Required prior learning from KS3

Working scientifically	Biology	Chemistry	Physics
Pupils should develop their use of scientific vocabulary, including the use of scientific nomenclature and units and mathematical representations. ***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	***Cells and organisation*** • Cells as the fundamental unit of living organisms, including how to observe, interpret and record cell structure using a light microscope • The functions of the cell wall, cell membrane, cytoplasm, nucleus, vacuole, mitochondria and chloroplasts • The similarities and differences between plant and animal cells • The role of diffusion in the movement of materials in and between cells ***Photosynthesis*** • The reactants in, and products of, photosynthesis, and a word summary for photosynthesis ***Cellular respiration*** • Aerobic and Anaerobic Respiration in living organisms, including the breakdown of organic molecules to enable all the other chemical processes necessary for life • A word summary for aerobic respiration • The process of anaerobic respiration in humans and micro-organisms, including fermentation, and a word summary for anaerobic respiration • The differences between aerobic and anaerobic respiration in terms of the reactants, the products formed and the implications for the organism.	***The particulate nature of matter*** • The properties of the different states of matter (solid, liquid and gas) in terms of the particle model, including gas pressure • Changes of state in terms of the particle model. ***Atoms, elements and compounds*** • A simple (Dalton) atomic model • Differences between atoms, elements and compounds • Conservation of mass changes of state and chemical reactions.	***Energy changes and transfers*** • Other processes that involve energy transfer: changing motion, dropping an object, completing an electrical circuit, stretching a spring, metabolism of food, burning fuels. ***Changes in systems*** • Energy as a quantity that can be quantified and calculated; the total energy has the same value before and after a change ***Forces*** • Forces as pushes or pulls, arising from the interaction between two objects • using force arrows in diagrams, adding forces in one dimension, balanced and unbalanced forces • Forces: associated with deforming objects; stretching and squashing – springs; with rubbing and friction between surfaces, with pushing things out of the way; resistance to motion of air and water • Forces measured in Newton, measurements of stretch or compression as force is changed • Force-extension linear relation; Hooke's Law as a special case • Work done and energy changes on deformation • Non-contact forces: gravity forces acting at a distance on Earth and in space, forces between magnets and forces due to static electricity. ***Balanced forces*** • Opposing forces and equilibrium: weight held by stretched spring or supported on a compressed surface. ***Forces and motion*** • Forces being needed to cause objects to stop or start moving, or to change their speed or direction of motion (qualitative only) • Change depending on direction of force and its size. ***Physical changes*** • Conservation of material and of mass, and reversibility, in melting, freezing, evaporation, sublimation, condensation, dissolving • Similarities and differences, including density differences, between solids, liquids and gases • The difference between chemical and physical changes. ***Particle model*** • The differences in arrangements, in motion and in closeness of particles explaining changes of state, shape and density • Atoms and molecules as particles.

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.			

New KS4 learning

Throughout			
Working scientifically • the use of conceptual models and theories to make sense of the observed diversity of natural phenomena • the assumption that every effect has one or more cause • that change is driven by interactions between different objects and systems • that many such interactions occur over a distance and over time • that science progresses through a cycle of hypothesis, practical experimentation, observation, theory development and review • develop scientific knowledge and conceptual understanding through the specific disciplines of biology, chemistry and physics • develop understanding of the nature, processes and methods of science, through different types of scientific enquiry that help them to answer scientific questions about the world around them • develop and learn to apply observational, practical, modelling, enquiry, problem-solving skills and mathematical skills, both in the laboratory, in the field and in other environments ***1. The development of scientific thinking*** • the ways in which scientific methods and theories develop over time • using a variety of concepts and models to develop scientific explanations and understanding • appreciating the power and limitations of science and considering ethical issues which may arise • explaining every day and technological applications of science; evaluating associated personal, social, economic and environmental implications; and	**Biology** ***Cells*** • Cells as the basic structural unit of all organisms; adaptations of cells related to their functions. • The fundamental units of living organisms are cells, which may be part of highly adapted structures including tissues, organs and organ systems, enabling life processes to be performed more effectively. ***Respiration*** • The importance of cellular respiration; the processes of aerobic and anaerobic respiration • The process of photosynthesis. ***Diffusion*** • The need for transport systems in multicellular organisms, including plants.	**Chemistry** ***States of matter*** • Melting, evaporation, and sublimation as reversible changes ***Atoms and Structure*** • Matter is composed of tiny particles called atoms and there are about 100 different naturally occurring types of atoms called elements. • A simple model of the atom consisting of the nucleus and electrons. • Relative atomic mass.	**Physics** ***Forces and energy*** • Energy changes in a system: calculating the stored energies and energy changes involved. • Conservation of energy in a closed system, dissipation. • Weight and Gravitational Field Strength. • Braking distances involved on Roads, Safety.

making decisions based on the evaluation of evidence and arguments • evaluating risks both in practical science and the wider societal context, including perception of risk • recognising the importance of peer review of results and of communication of results to a range of audiences **2. Experimental skills and strategies** • using scientific theories and explanations to develop hypotheses • planning experiments to make observations, test hypotheses or explore phenomena • applying a knowledge of a range of techniques, apparatus, and materials to select those appropriate both for fieldwork and for experiments • carrying out experiments appropriately, having due regard to the correct manipulation of apparatus, the accuracy of measurements and health and safety considerations • recognising when to apply a knowledge of sampling techniques to ensure any samples collected are representative • making and recording observations and measurements using a range of apparatus and methods • evaluating methods and suggesting possible improvements and further investigations. ***3. Analysis and evaluation*** • applying the cycle of collecting, presenting and analysing data, including: 1. presenting observations and other data using appropriate methods 2. translating data from one form to another 3. carrying out and representing mathematical and statistical analysis 4. representing distributions of results and making estimations of uncertainty			

5. interpreting observations and other data, including identifying patterns and trends, making inferences and drawing conclusions 6. presenting reasoned explanations, including relating data to hypotheses 7. being objective, evaluating data in terms of accuracy, precision, repeatability and reproducibility and identifying potential sources of random and systematic error • communicating the scientific rationale for investigations, including the methods used, the findings and reasoned conclusions, using paper-based and electronic reports and presentations. ***4. Vocabulary, units, symbols and nomenclature*** • developing their use of scientific vocabulary and nomenclature • recognising the importance of scientific quantities and understanding how they are determined • using prefixes and powers of ten for orders of magnitude (e.g. tera, giga, mega, kilo, centi, milli, micro and nano) • interconverting units • using an appropriate number of significant figures in calculations.			