Science

Vision: At Bispham, our vision is to provide a high-quality and engaging science curriculum that empowers all children, regardless of their background or abilities, to actively explore and discover the diverse world around them. By igniting their curiosity, we aim to foster a deep understanding not only of our immediate surroundings but also of the broader scope of our world and beyond.

Physics

KS1	Year 3	Year 4	Year 5	Year 6	KS3
SUBSTANTIVE KNOWLEDGE					
Light - recognise that they need light in order to see things and that dark is the absence of light - notice that light is reflected from surfaces - recognise that light from the sun can be dangerous and that there are ways to protect their eyes - recognise that shadows are formed when the light from a light source is blocked by an opaque object - find patterns in the way that the size of shadows change Forces and magnets - compare how things move on different surfaces - notice that some forces need contact between 2 objects, but magnetic forces can act at a distance - observe how magnets attract or repel each other and attract some materials and not others - compare and group together a variety of everyday materials on the basis of whether they are attracted to a magnet, and identify some magnetic materials - describe magnets as having 2 poles - predict whether 2 magnets will attract or repel each other, depending on which poles are facing	**Autumn 1:** Light and Shadows To know that light is needed in order to see things To know that dark is the absence of light To know that light is reflected from surfaces To know that shadows are formed when the light from a light source is blocked by an opaque object To know that light from the sun can be dangerous and that there are ways to protect their eyes To know that there are patterns in the way the size of a shadow can change. To know that changing the angle and distance of the light source can alter the shadow **Summer 2:** Forces and magnets	**Spring 2:** Sound To identify how sounds are made, associating some of them with something vibrating To recognise that vibrations from sounds travel through a medium to the ear To find patterns between the pitch of a sound and features of the object that produced it To find patterns between the volume of a sound and the strength of the vibrations that produced it To recognise that sounds get fainter as the distance from the sound source increases. **Summer 2:** Electricity To identify common appliances that run on electricity To construct a simple series electrical circuit, identifying and naming its basic parts,	**Spring 1:** Earth & Space To describe the movement of the Earth, and other planets, relative to the Sun in the solar system To describe the movement of the Moon relative to the Earth To describe the Sun, Earth and Moon as approximately spherical bodies To use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky **Spring 2:** Forces To identify the effects of air resistance, water resistance and friction, that act between moving surfaces To recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect.	**Autumn 1:** Electricity To associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit To compare and give reasons for variations in how components function, including the brightness of bulbs, the loudness of buzzers and the on/off position of switches To use recognised symbols when representing a simple circuit in a diagram. **Autumn 2:** Light To recognise that light appears to travel in straight lines To use the idea that light travels in straight lines to explain that objects are seen because they give out or reflect light into the eye	Energy Calculation of fuel uses and costs in the domestic context - comparing energy values of different foods (from labels) (kJ) - comparing power ratings of appliances in watts (W, kW) - comparing amounts of energy transferred (J, kJ, kW hour) - domestic fuel bills, fuel use and costs - fuels and energy resources Energy changes and transfers - simple machines give bigger force but at the expense of smaller movement (and vice versa); product of force and displacement unchanged - heating and thermal equilibrium: temperature difference between 2 objects leading to energy transfer from the hotter to the cooler one, through contact (conduction) or radiation; such transfers tending to reduce the temperature difference; use of insulators - 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 - comparing the starting with the final conditions of a system and describing increases and decreases in the amounts of energy associated with movements, temperatures, changes in positions in a field, in elastic distortions and in chemical compositions - using physical processes and mechanisms, rather than energy, to explain the intermediate steps that bring about such changes Motion and forces Describing motion - speed and the quantitative relationship between average speed, distance and time (speed = distance ÷ time) - the representation of a journey on a distance–time graph - relative motion: trains and cars passing one another Forces - forces as pushes or pulls, arising from the interaction between 2 objects - using force arrows in diagrams, adding forces in 1 dimension, balanced and unbalanced forces - moment as the turning effect of a force - 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 newtons, measurements of stretch or compression as force is changed

	To compare how things move on different surfaces To notice that some forces need contact between two objects, but magnetic forces can act at a distance To compare and group together a variety of everyday materials on the basis of whether they are attracted to a magnet, and identify some magnetic materials To observe how magnets attract or repel each other and attract some materials and not others To describe magnets as having two poles To predict whether two magnets will attract or repel each other, depending on which poles are facing.	including cells, wires, bulbs, switches and buzzers To identify whether or not a lamp will light in a simple series circuit, based on whether or not the lamp is part of a complete loop with a battery To recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit To recognise some common conductors and insulators, and associate metals with being good conductors. Summer 1: States of Matter To compare and group materials together, according to whether they are solids, liquids or gases To observe that some materials change state when they are heated or cooled, and measure or research the temperature at which this happens in degrees Celsius (°C) To identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature.	To explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object	To explain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes To use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them.	- 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 <u>Pressure in fluids</u> - atmospheric pressure, decreases with increase of height as weight of air above decreases with height - pressure in liquids, increasing with depth; upthrust effects, floating and sinking - pressure measured by ratio of force over area – acting normal to any surface <u>Balanced forces</u> - opposing forces and equilibrium: weight held by stretched spring or supported on a compressed surface <u>Forces and motion</u> - 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 <u>Waves</u> <u>Observed waves</u> - waves on water as undulations which travel through water with transverse motion; these waves can be reflected, and add or cancel – superposition <u>Sound waves</u> - frequencies of sound waves, measured in hertz (Hz); echoes, reflection and absorption of sound - sound needs a medium to travel, the speed of sound in air, in water, in solids - sound produced by vibrations of objects, in loudspeakers, detected by their effects on microphone diaphragm and the ear drum; sound waves are longitudinal - the auditory range of humans and animals <u>Energy and waves</u> - pressure waves transferring energy; use for cleaning and physiotherapy by ultrasound; waves transferring information for conversion to electrical signals by microphone <u>Light waves</u> - the similarities and differences between light waves and waves in matter - light waves travelling through a vacuum; speed of light the transmission of light through materials: absorption, diffuse scattering and specular reflection at a surface - use of ray model to explain imaging in mirrors, the pinhole camera, the refraction of light and action of convex lens in focusing (qualitative); the human eye - light transferring energy from source to absorber, leading to chemical and electrical effects; photosensitive material in the retina and in cameras - colours and the different frequencies of light, white light and prisms (qualitative only); differential colour effects in absorption and diffuse reflection <u>Electricity and electromagnetism</u> <u>Current electricity</u> - electric current, measured in amperes, in circuits; series and parallel circuits, currents add where branches meet and current as flow of charge - potential difference, measured in volts, battery and bulb ratings; resistance, measured in ohms, as the ratio of potential difference (p.d.) to current - differences in resistance between conducting and insulating components (quantitative) <u>Static electricity</u>

					- separation of positive or negative charges when objects are rubbed together: transfer of electrons, forces between charged objects - the idea of electric field: forces acting across the space between objects not in contact Magnetism - magnetic poles, attraction and repulsion - magnetic fields by plotting with compass; representation by field lines - Earth's magnetism, compass and navigation the magnetic effect of a current; electromagnets; DC motors (principles only) Matter 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 - Brownian motion in gases - diffusion in liquids and gases driven by differences in concentration - 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; the anomaly of ice-water transition - atoms and molecules as particles Energy in matter - changes with temperature in motion and spacing of particles - internal energy stored in materials Space physics - gravity force, weight = mass x gravitational field strength (g), on Earth g=10 N/kg, different on other planets and stars; gravity forces between Earth and Moon, and between Earth and sun (qualitative only) - our sun as a star; other stars in our galaxy; other galaxies - the seasons and the Earth's tilt; day length at different times of year, in different hemispheres - the light year as a unit of astronomical distance
	Autumn 1: Light experiment: objects in a shoe box to show what effect the absence of light has on our sight and what happens when a light source is placed in darkness. **Working Scientifically** Questioning Identifying (& classifying) Data recording Table **Spring 2: Forces and magnets experiment**	**Spring 2: Sound** How does distance change the volume of a sound? **Working Scientifically** Testing Hypothesising Interpreting and recording data Data recording Bar chart table **Summer 2: Electricity** Testing the conductivity of materials (conductors and insulators)	**Spring 1: Earth and space** Keep a moon diary over the half term to show the changes in the way the light makes it appear. **Working Scientifically** Observing and measuring Interpreting and recording data Data recording Labelled diagram **Spring 2: Forces** Compare the length of time it takes for an object to fall based around the size of parachute attached to the object	**Autumn 1: Electricity** Voltage amount increase measuring the effect on parts of the circuit **Working Scientifically** Observing and measuring Testing Hypothesising **Autumn 2: Light** Explore and record how to get light from a source from one place to another (a cardboard eye) using reflective materials. **Working Scientifically**	

	I.I Movement of toy car on various surfaces to show how friction effects movement **Working Scientifically** Testing Observing and measuring Hypothesising Interpreting and recording data Data recording Table Bar chart **Spring 2: Forces and magnets** I.2 Magnetism of various objects to move a toy car **Working Scientifically** Identifying and classifying Hypothesising	**Working Scientifically** Questioning Observing and measuring Identifying and classifying	**Working Scientifically** Observing and measuring Testing Data recording Bar chart	Questioning Testing Hypothesising	

Biology

KS1	Year 3	Year 4	Year 5	Year 6	KS3
SUBSTANTIVE KNOWLEDGE					
Plants - identify and describe the functions of different parts of flowering plants: roots, stem/trunk, leaves and flowers - explore the requirements of plants for life and growth (air, light, water, nutrients from soil, and room to grow) and how they vary from plant to plant - investigate the way in which water is transported within plants - explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal Animals, including humans - identify that animals, including humans, need the right types and amount of nutrition, and that they cannot make their own food; they get nutrition from what they eat - identify that humans and some other animals have skeletons and muscles for support, protection and movement	**Autumn 2:** Animals including humans To identify that humans and some other animals have skeletons and muscles for support, protection and movement. **Spring 1:** Animals including humans To identify that animals, including humans, need the right types and amount of nutrition,	**Autumn 1:** Living Things and their habitats To recognise that living things can be grouped in a variety of ways To explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment	**Autumn 2:** Animals, including Humans To describe the changes as humans develop to old age. **Summer 2:** Living things and their habitats To describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird	Spring 1: Living things and their habitats To describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including microorganisms, plants and animals To give reasons for classifying plants and animals based on specific characteristics.	Structure and function of living organisms 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 - the structural adaptations of some unicellular organisms - the hierarchical organisation of multicellular organisms: from cells to tissues to organs to systems to organisms The skeletal and muscular systems - the structure and functions of the human skeleton, to include support, protection, movement and making blood cells - biomechanics – the interaction between skeleton and muscles, including the measurement of force exerted by different muscles - the function of muscles and examples of antagonistic muscles Nutrition and digestion

	and that they cannot make their own food; they get nutrition from what they eat **Spring 2:** Plants To identify and describe the functions of different parts of flowering plants: roots, stem/trunk, leaves and flowers To explore the requirements of plants for life and growth (air, light, water, nutrients from soil, and room to grow) and how they vary from plant to plant To investigate the way in which water is transported within plants To explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal.	To recognise that environments can change and that this can sometimes pose dangers to living things. **Spring 1:** Animals, including humans To describe the simple functions of the basic parts of the digestive system in humans To identify the different types of teeth in humans and their simple functions To construct and interpret a variety of food chains, identifying producers, predators and prey.	To describe the life process of reproduction in some plants and animals.	**Spring 2:** Animals inc humans To identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood To recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function To describe the ways in which nutrients and water are transported within animals, including humans. **Summer 1:** Evolution and Inheritance To recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago To recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents To identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution	- the content of a healthy human diet: carbohydrates, lipids (fats and oils), proteins, vitamins, minerals, dietary fibre and water, and why each is needed - calculations of energy requirements in a healthy daily diet - the consequences of imbalances in the diet, including obesity, starvation and deficiency diseases - the tissues and organs of the human digestive system, including adaptations to function and how the digestive system digests food (enzymes simply as biological catalysts) - the importance of bacteria in the human digestive system - plants making carbohydrates in their leaves by photosynthesis and gaining mineral nutrients and water from the soil via their roots Gas exchange systems - the structure and functions of the gas exchange system in humans, including adaptations to function - the mechanism of breathing to move air in and out of the lungs, using a pressure model to explain the movement of gases, including simple measurements of lung volume - the impact of exercise, asthma and smoking on the human gas exchange system - the role of leaf stomata in gas exchange in plants Reproduction - reproduction in humans (as an example of a mammal), including the structure and function of the male and female reproductive systems, menstrual cycle (without details of hormones), gametes, fertilisation, gestation and birth, to include the effect of maternal lifestyle on the foetus through the placenta - reproduction in plants, including flower structure, wind and insect pollination, fertilisation, seed and fruit formation and dispersal, including quantitative investigation of some dispersal mechanisms Health - the effects of recreational drugs (including substance misuse) on behaviour, health and life processes Material cycles and energy Photosynthesis - the reactants in, and products of, photosynthesis, and a word summary for photosynthesis - the dependence of almost all life on Earth on the ability of photosynthetic organisms, such as plants and algae, to use sunlight in photosynthesis to build organic molecules that are an essential energy store and to maintain levels of oxygen and carbon dioxide in the atmosphere - the adaptations of leaves 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 Interactions and interdependencies Relationships in an ecosystem - the interdependence of organisms in an ecosystem, including food webs and insect pollinated crops - the importance of plant reproduction through insect pollination in human food security - how organisms affect, and are affected by, their environment, including the accumulation of toxic materials Genetics and evolution Inheritance, chromosomes, DNA and genes - heredity as the process by which genetic information is transmitted from one generation to the next

					- a simple model of chromosomes, genes and DNA in heredity, including the part played by Watson, Crick, Wilkins and Franklin in the development of the DNA model - differences between species - the variation between individuals within a species being continuous or discontinuous, to include measurement and graphical representation of variation - the variation between species and between individuals of the same species meaning some organisms compete more successfully, which can drive natural selection - changes in the environment which may leave individuals within a species, and some entire species, less well adapted to compete successfully and reproduce, which in turn may lead to extinction - the importance of maintaining biodiversity and the use of gene banks to preserve hereditary material
WORKING SCIENTIFICALLY EXPERIMENT / DATA RECORDING					
	Spring 2: Plants Removal of leaves, roots from a healthy plant. Observe its effects on the growth of the plant. **Working Scientifically** Observing and measuring Testing Interpreting and recording data Data recording Drawing Labelled diagrams	**Autumn 2: Living things and their habitats** Whole class key - human classification. Use children on playground to classify them so that each child fits into their own classification by the end. **Working Scientifically** Questioning Identifying and classifying Interpreting and recording data Hypothesising Data recording Key		**Spring 1: Living things and their habitats** How can we classify living organisms and what knowledge do we need to classify them? **Working Scientifically** Interpreting data Identifying and classifying Data recording Classification key	

Chemistry

KS1	Year 3	Year 4	Year 5	Year 6	KS3
SUBSTANTIVE KNOWLEDGE					
Rocks - compare and group together different kinds of rocks on the basis of their appearance and simple physical properties - describe in simple terms how fossils are formed when things that have lived are trapped within rock - recognise that soils are made from rocks and organic matter	**Summer 1**: Rocks and soils To compare and group together different kinds of rocks on the basis of their appearance and simple physical properties		**Summer 1**: Properties & Changes of Materials To compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity		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 - chemical symbols and formulae for elements and compounds - conservation of mass changes of state and chemical reactions Pure and impure substances

	To describe in simple terms how fossils are formed when things that have lived are trapped within rock To recognise that soils are made from rocks and organic matter.		(electrical and thermal), and response to magnets To know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution To use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating To give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic To demonstrate that dissolving, mixing and changes of state are reversible changes To explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible, including changes associated with burning and the action of acid on bicarbonate of soda		- the concept of a pure substance - mixtures, including dissolving - diffusion in terms of the particle model - simple techniques for separating mixtures: filtration, evaporation, distillation and chromatography - the identification of pure substances Chemical reactions - chemical reactions as the rearrangement of atoms - representing chemical reactions using formulae and using equations - combustion, thermal decomposition, oxidation and displacement reactions - defining acids and alkalis in terms of neutralisation reactions - the pH scale for measuring acidity/alkalinity; and indicators - reactions of acids with metals to produce a salt plus hydrogen - reactions of acids with alkalis to produce a salt plus water - what catalysts do Energetics - energy changes on changes of state (qualitative) - exothermic and endothermic chemical reactions (qualitative) The periodic table - the varying physical and chemical properties of different elements - the principles underpinning the Mendeleev periodic table - the periodic table: periods and groups; metals and non-metals - how patterns in reactions can be predicted with reference to the periodic table - the properties of metals and non-metals - the chemical properties of metal and non-metal oxides with respect to acidity Materials - the order of metals and carbon in the reactivity series - the use of carbon in obtaining metals from metal oxides - properties of ceramics, polymers and composites (qualitative) Earth and atmosphere - the composition of the Earth - the structure of the Earth - the rock cycle and the formation of igneous, sedimentary and metamorphic rocks - Earth as a source of limited resources and the efficacy of recycling - the composition of the atmosphere - the production of carbon dioxide by human activity and the impact on climate
			Summer 1: Properties & changes of materials What materials in my kitchen cupboard dissolve? Classify solutions into soluble and insoluble groups		

			Working Scientifically Questioning Testing Identifying and classifying Hypothesising Data recording Table		

Working Scientifically - Learning Progression

Key Areas	KS1	Y3	Y4	Y5	Y6
Questioning	To know that questions can be asked to gather information to support understanding. To know that specifically there are scientific questions and that there is more than one way of finding the answer.	To know how questions can be asked and answered through carrying out a scientific enquiry	To know how to ask and answer relevant questions through different types of scientific enquiries	To know how questions can be or might need to be refined through the scientific process	To know how precision is achieved through refinement of both questioning and of control of the variables in a scientific enquiry
Observing and Measuring	To know that there are different ways to observe things closely. To know that an appropriate choice of simple equipment will make observations more effective in the gathering of information.	To know how careful observations can form part of scientific enquiry To know how data can be collected from observations and measurements	To know how the quality of systematic observations in scientific enquiry is affected by how accurately equipment is used to gather data.	To know how specialised equipment can be used to observe and measure more accurately To know how repeating an observation or measurement may provide more accurate information	To know how the level of accuracy and precision will determine the success of scientific enquiry

Testing	To know that a test is a procedure which can be used to check the accuracy of the information used to answer questions. To know that there are different ways to perform a test including the use of simple equipment.	To know how the process used to carry out a scientific enquiry must be fair	To know that if the procedure used in the scientific enquiry is not fair then the information gathered is unreliable	To know how the outcome of a fair test can inform and shape further enquiries	To know how outcomes from fair tests support factual understanding of a scientific enquiry which may differ from opinion
Identifying (& Classifying)	To know that by comparing common features, it is possible to group and sort objects, materials or living things. To know that sorting and grouping by features and characteristics can be refined to give more accurate and detailed identification (for example, tree/oak tree/deciduous)	To know how information collected during simple scientific enquiry can be used to inform identification and classification	To know that accurate identification and classification can be used to answer questions in a simple scientific enquiry	To know how identification and classification can involve the organisation of a substantial amount of information and there are agreed methods for doing this (e.g. key, graphs)	To know how the success of a more complex scientific enquiry requires appropriate selection of the most effective method of classifying information

Hypothesising	To know that ideas can be used to predict possible outcomes to a scientific enquiry. To know that a prediction can be informed by prior knowledge and experience.	To know how a hypothesis is a starting point for further scientific enquiry	To know that a hypothesis can be refined as a result of scientific enquiry and used to inform the next stage of the process	To know how knowledge gained from previous scientific enquiries can be used to inform a more accurate hypothesis at the outset of a new enquiry	To know that an efficient and effective scientific enquiry should be based on an informed hypothesis
Interpreting and Recording Data	To know that there are many ways to collect and record information and that this can be used by others. To know that recorded data can be used to find answers to questions.	To know that recorded data is an important part of scientific enquiry as it can be used to draw conclusions	To know that inaccurately recorded data can mislead and cause incorrect conclusions	To know how filtering data is an important step when drawing conclusions so that only the most relevant information is used	To know how accurate data can be a powerful tool when supporting or refuting scientific ideas/arguments

Key:

Year Group:	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
3	Light and shadows	Animals including humans - skeletons of animals	Animals including humans - diet/ health and nutrition	Plants	Rocks and soils	Forces and magnets
4		Living things and their habitats	Animals including humans	Sound	States of matter	Electricity
5		Humans including animals	Earth and space	Forces	Properties and changes of materials	Living things and their habitats
6	Electricity	Light	Living things and their habitats	Animals including humans	Evolution and inheritance	

Blue: Physics

Orange: Biology

Green: Chemistry

Data recording:

UKS 2 Drawing, labelled diagrams, keys, bar charts, tables

LKS 2 Labelled diagrams, classification keys, bar charts, tables, scatter graphs, line graphs