		How Science Works	Biology	Chemistry	Physics
	9+ 9	•	•	•	•
A*	9- 8+ 8 8-	• Recognise that different approaches are required to investigate different kinds of scientific questions, and use scientific knowledge and understanding to select appropriate strategies. • Identify hazards, seek appropriate risk assessment information and adjust practice as required. • Make records of relevant observations and comparisons, clearly identifying points of particular significance. • Decide the level of precision needed for measurements and collect data that satisfy these requirements. • Analyse findings to interpret trends and patterns and draw conclusions from their evidence. • Make effective use of a range of quantitative relationships between variables in calculations or when using data to support evidence. • Communicate findings and arguments, showing their awareness of the degree of uncertainty and a range of alternative views. • Evaluate evidence critically and give	• Critically evaluate the relative impact of chemical, physical and biological factors and their effect on life processes in unfamiliar contexts. • Apply and use their extensive knowledge of variation and interdependence to explain and critically evaluate the impact of human activity on evolutionary and ecological. • Evaluate evidence from different sources about the impact of natural and artificial substances on behaviour. • Use and apply their understanding of how life processes in organisms work together in unfamiliar contexts. • Link and synthesise data and evidence from a range of sources to explain human impact on the biosphere.	• Use the particle model and ideas from science and across disciplines to explain complex phenomena and make critical evaluations to justify the use of a 'good enough' model. • Use a particle model to predict the outcome of complex chemical reactions and to produce balanced symbol equations and ionic half-equations when appropriate. • Explain the evidence that a chemical reaction has taken place (in a system at equilibrium) in terms of energy transfer and rearrangements of bonds between atoms. • Apply knowledge of patterns of reactivity in the periodic table to evaluate critically a range of domestic and industrial processes including systems at equilibrium. • Apply and use the theory of plate tectonics to explain related geological phenomena.	• Apply broader or deeper knowledge and understanding of energy in explanations of observations and phenomena. • Use valid and rational argument to offer solutions to problems arising from the applications and implications of energy. • Apply knowledge and understanding of forces in explanations of observations and phenomena to complex and unfamiliar contexts. • Use valid and rational argument to offer solutions to problems arising from the applications and implications of forces. • Describe how evidence and arguments from different political and economic perspectives have been used to justify decisions taken to manage sustainability. • Explain, using available evidence and models of the universe, why the ultimate fate of the universe is difficult to predict.

		reasoned accounts of how they could collect additional evidence.			
A	7+ 7 7- 6+	• Recognise that different strategies are required to investigate different kinds of scientific questions, and use scientific knowledge and understanding to select an appropriate strategy. • Adapt the approach to practical work to control risk. • Record data that is relevant and sufficiently detailed. • Choose methods that will obtain this data with the precision and reliability needed. • Analyse data and begin to explain, and allow for, anomalies. • Carry out multi-step calculations and use compound measures, such as speed, appropriately. • Communicate findings and arguments, showing awareness of a range of views. • Evaluate evidence critically and suggest how inadequacies can be remedied.	• Explain how the different intracellular and extracellular processes work together to support life in familiar contexts. • Evaluate the impact of chemical, physical and biological factors and explain their effects on the life processes. • Apply and use their knowledge of variation and interdependence to explain natural selection, the applications and implications of artificial selection and evolutionary and ecological relationships. • Explain the effects of natural and artificial substances on chemical and electrical signals within the body, and possible effects on behaviour. • Evaluate the accuracy and validity of primary and secondary evidence in relation to human impact on the biosphere.	• Use the particle model and ideas from science and across disciplines to explain phenomena and evaluate the use of the model. • Use a particle model to predict the outcome of chemical reactions and to produce balanced symbol equations. • Explain the evidence that a chemical reaction has taken place in terms of rearrangements of bonds between atoms, using the model of the differences of electron structure between elements • Apply knowledge of patterns of reactivity in the periodic table to predict the outcomes of reactions from a range of familiar contexts. • Link plate tectonic theory to its supporting geological evidence.	• Use quantitative measures and the concept of energy conservation to evaluate a range of strategies to conserve limited energy resources. • Use and apply complex models of energy transfer to a wide range of phenomena. • Explain a wide range of complex phenomena using the principle of conservation of energy and appropriate wave or particle models. • Use relationships involving more complex quantities, to make quantitative predictions in more complex and unfamiliar situations. • Describe and analyse how complex data could be represented or misrepresented to justify decisions taken to manage sustainability. • Evaluate the available evidence and explain why it favours an expanding universe as the current consensus model.
B	6 6- 5+	• Plan appropriate approaches and procedures, by synthesising information from a range of sources. • Identify key factors in complex contexts and in which variables cannot readily be controlled. • Select and use methods to obtain reliable data, including making systematic observations and measurements with precision, using a range of apparatus. • Recognise the need for a risk assessment and consult appropriate sources of information, which they follow. • Record data in graphs, using lines of best fit.	• Explain how individual intracellular and extracellular processes and structures in plants and animals support the seven life processes. • Explain why certain chemical, physical and biological factors can disrupt the seven life processes. • Explain how the combined effects of changes to genes and environmental change can lead to variation in a species. • Explain the fluctuations in distribution and population size using energy flow, pyramids of number and biomass, and predator/prey relationships. • Explain how chemical and electrical	• Apply particle models in unfamiliar contexts, and begin to evaluate the strengths and weaknesses of the model. • Refine the particle model to explore the structure of atoms, including protons, neutrons and electrons. • Use a particle model to construct predictions for chemical reactions and to produce symbol equations. • Explain the evidence that a chemical reaction has taken place in terms of energy transfer and rearrangements of bonds between atoms. • Explain properties and patterns in reactivity in terms of a particle model for atomic structure.	• Apply the concept of conservation of energy to energy efficiency calculations in living and non-living systems. • Develop the idea of energy dissipation in a variety of contexts. • Evaluate the economic costs and environmental effects of energy use through the measurement of energy transfers and efficiency calculations. • Describe the effects of energy transfer to living systems by electromagnetic and nuclear radiation. • Use simple quantitative relationships to make predictions in more complex situations.

	5	• Analyse findings to draw conclusions that are consistent with the evidence and use scientific knowledge and understanding to explain these conclusions. • Identify possible limitations in primary and secondary data. • Use quantitative relationships between variables. • Communicate effectively, using a wide range of scientific and technical conventions and terminology, including symbols and flow diagrams. • Consider whether the data they have collected is sufficient for the conclusions they have drawn.	signals enable body systems to respond to internal and external changes and the effect of this on behaviour. • Use primary and secondary forms of evidence to describe and explain the impact of human actions at a local, regional and global level.	• Use the idea of plate tectonics to explain some of the major slow (long-term) changes and the distribution and nature of active zones on the surface of the Earth.	• Use simple relationships involving more complex quantities, to make quantitative predictions in familiar situations. • Explain some methods used to explore the solar system and galaxy (both from the Earth and from Space). • Explain how the electromagnetic spectrum can inform the study of the stars in our galaxy (and universe).
C	5- 4 + 4	• Identify an appropriate approach in investigatory work, selecting and using sources of information, scientific knowledge and understanding. • Select and use methods to collect adequate data for the task. • Measure with precision, using instruments with fine scale divisions, and identify the need to repeat measurements and observations. • Recognise a range of familiar risks and take action to control them. • Record data and features effectively, choosing scales for graphs and diagrams. • Analyse findings to draw conclusions that are consistent with the evidence and use scientific knowledge and understanding to explain them. • Account for any inconsistencies in the evidence. • Manipulate numerical data to make valid comparisons and draw valid conclusions. • Communicate qualitative and quantitative data effectively, using scientific conventions and	• Explain how the specialisation of cells in plants and animals support the seven life processes in a healthy organism. • Explain how chemical, physical and biological factors can disrupt the seven life processes. • Explain how variation in organisms can be artificially induced and the effect of these organisms on the environment. • Explain how internal and external factors can affect energy transfer in food chains and webs • Make links between observed social behaviours and the benefit to the survival of the species. • Use one or more models, such as the carbon cycle or food webs, to explain some of the consequences of changes in the environment.	• Evaluate and refine the particle model to explain a range of physical observations. • Evaluate and refine the particle model to explain a range of separation techniques. • Use a particle model to construct predictions for simple chemical reactions and to produce word equations. • Link experimental and numerical data to illustrate a range of patterns in chemical reactions. • Use the rock cycle as a model to explain the cyclical nature of rock-forming processes and the timescales over which they operate.	• Develop more complex models of energy transfer mechanisms (incorporating ideas about particles or waves). • Use energy-accounting systems, including Sankey diagrams to track energy transfers. • Apply the idea of energy conservation and dissipation to simple biological, chemical and physical systems. • Use quantitative measures of energy transfer to support informed decision-making. • Recognise how simple quantitative relationships can be applied to the way objects move (including balanced and unbalanced forces). • Recognise how simple quantitative relationships can be applied to situations where forces are applied over large and small areas or have a turning effect. • Apply models and use scientific data to explain the relative movement of the celestial bodies in the solar system. • Describe how astronomy and space

	4-	terminology. • Evaluate evidence, making reasoned suggestions about how their working methods could be improved.			science provide evidence of the solar system and galaxy.
D	3 + 3 3-	• Decide appropriate approaches to a range of tasks, including selecting sources of information and apparatus. • Select and use methods to obtain data systematically. • Recognise hazard symbols and make, and act on, simple suggestions to control obvious risks to themselves and others. • Use line graphs to present data, interpret numerical data and draw conclusions from them. • Analyse findings to draw scientific conclusions that are consistent with the evidence. • Communicate these using scientific and mathematical conventions and terminology. • Evaluate their working methods to make practical suggestions for improvements.	• Explain how the organs and tissues in plants and animals function to support the seven life processes in a healthy organism. • Explain how variation has benefits and limitations for the survival of organisms in specific habitats. • Describe some examples of variation arising from inherited and environmental factors. • Explain energy transfer in food chains and webs and relate this to the abundance of organisms. • Explain how changes in learned behaviour due to internal and external stimuli are of benefit to the organism.	• Apply and use the particle model to describe a range of physical observations. • Apply and use the particle model to describe a range of separation techniques. • Recognise that materials can be made up of one or more kinds of particles. • Describe the type and arrangement of atoms in elements, compounds and mixtures. • Describe and develop a particle model to explain the differences between the terms atoms, elements, compounds and mixtures. • Describe patterns in a range of chemical reactions. • Explain some of the changes that have led to the composition of the current atmosphere. • Describe the processes involved in the formation of sedimentary, metamorphic and igneous rocks and use the characteristics of the rocks to explain how they formed.	• Use a simple model of energy transfer to describe common observations. • Explain why quantitative measures of energy transfer should also be considered when making informed decisions, e.g. building wind farms. • Explain how electricity is generated using a variety of energy resources. • Apply ideas about balanced and unbalanced forces to explain the way objects move. • Investigate situations where forces are applied over large and small areas or have a turning effect. • Recognise that forces at a distance get weaker as the distance increases. • Recognise simple ideas of sustainable development. • Describe the position of the Earth in relation to the position of other bodies in the solar system and use this to explain some phenomena. • Recognise that astronomy and space science provide evidence about the solar system.
E	2 +	• Decide on an appropriate approach, including using a fair test to answer a question. • Select suitable equipment and information from that provided. • Select and use methods that are adequate for the task. • Following instructions, they take action to control obvious risks to themselves.	• Describe the role of organ systems in plants and animals that can contribute to the seven life processes. • Describe how organisms can vary and how this may lead to their survival in changing environments. • Describe how the major taxonomic groups are classified. • Use a combination of food chains	• Describe matter using a simple model and use it to explain changes of state. • Recognise the link between heating and cooling and changes of state. • Use the simple particle model to explain the physical characteristics of solids, liquids and gases. • Sort some reactions into reversible and irreversible. • Recognise that new materials are	• Describe how energy can be stored, e.g. food, fuels and electrical cells. • Describe how energy is transferred in simple contexts such as heating and cooling, food chains and simple circuits. • Recognise that quantitative measures of energy transfer are needed to inform decisions, e.g. about lifestyles. • Describe how energy stored in a

	2 2-	• Make a series of observations and measurements and vary one factor while keeping others the same. • Record their observations, comparisons and measurements using tables. • Draw bar charts and begin to plot points to form simple graphs. • Interpret data containing positive and negative numbers. • Relate their conclusions to patterns in data, including graphs, and to scientific knowledge and understanding. • Communicate their conclusions using appropriate scientific language. • Suggest improvements in their work, giving reasons.	within a habitat to produce food webs. • Describe simple learned and innate behaviours in response to internal and external stimuli and how these aid survival.	made during chemical reactions. • Describe, record and group observations from chemical reactions. • Describe how natural and human processes have changed the atmosphere over time. • Recognise the processes involved in the formation of rocks.	range of energy resources, e.g. food, biomass, oil, gas, wind and waves, can be usefully transferred. • Recognise the forces acting on an object in different situations. • Distinguish between situations involving balanced and unbalanced forces. • Recognise that forces can combine or wholly or partly cancel each other out and their size and direction can be represented using arrows. • Recognise that there are contact forces and forces that act at a distance. • Describe the apparent movement of the Sun across the sky and the pattern in the changing appearance of the Moon.
F	1 + 1	• Respond to suggestions and put forward their own ideas about how to investigate an idea or find answers to questions. • Recognise why it is important to collect data to investigate ideas and answer questions, and use texts to find information. • Recognise risks with help. • Make relevant observations and measure quantities, such as length or mass, selecting and using a range of simple equipment. • Carry out fair tests with some help, recognising and explaining what makes them fair. • Record findings in a variety of ways, including tables or charts. • Give explanations for observations and for patterns in measurements they have made and recorded. • Communicate in a scientific way what they have found out and suggest improvements in their work.	• Use knowledge and understanding of organisms, their behaviour and the environment, to describe similarities, differences and changes in the plants, animals, and non-living things they observe. • Use simple scientific ideas with evidence they have collected to give explanations of their observations, linking cause and effect and the ways in which animals or plants are suited to their environments. • Recognise and explain the purpose of a variety of scientific and technological developments in their everyday lives, for example medicines helping people get better when they are ill.	• Use knowledge and understanding of materials, their properties and the Earth to sort materials into groups in a variety of ways, according to their properties. • Explain the ways in which some materials are suited to specific purposes such as glass for windows or copper for electrical cables. • Classify changes in materials as reversible, such as water freezing, and non-reversible, such as baking of cakes. • Use simple scientific ideas with evidence they have collected to give explanations of their observations, linking cause and effect, for example the evaporation of water. • Recognise and explain the purpose of a variety of scientific and technological developments in their everyday lives, for example sustainable packaging.	• Use their knowledge and understanding of energy, forces and space to link cause and effect in their observations of the properties and effects of light, sound, forces, and electricity, such as a bulb failing to light because of a break in an electrical circuit, or a push or pull changing the speed or direction of a moving object. • Make generalisations such as sounds getting fainter the further the listener is from the source. • Use simple scientific ideas with evidence they have collected to give explanations of their observations, linking cause and effect, for example using a switch to turn off a light bulb in an electrical circuit. • Recognise and explain the purpose of a variety of scientific and technological developments in their everyday lives, for example streamlining and air resistance.
G		• Respond to suggestions and make	• Use their knowledge related to	• Use their knowledge related to	• Use their knowledge related to

	1-	their own suggestions, with help, about how to collect relevant data and answer questions. • Find information by using texts, with help. • Follow direct instructions in order to stay safe. • Make observations and measurements to compare living things, objects and events, using equipment provided for them. • Record findings using prepared tables and communicate observations using scientific vocabulary. • State whether what happened was what they expected. • Suggest different ways they could have done things.	organisms, their behaviour and the environment to describe plants and animals, the places they are found and the basic conditions they need in order to survive. • Recognise and describe similarities and differences between the plants, humans and other animals they observe, using these to sort them into groups. • Use questions based on their own ideas and evidence such as finding different types of plants and animals in different places. • Identify science in everyday contexts and say whether it is helpful, for example ways of growing vegetables for food.	materials, their properties and the Earth to identify a range of common materials and some of their properties. • Recognise, and describe similarities and differences between the materials they observe, using these to sort them into groups. • Recognise and describe ways in which some materials are changed by heating or cooling or by processes such as bending or stretching. • Suggest answers to questions, such as the best material to reflect light, based on their own ideas and evidence. • Identify science in everyday contexts and say whether it is helpful, for example ice melting.	energy, forces and space to recognise, describe and compare a range of properties and effects of light, sound, forces, and electricity, such as the ways in which devices work in different electrical circuits, the brightness or colour of lights, the loudness of sounds or the speed or direction of different objects. • Suggest answers to questions such as which sound is loudest based on their own ideas and evidence. • Identify science in everyday contexts and say whether it is helpful, for example electricity in domestic appliances.