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| **Science: Curriculum Key Knowledge(K) & Skills(S)** | | | | |
| Ensuring deep learning  Workschemes have opportunities to review and reflect built in e.g. lessons, analysis of tests etc. The arrangement of the topics is a spiral with opportunities each year to build on and develop previous topics skills and knowledge. These topics are based on the arrangement of topics at GCSE.  GL tests, Topic tests and AREX are analysed to ensure gaps in knowledge and skills are addressed by adapting the schemes and planning as necessary. When marking is undertaken and notes made to revisit those topics pupils may have found difficult. Revision of previous topics is also undertaken through homework, starters and plenaries to aid ‘chunking’ and so recall. KS3 pupils are also given the opportunity to resit topic tests at a later date.  Topics are also reviewed through pupil voice and staff voice. They are adapted to reflect comments and to encourage a variety of approaches. | | | | |
| Cultural capital  Each topic has misconceptions and cultural capital outlined at the start of the topic. Staff are encouraged to add to this as issues arise as the workscheme is a working documents.  A love of Science is promoted through trips, Science week events e.g. Professor brainstorm, quizzes, competitions etc. Science club is run part of the year. A biannual Science fair is run between the Middle Schools.  Science in the news is shared in the department and shared with pupils. | | | | |
| Developing careers  Opportunities for developing careers are outlined e.g. context given in topics that may link to real life science roles such as Forensics, Medicine etc. as well as a careers board in the lab. A trip to a local science firm is undertaken and STEM ambassadors plus other local science are involved in the Science fair. Trips to Huddersfield University and Leeds university are also run each year. Transferable skills/Context | | | | |
| Inclusion  Opportunities to support and extend pupils are outlined in schemes as part of an ongoing process. Pupils are encouraged to work as independently as possible. Pupils are also encouraged to think about the processes used and show this in work e.g. showing formulae and working out.  Staff and students are encouraged to discuss ideas (promoting auracy/oracy and in turn literacy), model processes or explanations to each other to encourage metacognition and reflective learning.  Frameworks are used to support pupils where needed to aid them to reach the same understanding as others.  Pupils are encouraged to challenge themselves through the use of growth mindset techniques.  Staff also intervene where necessary from review of work in books, homework and tests. | | | | |
| **Focus** |  | **Year 6** | **Year 7** | **Year 8** |
| Forces | **K** | Identify and describe the common forces; gravity(weight), friction, drag(air resistance), upthrust, reaction forces, thrust and magnetism and classify these as either contact/non-contact forces Recognise balanced and unbalanced forces for stationary objects and relate this idea to floating and sinking.  Describe how simple machines such as levers and pulleys are force multipliers and make work easier. | Understand the difference between average speed, instantaneous speed and relative speed.  Recognise the motion of an object from time distance graphs  Identify using resultant forces (in two and four direction) when the overall force is balance or unbalanced and use this to describe the motion of the object.  Understand the difference between mass and weight and describe the factors that affect weight.  Know that acceleration due to gravity is the same for any object on the Earth.  Pupils understand the structure of the solar system and how seasons, day/night occur and what a light year is. | Describing pressure in solids and liquids.  Use Archimedes’ principle and density to explain floating and sinking.  Use Newton’s 1st law to motion work to out the motion of an object from the forces acting on it, including the concept of inertia.  Explain the factors that affect friction and drag.  Use tensile and compressive forces to explain the extension of springs and the compression of sponges.  Explain elasticity using Hooke’s law and how after the elastic limit the material experiences deformation. |
| **S** | Draw diagrams using force arrows.  Measure forces using forcemeters and applying the correct units. | Calculate speed, time or distance by manipulating equations, changing units where necessary.  Plot and use time distance graphs, including interpolation, to describe and calculate motion.  Draw simple force diagrams to describe and calculate resultant forces | Calculate pressure / density in a solid and in liquids and the extension in springs using the correct formulae, manipulating these formulae to give other quantities.  Use scaled drawings and Pythagoras theorem to work out resultant forces on an object.  Use graphical methods to identify the elastic limit of springs and where it obeys Hooke Law. |
| Energy | **K** | Identify electrical conductors and insulators.  Design and explain how different components can be used to produce both series and parallel electrical circuits.  Describe the effects of changing the voltage and current in a simple circuit. | Explain, using the particle model, how heat energy can be transferred by conduction and convection, and introduce the idea of waves to explain heat radiation. Explain how this energy transfer could be stopped through different methods of insulation.  Explain how voltage, current and resistance changes in both series and parallel circuits. | Use the particle model to explain how sound energy is transferred through longitudinal waves and how the volume and pitch of the sound are related to the amplitude, frequency and wavelength of the wave.  Explain both absorption and reflection (diffuse and specular), in both sound and light.  Explain how the ear and the eye turn both sound and light energy into electrical energy allowing humans to see and hear and how these process can sometimes go wrong and then be corrected.  Understand that light energy is transferred through a transverse wave that can travel through a vacuum.  Explain how light is refracted as it passes through different media and how this allows lenses to either converge or diverge light rays.  Explain the dispersal of white light and how we see different colour. |
| **S** | Draw circuit diagrams | Use ammeters and voltmeters to measure current and voltage in different electrical circuits. Use ohms’ law to calculate voltage, current and resistance. | Draw ray diagrams to explain shadows, reflection, refraction and dispersal. |
| Matter | **K** | Describe the properties of solids, liquids, and gases and begin to explain their differences using the particle model of matter. Identify changing of states as physical that can be reversed. Identify soluble and insoluble substances and use scientific terminology, solute, solvent solution to describe dissolving. Describe some simple methods of separating mixtures sieving, filtration and chromatography. | Apply the particle model to explain different physical processes;  Changes of state, including heating/cooling curves, melting and boiling points and sublimation.  The factors affecting the rates of diffusion in liquids and gases.  The factors affecting the rates of dissolving and solubility.  The viscosity of different substances and the effect of temperature on the rate of flow of a liquid.  Air Pressure  Explain how separation techniques, such as decanting, distillation and chromatography exploit differences between substances to separate a mixture. | Understand the difference elements compounds and mixtures.  Recognise a range of elements, their symbols, physical state at room temperature and physical and chemical properties.  Describe how the history of atomic theory has developed.  Describe the structure of the periodic table, identifying solid, liquids and gases, metals and non-metals, groups and periods.  Use a simple atomic model to explain the difference between the atoms of different elements.  Describe simple physical and chemical trends in the alkali metal and halogen groups of the periodic table.  Understand that atoms can make bonds that form molecules and when these atoms are different compounds are formed.  Identify simple compounds from their formulae and explain how to name them.  Understand that the properties of a compound are often very different from the properties of the elements it’s made from. |
| **S** |  | Plot heating and cooling curves and solubility graphs | Plot graphs using positive and negative numbers to identify trends |
| Reactions | **K** | Identify simple physical and chemical changes and describe the difference between these two types of change.  Explain the need for oxygen fuel and heat when something burns. | Recognise everyday and laboratory acids and alkalis and their properties.  Explain how indicators can be used to identify acid and alkalis and how they can be classified using the pH scale.  Explain how when acid and alkalis are reacted together neutralisation take place and salts are formed.  Recognise some of the physical and chemical properties of metals.  Describe the reaction between acids and metals and how you can test for hydrogen gas.  Understand that metals can be placed into a reactivity series, which can be used to predict what happens in a displacement reaction between a metal and a metal salt. | Explain the concept of the conservation of mass in physical and chemical changes and understand how this is sometimes hidden if it happens in an open system.  Recognise exothermic and endothermic reactions.  Describe oxidation reactions including the combustion of fuels.  Understand that reactions between acids and carbonates are a type of neutralisation that produces carbon dioxide.  Decompositions reaction (including thermal decomposition)  Understand the role of catalysts in the decomposition of hydrogen peroxide.  Know how we can test for oxygen and carbon dioxide. |
| **S** | Identify and draw simple chemical apparatus  Use simple laboratory apparatus including a Bunsen burner.  Identify possible hazard and consider ways in which to reduce risk. | Write a risk assessment including control and emergency measures.  Use patterns to predict the products of some types of chemical reactions. | Apply patterns found in different types of chemical reaction to predict products produced.  Write simple word equation to describe chemical reaction.  Begin to write balanced formula equations. |
| Organisms and genes | **K** | Recognise, locate and describe the function of the major organs or the human body and begin to group them into organ systems.  Describe the structure and explain the function of the heart and circulatory system including red blood cells  Recognise different nutrients required by the body and the need for a balanced diet to provide all of these nutrient in the correct proportions.  Explore the need to maintain a heathy lifestyles including a healthy diet, exercise and the avoidance of drugs. | Describe and explain the function of the muscular-skeletal system, including the adaptation of the bones, the different types of joints and the system of antagonistic muscles, as well as some of the problems that this organ system can develop.  Describe the organisation of living things from cells to tissues to organs, orang systems and then whole organism.  Compare and contrast the structure of typical animal and plant cells and explain how specialised cells are adapted to carry out their specific function.  Identify the differences between Eukaryotic and Prokaryotic cells.  Identify the male and female organs of the Reproductive system and explain their function and the changes that happen during puberty including menstruation. Explore the possible reasons for IVF for infertile couples.  Describe the process of fertilisation in humans, other animals and plants.  Explain the formation of identical and non-identical twins.  Describe the development of the embryo and foetus through pregnancy and what happens during labour. | Describe the respiratory system, including the mechanics of breathing, and how breathing and heart rate are adapted during exercise.  Explain the adaptation of the alveoli to enable the process of gas exchange and how the composition of inhaled and exhaled air changes.  Describe the impact of asthma and smoking on the respiratory system.  Explain the difference between aerobic and anaerobic respiration as ways of releasing energy in the body’s cells.  Describe where mechanical and chemical digestion takes place within the digestive system and explain the role that enzymes play in this process.  Understand that malnutrition can cause deficiency diseases, including scurvy and rickets.  Understand that the body requires a balance between the energy it takes in through the food eaten and the energy the body expends carrying out vital processes and exercise and explain the consequences of not maintaining this balance. |
| Ecosystems | **K** | Explain how animals and plants are adapted to their environment particularly in extreme habitats.  Describe how animals and plants can be classified into groups with common features and properties.  Describe how animals have evolved over time and home evidence for these changes is preserved in fossils.  Use food chains and food webs to describe feeding relationships with in a habitat. | Identify and explain different types of variation in living things, continuous and discontinuous inherited and environmental.  Explain the importance of variation to species survival and how overtime species evolve and characteristic within a population change. Explain the natural selection as the process by which species evolve.  Pupils understand the structure of the earth, and the formation of rocks. Pupils understand the interdependence of the earth, atmosphere and its effects on the organisms that live there. | Compare the processes of photosynthesis and aerobic respiration.  Explain the structure of a leaf and how it is adapted for photosynthesis.  Describe the limiting factors that affect photosynthesis in plants. |
| **S** | Use and make classification keys and construct food chains | Record variation within a population in the form of block graphs, histograms and scattergrams and identify correlations and normal distributions. | Construct graphs to work out optimum conditions for photosynthesis. |
| Planning | **S** | Identify possible variables in an investigation.  Identify hazards and assess simple risk.  Write plans using checklists.  Select equipment to use in an experiment from a list of apparatus.  Incorporate the idea of fair testing and repeatability into their investigations.  Use various forms of enquiry to tackle a scientific question or hypothesis. | Identify independent, dependent and control variables to construct a fair test in an investigation.  Write a risk assessment to control the risk in an experiment.  Select equipment with suitable resolution to measure accurately in their experiment.  Make investigations more repeatable by conducting more than one trial and use averages to improve the accuracy of their results | Independently write plans explaining the variables used, giving the appropriate range for their independent variable and the specific nature or value of control variables.  Write detailed risk assessment giving control and emergency measures.  Identify possible sources of error and adjust their method to reduce these errors. |
| Observing/  recording | **S** | Construct simple results tables.  Make accurate measurements of a series of different quantities; force, capacity, length, time, temperature, using a range of different equipment with varying scales.  Draw block graphs and simple line graphs labelling axes correctly and giving an appropriate title. | Construct table to record results to include a number of trials and averages with the correct columns headings in table with units.  Identifying range/intervals used on a range of different equipment.  Choose the appropriate type of graph to present either discrete or continuous data, making sure it is correctly labelled and titled.  Choose appropriate scales for the axes plot points accurately, identify anomalies and drawing lines or curves of best fit. | Design their own results tables with repeats, averages, discounted anomalies (outliers) where appropriate.  Independently draw block graphs and line graphs for the appropriate data, choosing scales, with axes breaks if appropriate.  Draw accurate lines or curves of best fit, leaving out anomalies that don’t fit the general trend. |
| Analysis | **S** | Draw conclusion describing the patterns linking the variables they have investigated and link their findings to scientific concepts. | Drawing valid conclusions describing the relationships between variable using evidence from graphs and results tables and use scientific concepts to explain these conclusions. | Use data to describe different types of relationships between variables including correlations, using clear scientific knowledge and understanding to explain these conclusions in depth. |
| Evaluations | **S** | Suggest simple improvements and further questions giving reasons for their suggestions. | Begin to identify simple sources of errors in their experiments.  Understand the difference between accuracy and precision in an experiment and  make suggestions on how to improve these in their experimental methods. | Make valid comments on the quality of data including its accuracy and precision, using data from tables and graphs. Start to identify sources of systematic and random error in an experiment and ways to overcome them. |
| Thinking skills | **S** | Understanding the particle model. | Applying the particle model. | Changing scientific ideas  History of periodic table/atom |
| Literacy across the curriculum | **S** | Pupils can learn keywords, start to use in descriptions to ensure they are science specific.  Pupils start to use writing to instruct with subheadings/structure given and identify/ understand some of the requirements of a well written method e.g. imperative verbs.  They apply these skills to all the branches of enquiry they may encounter. | Pupils use keywords correctly in their explanations which are science specific.  Pupils independently write plans with subheadings using most of the requirements of a well written method.  Pupil begin to structure long answer questions with support (PEE/QWoC). | Pupils use keywords with fluency ensuring they are writing with specificity to the subject matter.  Pupils independently write scientific plans/reports with well written methods.  Pupils structure long answer questions without support (PEE/QWoC). |
| Numeracy | **S** | Identify a relationship from a set of data or graph. | Plot DT Graphs and Interpret  Analyse graph data  Rearranging speed and w=mg | Using equations involving more than one process including conversions of units.  Independent selection of correct graph and plotting. |

**Prior learning**

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| KS2 Y5- These topics were agreed between the Schools within the pyramid several years ago. The HODs and Heads of the middle school remind the first schools of this arrangement through meetings and emails on a regular basis. | **K** | **Biology**  Living things and their habitats Y5  Life cycles of organisms Y5 | **Chemistry**  Materials, uses and properties. Y5 | **Physics**  Earth and Space Y5  Light Y6 |
| **Skills** | **Working scientifically**  -planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary  -taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate  -recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs  - using test results to make predictions to set up further comparative and fair tests  -reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and degree of trust in results, in oral and written forms such as displays and other presentations  -identifying scientific evidence that has been used to support or refute ideas or arguments. | | |

**Next stage:**

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| KS3 Y9  Topics have been agreed between middle schools and Shelley High School. | **K** | **Biology**  Genes  Gas exchange  Photosynthesis  Relationships in Ecosystems | C**hemistry**  Reactions  The Earth | **Physics**  Energy and changes  Waves  Current  Magnetism |
| **Skills** | **Working Scientifically**  Scientific attitudes ♣ pay attention to objectivity and concern for accuracy, precision, repeatability and reproducibility ♣ 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 ♣ evaluate risks. Experimental skills and investigations ♣ ask questions and develop a line of enquiry based on observations of the real world, alongside prior knowledge and experience ♣ make predictions using scientific knowledge and understanding ♣ select, plan and carry out the most appropriate types of scientific enquiries to test predictions, including identifying independent, dependent and control variables, where appropriate ♣ use appropriate techniques, apparatus, and materials during fieldwork and laboratory work, paying attention to health and safety ♣ make and record observations and measurements using a range of methods for different investigations; and evaluate the reliability of methods and suggest possible improvements ♣ apply sampling techniques. Analysis and evaluation ♣ apply mathematical concepts and calculate results ♣ present observations and data using appropriate methods, including tables and graphs ♣ interpret observations and data, including identifying patterns and using observations, measurements and data to draw conclusions ♣ present reasoned explanations, including explaining data in relation to predictions and hypotheses ♣ evaluate data, showing awareness of potential sources of random and systematic error ♣ identify further questions arising from their results. Measurement ♣ understand and use SI units and IUPAC (International Union of Pure and Applied Chemistry) chemical nomenclature ♣ use and derive simple equations and carry out appropriate calculations ♣ undertake basic data analysis including simple statistical techniques. | | |