why humans selectively breed plants and animals. Recall selective breeding as a type of sexual reproduction. Describe the process of selective breeding and give examples. Describe evolution by Darwin’s theory of natural selection, recalling the main stages of natural selection. Recall why mutation may lead to more rapid change in a species. Define the term species. Identify organisms that are of different species. Recall the work of Alfred Russel Wallace on natural selection. Recall the work of Jean-Baptiste Lamarck. Define the terms inherited and acquired characteristics. Recall types of evidence for the theory of evolution by natural selection. Define the term ‘fossil’.
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Explain how levels of adrenaline are controlled by a negative feedback system. Explain how its release is stimulated by thyroid stimulating hormone and the levels of these two hormones are controlled by a negative feedback system. Biology Only Describe how the eye changes to focus on near and distant objects. Complete simple ray diagrams to show normal vision, long-sightedness and short-sightedness Describe and explain the changes that happen when body temperature is too high or too low. Explain why we drink more fluid during hot weather. Explain why there is no control over water, ion and urea loss by the lungs and skin. Explain when cells might gain or lose too much water, in terms of osmosis (links to B1)). Describe the effect of too much or too little water on cells. Explain how the body responds to different temperature and osmotic challenges in terms of sweat and urine release. Describe how urine is produced. Describe the absorption of glucose and ions by diffusion and active transport (link to B1). Explain why dialysis fluid contains sugar and ions at the same concentration as normal blood, but no urea. Evaluate the use of kidney transplants and dialysis to treat kidney failure. Explain the role of auxin in plant responses in terms of unequal distribution in shoots and roots. Describe the use of ethene to control the ripening of fruit during storage and transport. Describe the use of gibberellins to end seed dormancy, promote flowering and to increase fruit size. <u>Upper Hierarchical Knowledge</u> Explain when glucagon is produced by the pancreas and its effect on blood glucose levels. Explain how insulin and glucagon work together to control blood glucose levels. Explain the cause, effects, treatment and problems associated with Type 1 diabetes. Evaluate modern methods of treating diabetes. Explain the interaction between these hormones in the control of the menstrual cycle. Evaluate hormonal and non-hormonal contraceptives. Evaluate the use of fertility treatments. Biology Only - Describe the techniques used to map areas of the brain to their functions. - Evaluate the benefits and risks of procedures carried out on the brain and nervous system. - Describe how amino acids are deaminated in the liver to form ammonia, which is converted to urea for excretion. - Recall the site of production and target organs for ADH. - Describe the effects of ADH on kidney tubules. - Explain, with the aid of a diagram, how ADH controls the concentration of the blood using a negative feedback mechanism.	Recall how fossils may be formed. Define the term extinction. Explain how extinction may be caused. Biology Only Recall advantages and disadvantages of asexual and sexual reproduction. Explain the structure of DNA using diagrams and models. Recall how the bases on the two strands link together. Describe some of the experiments carried out by Mendel using pea plants. Recall a timeline showing the main developments in the understanding of inheritance Recall the work of Wallace. Procedural Knowledge: Explain why sexual reproduction produces variation in the offspring, but asexual reproduction does not. Explain why sexual reproduction results in variety. Compare mitosis and meiosis Describe advantages and disadvantages of sexual and asexual reproduction. Describe some organisms that can reproduce by both methods (Malarial parasite and types of fungi). Explain using a Punnett square and genetic diagram how sex is determined in humans. Explain the probability of having a child that is a boy or a girl. Explain how knowledge of the human genome will help medicine in the future. Explain the ethical issues related to DNA sequencing. Use genetic cross diagrams to explain inheritance and carriers. Make informed judgements about the economic, social and ethical issues concerning embryo screening. Describe the use of genetic modification to treat genetic disorders. Explain why Mendel proposed the idea of separately inherited factors and why the importance of this discovery was not recognised until after his death. Predict and explain the outcome of crosses using genetic diagrams based on Mendel's experiments and using unfamiliar information. Evaluate the use of genetic engineering in medicine, eg in gene therapy and production of hormones and some vaccines. Interpret information about genetic engineering techniques. Make informed judgements about the economic, social and ethical issues concerning genetic engineering and GM crops. Explain the importance of cloning to plant growers. Interpret information about plant cloning techniques. Explain advantages and disadvantages of plant cloning techniques. Evaluate arguments for and against human cloning. Make informed judgements about the economic, social and ethical issues concerning cloning. Explain the benefits and risks of selective breeding in plants and animals.
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● Explain the interaction between these hormones in the control of the menstrual cycle. ● Describe the functions of gibberellins and ethene in plants. <u>Working Scientifically</u> Testing samples of urine for glucose: ● WSAN 1 make and record observations and measurements and present data using appropriate methods including tables with repeat measurements Required practical- Plan and carry out an investigation into the effect of a factor on human reaction time: ● WS8 make and record observations and measurements using a range of methods for different investigations; and evaluate the reliability of methods and suggest possible improvements. Biology Only: Eye Dissection: ● WSAN 1 make and record observations and measurements and present data using appropriate methods including tables with repeat measurements. Plot cooling curves: ● WSAN 2 use basic data analysis to calculate means, plot graphs with line of best fit and use this data to draw conclusions Kidney Dissection: ● WSAN 1 make and record observations and measurements and present data using appropriate methods including tables with repeat measurements. Required practical-Plan and carry out an investigation into the effect of light on plant shoots: ● WS6 select, plan and carry out the most appropriate types of scientific enquiries to test predictions, including identifying independent, dependent and control variables, where appropriate.	Interpret evolutionary trees Identify differences between Darwin’s theory of evolution and conflicting theories. Suggest reasons for the different theories. Explain why scientists cannot be certain how life began on Earth. Explain how fossils provide evidence for evolution. Explain what we should do to slow down the rate of development of resistant strains of bacteria (Link to B3). Explain that organisms become extinct because something changes and the species cannot adapt quickly enough to the new circumstances. Biology Only Describe in simple terms how a protein is synthesised. Describe how a mutation could affect the formation of a protein, including enzymes and how the shape of the protein links to enzyme action (link to B2). Explain how new species arise using the terms: ● isolation ● genetic variation ● natural selection ● speciation. <u>Upper Hierarchical Knowledge</u> Describe how an embryo is formed. Describe the function of non-coding parts of DNA and the possible effect of a mutation in a non-coding section of DNA. Construct genetic cross diagrams. Describe in detail the process of genetic engineering. Describe the impact of antibiotic resistance. <u>Working Scientifically</u> Observing under slides under a microscope- Observe mitosis and meiosis slides. Making observational drawings. ● WSAN 1 make and record observations and measurements and present data using appropriate methods including tables with repeat measurements. DNA Extraction: The extraction of DNA from a kiwi: ● WSAT 2 identify hazards and risks and suggest appropriate ways to reduce the risks. Appreciate how scientific developments can be used to control reproduction: WSAT 1 explain how scientific methods and theories have developed, as new evidence and ideas are taken into account by the scientific community (e.g. the development of the periodic table) Appreciate the power and limitations of science and consider any ethical issues: ● WS2 understand that scientific methods and theories develop as earlier explanations are modified to take account of new evidence and ideas, together with the importance of publishing results and peer review Model DNA structure. Produce cauliflower clones using aseptic technique. Evaluate the method and results: ● WSAN 1 make and record observations and measurements and present data using appropriate methods including tables with repeat measurements Model how a fossil can be formed.
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Year 10 (biology) Final Composite Knowledge End Point			
Schemata 1 B7 Ecology - Recall the terms ecosystem, community, competition, habitat, interdependence. - Recall the definition of a stable community. - Recall the resources that plants and animals compete for in a given habitat. - Recall structural, behavioural and functional adaptations, in a range of organisms. - Recall the Linnaean classification system. - Recall Carl Woese’s system of classification and classify organisms into the three domains. - Recall biotic factors in a habitat. - Recall abiotic factors in a habitat. - Define biodiversity - Recall the types of water pollution. - Recall examples of air pollutants and where they come from. - Recall what global warming is - Recall the gases responsible for global warming. Schemata 2 B6 Inheritance, Variation and Evolution - Recall sexual and asexual reproduction in animals and plants. - Recall the term clone. - Define a cutting from a plant. - Define meiosis. - Describe the process of meiosis. - Define fertilisation. - Define the term gametes. - Recall the number of chromosomes in the gametes during meiosis and fertilisation. - Recall the structure of chromosomes, DNA and genes. - Define the term genome. - Recall what a mutation is. - Give examples of characteristics controlled by a single gene and describe their alleles. - Give examples of characteristics controlled by multiple genes. - Define and use the terms: gametes, genotype, phenotype, dominant recessive, homozygous and heterozygous. - Describe the inherited disorders polydactyly and cystic fibrosis. - Define the term genetic engineering. - Recall the process of genetic engineering and its advantages. - Recall plant cloning techniques to include: - Explain why identical twins are clones. - Describe animal cloning techniques. - Recall examples of continuous and discontinuous variation.			
- Recall why humans selectively breed plants and animals. - Describe the process of selective breeding and give examples. - Recall the main stages of Darwin’s theory of natural selection. - Define the term species. - Recall the work of Alfred Russel Wallace on natural selection. - Recall the work of Jean-Baptiste Lamarck. - Define the terms inherited and acquired characteristics. - Recall types of evidence for the theory of evolution by natural selection. - Define the term ‘fossil’. - Define the term extinction. - Explain how extinction may be caused. Biology Only - Recall advantages and disadvantages of asexual and sexual reproduction. - Recall the structure of DNA and how the bases on the two strands link together. - Describe some of the experiments carried out by Mendel using pea plants. - Recall a timeline showing the main developments in the understanding of inheritance - Recall the work of Wallace.			
Year 11 Chemistry Essential Knowledge Summary			
Schemata 1: C7 Organic Chemistry	Schemata 2: C8 Chemical Analysis	Schemata 3: C9 Chemistry of the Atmosphere	Schemata 4: C10 Using Resources
Composite Knowledge: Pct. Component Knowledge: Foundational Knowledge: Declarative Knowledge: - Be able to recognise substances as alkanes given their formulae in these forms. - Describe the formation of crude oil. - Describe the composition of crude oil. - Define a hydrocarbon. - Explain what is meant by the formula C_nH_{2n+2} - Make molecular models and work out general formula for the alkanes. - Draw the covalent bonding in: - methane	Composite Knowledge: Pues. Component Knowledge: Foundational Knowledge: Declarative Knowledge: - Define the terms: - pure substance - compound. - Use data to identify pure and impure substances. - Identify the contents of mineral waters sold as ‘pure’. Discuss the meaning of ‘pure’. - Define the terms: - mixture - formulation. - Describe a method for paper chromatography. - Describe what the R_f value is and instructions on how to calculate the R_f value. - Devise a method for distinguishing between pure and impure	Composite Knowledge: Pues. Component Knowledge: Foundational Knowledge: Declarative Knowledge: - Describe the composition of the atmosphere. - Describe the approximate levels of gases in Earth’s early atmosphere. - Draw accurate pie charts for the composition of the atmosphere. - Describe how sedimentary rocks formed and locked up carbon dioxide. - Describe the main changes in the atmosphere over time and some of the likely causes of these changes. - Describe and explain the formation of deposits of limestone, coal, crude oil and natural gas.	Composite Knowledge: Pues. Component Knowledge: Foundational Knowledge: Declarative Knowledge: - State examples of natural products that are supplemented or replaced by agricultural and synthetic products. - Distinguish between finite and renewable resources given appropriate information. - Define the terms: - finite - renewable. - Distinguish between potable water and pure water. - Describe the differences in treatment of ground water and salty water. - Give reasons for the steps used to produce potable water. - Define the terms:

● ethane ● propane ● butane. ● Define the term saturated ● Describe how fractional distillation works in terms of evaporation and condensation. ● Describe in general terms the conditions used for catalytic cracking and steam cracking. ● Recall the colour change when bromine water reacts with an alkene. ● Recall how boiling point, viscosity and flammability change with increasing molecular size. ● Write balanced equations for the complete combustion of hydrocarbons with a given formula. ● Knowledge of trends in properties of hydrocarbons is limited to: ● boiling points ● viscosity ● flammability. ● Describe the balanced symbol equation including moles present, reactants and products. ● Describe the reaction including moles present, reactants and products. ● Describe what happens when any of the first four alcohols react with sodium, burn in air, are added to water, react with an oxidising agent. ● Recall the main uses of these alcohols. ● Know the conditions used for fermentation of sugar using yeast. ● Be able to recognise alcohols from their names or from given formulae. ● Describe what happens when any of the first four carboxylic acids react with carbonates, dissolve in water, react with alcohols. ● (HT only) ● Recognise carboxylic acids from their names or from given formulae. ● Students do not need to know the names of individual carboxylic acids other than methanoic acid. ● Recognise addition polymers and monomers from diagrams in the forms shown and from the presence of the functional group -C=C- in the monomers. ● Draw diagrams to represent the formation of a polymer from a given alkene monomer. ● Relate the repeating unit to the monomer. ● Explain the basic principles of condensation polymerisation by reference to the functional groups in the monomers and the repeating units in the polymers. ● Be able to name the types of monomers from which these naturally occurring polymers are made. ● Describe the structure of DNA in terms of two polymer chains and nucleotides. Procedural Knowledge: ● Plot boiling points of alkanes against number of carbons. ● Explain how fractional distillation works in terms of evaporation and condensation. ● Balance chemical equations as examples of cracking given the formulae of the reactants and products.	substances using chromatography. ● Describe the tests for hydrogen, oxygen, chlorine and carbon dioxide. ● Describe the flame tests for identifying cations to another student. ● Describe how sodium hydroxide can be used to identify some cations to another student. ● Describe how dilute acids can be used to identify carbonates. ● Describe how silver nitrate can be used to identify halides. ● Describe how barium chloride in the presence of dilute hydrochloric acid can be used to identify sulfate ions. ● Describe the process of flame emission spectroscopy. ● Discuss the advantages and disadvantages of instrumental analysis versus test tube analysis. ● State advantages of instrumental methods compared with the chemical tests in this specification. Procedural Knowledge: ● Be able to use melting point data to distinguish pure from impure substances. ● Interpret chromatograms and determine R_f values from chromatograms. ● Provide answers to an appropriate number of significant figures. ● Research how chemical analysis has been used to detect and solve crimes especially in forgery and murder by poisoning. ● Research how robotic spacecraft sent to investigate other planets analyse their atmospheres and surface materials using instrumentation. ● Research instrumental methods for detecting elements and compounds. ● Suggest advantages of the instrumental methods compared with the chemical tests. ● Upper Hierarchical Knowledge Explain, in terms of intermolecular forces, the terms: ● melting point ● boiling point. ● Explain what happens to substances during the process of chromatograph. ● Suggest how chromatographic methods can be used for distinguishing pure substances from impure substances. ● Be able to write balanced equations for the reactions to produce the insoluble hydroxides. ● Explain what happens to a sample throughout the process of flame emission spectroscopy. ● Interpret instrumental results for flame emission spectroscopy. ● Compare these to chemical tests carried out in this specification. ● Working Scientifically ● Research the melting and boiling points of common pure substances and compounds. ● Suggest reasons for differences in data available on the internet. ● Investigate how paper chromatography can be used to separate and tell the difference between coloured substances. Students should calculate R_f values. ● Carry out tests for hydrogen, oxygen. carbon dioxide and chlorine. ● Carry out flame tests on the following cations: ● lithium	● Describe how sedimentary rocks formed and locked up carbon dioxide. ● Describe the greenhouse effect in terms of the interaction of short and long wavelength radiation with matter. ● Recall two human activities that increase the amounts of each of the greenhouse gases carbon dioxide and methane. ● Evaluate the quality of evidence in a report about global climate change given appropriate information. ● Describe uncertainties in the evidence base. ● Describe how greenhouse gases are produced ● Describe briefly four potential effects of global climate change ● Identify the effects of global warming. ● Explain the effects of climate change. ● Describe what a carbon footprint is. ● Describe how emissions can be reduced. Suggest the consequences of the reductions on the Earth, atmosphere and everyday life. ● Describe how carbon monoxide, soot (carbon particles), sulfur dioxide and oxides of nitrogen are produced by burning fuels ● Predict the products of combustion of a fuel given appropriate information about the composition of the fuel and the conditions in which it is used. ● Write word equations for complete and incomplete combustion. ● Procedural Knowledge: ● Given appropriate information, interpret evidence and evaluate different theories about the Earth's early atmosphere ● Describe the effect of greenhouse gases on wavelength. ● Compare the Earth's atmosphere to that of Mars and Venus. ● Discuss the scale, risk and environmental implications of global climate change. ● Use the internet to obtain numerical predictions for the effects of climate change. Using these predictions, suggest the possible effects on the Earth and atmosphere should the predictions become reality. ● Suggest the consequences of the reductions on the Earth, atmosphere and everyday life. ● Predict the products of combustion of a fuel given appropriate information about the composition of the fuel and the conditions in which it is used. ● Describe the effect of the following products: ● Carbon monoxide on the human body. ● Sulfur dioxide and oxides of nitrogen on acidity of rain water. ● Sulfur dioxide and oxides of nitrogen on respiratory system. ● Particulates on global dimming. ● Particulates on human health problems. Upper Hierarchical Knowledge ● Extended writing: describe the theory of the evolution of the Earth's early atmosphere. ● Extended writing: explain why the composition of the atmosphere has changed over billions of years. ● Compare the Earth's atmosphere to that of Mars and Venus. ● Extended writing: explain how algae and plants have caused the concentrations of oxygen in the atmosphere to increase.	● potable water ● pure water. ● Describe what a LCA is using a suitable example. ● Discuss the negative issues relating to LCAs and why caution should be used when using them ● Define the following terms using suitable examples: ● corrosion ● rusting ● sacrificial protection. ● Describe how to prevent corrosion using the examples: ● oxide coating on aluminium ● zinc on iron ● magnesium on steel. ● Use suitable examples to explain why corrosion can be prevented using barriers and the role of sacrificial barriers if appropriate to the example used. ● Describe experiments and interpret results to show that both air and water are necessary for rusting. ● Recall a use of each of the alloys specified ● Interpret and evaluate the composition and uses of alloys other than those specified, given appropriate information. ● Define the terms: ● alloy ● high carbon steel ● low carbon steel. ● Explain how low density and high density poly(ethene) are both produced from ethene. ● Explain the difference between thermosoftening and thermosetting polymers in terms of their structures. ● Compare quantitatively the physical properties of glass and clay ceramics, polymers, composites and metals. ● Recall a source for the nitrogen and a source for the hydrogen used in the Haber process. ● State where the raw materials in the Haber process come from. ● Describe the process for manufacturing ammonia. ● Recall the names of the salts produced when phosphate rock is treated with nitric acid, sulfuric acid and phosphoric acid ● ● Compare the industrial production of fertilisers with laboratory preparations of the same compounds, given appropriate information. Procedural Knowledge: ● Extract and interpret information about resources from charts, graphs and tables. ● Use orders of magnitude to evaluate the significance of data. ● Evaluate the impacts and benefits of biological methods of extracting meta ● Research information for the processes of: ● phytomining ● bioleaching. ● Include percentage of metal extracted, concentration of global warming gases released, amount of electricity used etc. Use this data in an evaluation. ● Use information to interpret the LCA of a given material or product. ● Explain sacrificial protection in terms of relative reactivity. ● Using diagrams, describe the difference between metals and their alloys
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- Research uses of common alkenes. - Give examples to illustrate the usefulness of cracking. - Be able to explain how modern life depends on the uses of hydrocarbons. - Explain what is meant by the formula C_nH_{2n} - Write balanced symbol equations for the combustion of alkenes in oxygen. - Write the reaction between an alkene and hydrogen, giving suitable examples. - Write the reaction between an alkene and water, giving suitable examples. Upper Hierarchical Knowledge - Make predictions of the boiling points of other alkanes. - Suggest the impact on fuels, feedstocks and petrochemicals of the depleting stocks of crude oil. - Explain the properties of hydrocarbons in relation to intermolecular forces. - Write balanced symbol equations for the combustion of hydrocarbon fuels. - Describe the balanced symbol equation including moles present, long alkane reactant, specific reaction conditions, and alkene and short alkane products. - Draw the covalent bonding in: - ethene - propene - butene - pentene. - Explain why carboxylic acids are weak acids in terms of ionisation and pH. Draw the covalent bonding in: - methanoic acid - ethanoic acids - propanoic acid - butanoic acid. Describe what happens to one of the first four acids during the reactions: - dissolving in water to produce acidic solutions - reacting with carbonates to produce carbon dioxide - not ionising completely when dissolved in water (they are weak acids) - reacting with alcohols in the presence of an acid catalyst to produce esters, for example ethanoic acid reacts with ethanol to produce ethyl ethanoate and water. - Describe what takes place during condensation polymerisation. - Identify monomers, polymers and repeating units. - Describe the polymerisation of ethane-1,2-diol and hexanedioic acid. Working Scientifically - Investigate the properties of different hydrocarbons in terms of boiling point, viscosity and flammability with increasing molecular size. - Identify the products of combustion of alkanes. - Demo or practical: crack paraffin over porous clay pot. - Use bromine water to identify alkenes. - Test for unsaturation in other compounds.	- sodium - potassium - calcium - copper. - Use sodium hydroxide to test for the following cations: - aluminium - calcium - magnesium - copper(II) - iron(II) - iron(III). - Use dilute acid to test for the following carbonates: - sodium carbonate - potassium carbonate. - Analyse the composition of an egg shell, testing for the presence of various ions using acids and other test tube reactions and flame tests. - Interpret an instrumental result given appropriate data in chart or tabular form, when accompanied by a reference set in the same form. - Use of chemical tests to identify the ions in unknown single ionic compounds.	- Extended writing: explain how algae and plants have caused the concentrations of carbon dioxide in the atmosphere to decrease. - Grade 9: explain why the wavelength changes due to greenhouse gases. - Evaluate the quality of evidence in a report about global climate change given appropriate information. - Describe how greenhouse gases are produced. - Evaluate the use of models for predicting climate change. - Use these equations to describe the reactions in terms of reactants, products made and number of each present. - Explain why the following can be produced in combustion: - carbon dioxide - carbon monoxide - soot - water vapour - sulfur dioxide - oxides of nitrogen. Working Scientifically - Show that aquatic plants (eg Elodea) produce oxygen in daylight. - Use the internet to obtain data for concentrations of greenhouse gases. - Evaluate the reliability of the data available on the internet. - Research the process of peer review in reporting results/data. - Use data to calculate your own carbon footprint over a period/holiday. Suggest the effects on Earth and atmosphere of the calculated carbon footprint. - Use shells and acid to show how pollution can cause shells to corrode.	- Research the first alloy to include the history of it and its uses. - Model an alloy using different size marbles. Use this model to discuss the properties of alloys. - Describe how the following are produced and give uses for each: - soda-lime glass - borosilicate glass - clay ceramics - low-density poly(ethene) - high density poly(ethene) - composites. - Using diagrams, describe the structure of the following polymers: - thermosoftening - thermosetting. - Use these diagrams and descriptions to explain why the following happens when heated: - thermosoftening polymers melt - thermosetting polymers do not melt. - Extended writing: compare how fertilisers are produced in industry and in the laboratory. - Investigate what was used as fertilizer before the industrial preparation of fertilisers was invented. Upper Hierarchical Knowledge - Explain the differences between the two terms using suitable examples. - Explain the differences between the two terms. - Extended writing: describe the process of desalination. - Extended writing: describe the process of distillation - Extended writing: explain why distillation separates substances. - Explain what happens to substances during the process of distillation in terms of intermolecular forces of attraction. - Extended writing: describe the processes of - phytomining - bioleaching. - Evaluate ways of reducing the use of limited resources, given appropriate information. - Extended writing: describe the environmental impacts of obtaining raw materials from the Earth. - Describe how to prevent corrosion using the examples: - oxide coating on aluminium - zinc on iron - magnesium on steel. - Use suitable examples to explain why corrosion can be prevented using barriers and the role of sacrificial barriers if appropriate to the example used. - State properties of examples of alloys. Explain, in relation to the structure, why these alloys have these properties. Research the physical properties of: - soda-lime glass - borosilicate glass - clay ceramics - low-density poly(ethene) - high density poly(ethene) - composites Use these properties to explain how the materials are related to their use. Compare the properties of thermosetting and thermosoftening polymers. - Using diagrams, describe the structure of the following polymers: - thermosoftening
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• Research uses of the first four carboxylic acids. • Research some of the uses of esters and try to work out the alcohols and carboxylic acids used to make them. • Opportunities within investigation of the reactions of carboxylic acids. • Use models to represent condensation polymerisation. • Research common polyesters and their uses. • Research common amino acids and polypeptides, and polypeptide uses • Research the history of the discovery of DNA as a polymer chain. • Research naturally occurring polymers and their uses			• thermosetting. • Use these diagrams and descriptions to explain why the following happens when heated: • thermosoftening polymers melt • thermosetting polymers do not melt. • (HT only) Interpret graphs of reaction conditions versus rate. • (HT only) Apply the principles of dynamic equilibrium to the Haber process. • (HT only) Explain the trade-off between rate of production and position of equilibrium. • (HT only) Explain how the commercially used conditions for the Haber process are related to the availability and cost of raw materials and energy supplies, control of equilibrium position and rate. • Write a balanced symbol equation for the manufacture of ammonia. Use this to describe the reaction in terms of reactants, products, conditions and number of moles. • Recall the following topics: • dynamic equilibrium • temperature affecting the rate of a reaction • pressure. • Explain how each of these affects the Haber process reaction. • Discuss the effect of the following conditions on the reaction: • a high temperature • a low temperature • a high pressure • a low pressure • use of a catalyst • no catalyst. • Discuss the pros and cons of these varying conditions. • Explain the trade-off between the rate of the reaction and the position of the equilibrium. • Explain how the conditions used in industry affect the equilibrium position, rate and costs of the reaction. <u>Working Scientifically</u> • Research examples of natural products that are supplemented or replaced by agricultural and synthetic products. • Analysis and purification of water samples from different sources, including pH, dissolved solids and distillation. • Research how water is treated. • Model phytomining in the laboratory by watering geraniums with dilute copper sulphate for a period of time. The leaves can be burnt and copper can be extracted from the ash by rinsing in dilute hydrochloric acid and electrolysis of the solution. • Use the internet to carry out simple comparative LCAs for shopping bags made from plastic and paper. • Use the internet to carry out simple comparative LCAs for shopping bags made from plastic and paper. • Research methods of producing/obtaining metal/glass/building materials/clay ceramics/plastics. Identify in these methods the limited resources that are used to generate the energy. • Research how glass is recycled. • Research how metal is recycled and alternatives for use of scrap
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			metals ie in obtaining iron in a blast furnace. • Investigate the conditions for rusting of iron nails in test tubes. • Research the physical properties of: • soda-lime glass • borosilicate glass • clay ceramics • low-density poly(ethene) • high density poly(ethene) • composites • Research the availability and cost of the raw materials and energy supplies in the Haber process. Explain how these relate to the conditions used for the Haber process in industry. • Research compositions of NPK and their uses. • Research how fertilisers can be prepared: • industrially • in a laboratory.
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Year 11 Physics Essential Knowledge Summary		
Schemate 1: P5 Forces	Schemata 2: P7 Magnets & Electromagnets	Schemate 3: P8 Space (triple only)
Composite Knowledge: Pupils will learn the difference between, and examples of, vector and scalar quantities. Pupils will learn about forces: examples of contact and non-contact force &, how to represent them. Pupils will learn about Newton’s laws of motion, how to interpret motion graphs and how to calculate unknown quantities and manipulate the equation of motion. Pupils understand the concept of momentum and the principle of conservation of momentum. They will apply the conservation of energy to moments, levers & gears. Pupils will experimentally prove Hooke’s law and understand elastic and inelastic deformation. Component Knowledge: Foundational Knowledge: Declarative Knowledge: • State the units of: weight, mass, gravitational field strength, work done, distance, spring constant, extension, moment, pressure, area, speed, acceleration, velocity, momentum, • Define scalar and vector • Give examples of scalar and vector quantities • Draw arrows to scale to represent a vector quantity • Define a contact and non-contact force • Give examples of contact and non-contact forces • State the difference between weight and mass • Recall the equation that links: weight, mass and gravity • Define centre of mass • Define resultant force • Recall the equation that links: work done, force, and distance • Know that work done is equivalent to the energy transferred • Describe the difference between elastic and inelastic deformation • Describe how to stretch, compress or bend an object • Recall the equation that links: force, spring constant, and extension. • Describe the difference between linear and non-linear relationships • Know what is meant by the term moment (triple only) • Give examples of simple levers (triple only) • Know what is meant by a fluid (triple only) • Define pressure (triple only) • Describe how the density of a fluid changes with height (triple only) • Describe how pressure of the atmosphere changes with altitude (triple only) • Describe what is meant by upthrust (triple only) • Describe why some objects float and others sink (triple only)	Composite Knowledge: Pupils will understand how we represent magnetic fields and the properties of magnetic fields. They will be able to define and differentiate between permanent magnets, magnetic materials and electromagnets. Pupils will learn about how electromagnets are made and controlled. They will learn about the motor effect and generator effects and their applications. Pupils will be able to make predictions about the properties of motors and generators. Component Knowledge: Foundational Knowledge: Declarative Knowledge: • State where the magnetic forces are strongest relative to a magnet • Know how magnets behave • Know the difference between permanent magnets, magnetic materials and electromagnets • Know what is meant by the term ‘magnetic field’ • State which materials are magnetic • Sketch the diagram of the magnetic field around: a bar magnet, the Earth, a straight wire and a solenoid. • Describe how to plot the magnetic field using a magnet and compass • State that a current carrying wire produces a magnetic field around it. • Describe how to increase the strength of an electromagnet • Recall the corkscrew rule Procedural Knowledge: • Describe how to plot the magnetic field using a magnet and compass • Use an equation to find an unknown variable • Write methods for experiments. • Accurately plot axes & graphs • Draw lines of best fit and use them to find tangents and gradients. Upper Hierarchical Knowledge • Interpret diagrams of electromagnetic devices • Define the motor effect • Recall Fleming’s left-hand rule and be able to identify either the direction of the force, the current flow or the magnetic field. • Use and manipulate the equations • Recall the units of magnetic flux density • Describe how a simple electric motor works and how to change the speed or direction of rotation	Composite Knowledge: Pupils will learn about the formation and composition of the Solar System, they will learn about the movement of objects in the Solar System. Pupils will be able to describe and explain the formation and life cycle of stars. They will be able to understand the formation and potential future of the Universe and why there is doubt about this. Component Knowledge: Foundational Knowledge: Declarative Knowledge: • Name the celestial objects found in the Solar System • Describe how the Sun and planets in our Solar System formed • Describe and explain the life cycle of stars • Know that gravity is the force that maintains the motion of celestial objects • Describe red-shift and understand how this provides evidence of the Big Bang • Explain the evidence for the Big Bang • State what is meant by ‘dark energy’ and ‘dark matter’ Procedural Knowledge: Upper Hierarchical Knowledge • Explain circular motion Working Scientifically Big Bang theory • WS 1.2 Use a variety of models such as representational, spatial, descriptive, computational and mathematical to solve problems, make predictions and to develop scientific explanations and understanding of familiar and unfamiliar facts. ○ Use models in explanations, or match features of a model to the data from experiments or observations that the model describes or explains. ○ Give examples of ways in which a model can be tested by observation or experiment.

● Define displacement ● Define velocity ● Know the typical speed for: walking, running, cycling, sound in air ● Recall the equation that links: distance travelled, speed, and time. ● Recognise how the gradient of a of a d-t graph describes motion ● Recall the equation that links: acceleration, change in velocity, and time. ● Recognise how the gradient of a of a v-t graph describes motion ● State what happens to an object if the resultant force is zero ● State what is meant by inertia (higher tier) ● Recall the equation that links: force, mass, and acceleration. ● State Newton’s 2nd law ● State Newton’s 3rd law ● Recall the equation for stopping distance ● Recall and describe factors that affect thinking distance ● Recall and describe factors that affect braking distance ● Recall typical reaction times ● Recall the equation that links: momentum, mass, and velocity (higher tier). ● State the law of conservation of momentum (high tier) ● Recall the equation that links: force, change in momentum, and time (higher tier & triple-only) Procedural Knowledge: ● Use an equation to find an unknown variable ● Draw scale diagrams ● Calculate the resultant of parallel forces ● Calculate the extension of a linear object ● Use primary data and a graph to calculate the spring constant ● Calculate the resultant of non-parallel forces (higher tier only) ● Write methods for experiments ● Resolve a force into two perpendicular components (higher tier only) ● Draw free body diagrams Upper Hierarchical Knowledge ● Manipulate equations to find unknown variables ● Draw scale diagrams to find the resultant of non-parallel forces ● Draw scale diagrams to resolve a force into two perpendicular components ● Describe and explain the effect on motion for changing forces on an object ● Describe and explain how an object reaches a terminal velocity ● Using primary or secondary data to find the spring constant of an elastic object ● Use primary or secondary data to show the relationship in Newton’s 2nd law ● Apply the law of moments ● Explain the causes of pressure and changes in pressure ● Interpret d-t & v-t graphs to find speed, acceleration & distance travelled for both linear and non-linear relationships. ● Apply the law of conservation of momentum Working Scientifically Moments practical ● WS 3.3 Carrying out and represent mathematical and statistical analysis. ○ change the subject of an equation ○ substitute numerical values into algebraic ○ equations using appropriate Hooke’s law (RP 6) ● WS 3.3 Carrying out and represent mathematical and statistical analysis. ○ determine the slope and intercept of a linear graph Centre of mass of an irregular 2D shape <td> ● Describe how loudspeakers / headphones can use the motor effect to create sound waves ● Understand and describe the generator effect ● Understand that an induced current produces a magnetic field that opposes the change ● Recall the factors that affect the size or direction of an induced potential difference or current ● Apply the principles of the generator effect in other contexts ● Explain how an alternator and dynamo works ● Draw and interpret potential difference graphs produced by an alternator or dynamo ● Explain how a microphone works ● Describe and explain the structure of a transformer ● Explain how a transformer works Working Scientifically Demo shape of magnetic fields (bar magnet, straight wire, solenoid) ● WS 1.2 Use a variety of models such as representational, spatial, descriptive, computational and mathematical to solve problems, make predictions and to develop scientific explanations and understanding of familiar and unfamiliar facts. ○ Recognise/draw/interpret diagrams. Investigate electromagnet strength ● WS 2.2 Plan experiments or devise procedures to make observations, produce or characterise a substance, test hypotheses, check data or explore phenomena. ○ Identify in a given context: ■ the independent variable as the one that is changed or selected by the investigator ■ the dependent variable that is measured for each change in the independent variable ■ control variables and be able to explain why they are kept the same. Demo motor effect and generator effect ● WS 1.4 Explain everyday and technological applications of science; evaluate associated personal, social, economic and environmental implications; and make decisions based on the evaluation of evidence and arguments. ○ Describe and explain specified examples of the technological applications of science. <td></td></td>	● Describe how loudspeakers / headphones can use the motor effect to create sound waves ● Understand and describe the generator effect ● Understand that an induced current produces a magnetic field that opposes the change ● Recall the factors that affect the size or direction of an induced potential difference or current ● Apply the principles of the generator effect in other contexts ● Explain how an alternator and dynamo works ● Draw and interpret potential difference graphs produced by an alternator or dynamo ● Explain how a microphone works ● Describe and explain the structure of a transformer ● Explain how a transformer works Working Scientifically Demo shape of magnetic fields (bar magnet, straight wire, solenoid) ● WS 1.2 Use a variety of models such as representational, spatial, descriptive, computational and mathematical to solve problems, make predictions and to develop scientific explanations and understanding of familiar and unfamiliar facts. ○ Recognise/draw/interpret diagrams. 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● WS 2.2 Plan experiments or devise procedures to make observations, produce or characterise a substance, test hypotheses, check data or explore phenomena. ○ Describe a practical procedure for a specified purpose. Newton's 2nd law (RP7) ● WS 2.2 Plan experiments or devise procedures to make observations, produce or characterise a substance, test hypotheses, check data or explore phenomena. ○ Identify in a given context: ● the independent variable as the one that is changed or selected by the investigator ● the dependent variable that is measured for each change in the independent variable ● control variables and be able to explain why they are kept the same.		
Year 11 (physics) Final Composite Knowledge End Point		
● Learn about longitudinal and transverse, mechanical and electromagnetic waves. ● Learn about the electromagnetic spectrum, the different waves and their uses and dangers. ● All pupils will learn about reflection and refraction, in triple science they will learn about wave fronts and how we use lenses to form images. ● In triple science pupils will learn about sound waves and seismic waves. ● Draw and describe the shape of magnetic fields caused by permanent and temporary magnets. ● Explain how electromagnets are made and controlled. ● In triple science they will be able to define both the motor effect and generator effect. They will be able to describe how to use the motor and generator effects in different contexts. ● Space physics is only learnt by triple science pupils, they will describe the contents of our Solar System and how it was formed. ● Describe and explain the life cycle of a star similar to and much more massive than our Sun. ● They will learn how the Universe formed and explain the evidence for this. ● Pupils will able learn about what we know we don't know about the Universe and areas of current research.		