

JBMS Science Concept Progression [based on PLAN / NC]

Year Group	BIOLOGY	CHEMISTRY	PHYSICS	SCIENCE SKILLS
<p><i>Previous Knowledge and Skills (these need to be checked and tested)</i></p>	<ul style="list-style-type: none"> • 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. • 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. • Recognise that living things can be grouped in a variety of ways. • Explore and use classification keys to help group, identify and name a 	<ul style="list-style-type: none"> • 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. • Compare and group materials together, according to whether they are solids, liquids or gases. • 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). • Identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature. 	<ul style="list-style-type: none"> • Identify how sounds are made, associating some of them with something vibrating. • Recognise that vibrations from sounds travel through a medium to the ear. • Find patterns between the pitch of a sound and features of the object that produced it. • Find patterns between the volume of a sound and the strength of the vibrations that produced it. • Recognise that sounds get fainter as the distance from the sound source increases. • 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. 	<ul style="list-style-type: none"> • The children consider their prior knowledge when asking questions. They independently use a range of question stems. Where appropriate, they answer these questions. • The children answer questions posed by the teacher. • Given a range of resources, the children decide for themselves how to gather evidence to answer the question. They recognise when secondary sources can be used to answer questions that cannot be answered through practical work. They identify the type of enquiry that they have chosen to answer their question. • The children make systematic and careful observations. • They use a range of equipment for measuring length, time, temperature and capacity. They use standard units for their measurements. • The children select from a range of practical resources to gather evidence to answer questions generated by themselves or the teacher.

JBMS Science Concept Progression [based on PLAN / NC]

	<p><i>variety of living things in their local and wider environment.</i></p> <ul style="list-style-type: none"> • <i>Recognise that environments can change and that this can sometimes pose dangers to living things.</i> <p>• <i>Describe the simple functions of the basic parts of the digestive system in humans.</i></p> <p>• <i>Identify the different types of teeth in humans and their simple functions.</i></p> <p>• <i>Construct and interpret a variety of food chains, identifying producers, predators and prey.</i></p>		<ul style="list-style-type: none"> • <i>Compare how things move on different surfaces.</i> • <i>Notice that some forces need contact between two objects, but magnetic forces can act at a distance.</i> • <i>Observe how magnets attract or repel each other and attract some materials and not others.</i> • <i>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.</i> • <i>Describe magnets as having two poles.</i> • <i>Predict whether two magnets will attract or repel each other, depending on which poles are facing.</i> <ul style="list-style-type: none"> • <i>Identify common appliances that run on electricity.</i> • <i>Construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers.</i> • <i>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.</i> • <i>Recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit.</i> 	<ul style="list-style-type: none"> • <i>They follow their plan to carry out: observations and tests to classify; comparative and simple fair tests; observations over time; and pattern seeking.</i> • <i>The children sometimes decide how to record and present evidence. They record their observation e.g. using photographs, videos, pictures, labelled diagrams or writing. They record their measurements e.g. using tables, tally charts and bar charts (given templates, if required, to which they can add headings). They record classifications e.g. using tables, Venn diagrams, Carroll diagrams.</i> • <i>Children are supported to present the same data in different ways in order to help with answering the question.</i> • <i>Children answer their own and others' questions based on observations they have made, measurements they have taken or information they have gained from secondary sources. The answers are consistent with the evidence.</i> • <i>Children interpret their data to generate simple comparative statements based on their evidence. They begin to identify</i>
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JBMS Science Concept Progression [based on PLAN / NC]

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<h1>5</h1>	<p>Know that...</p> <ul style="list-style-type: none"> • Describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird. • Describe the life process of reproduction in some plants and animals. • Describe the changes as humans develop to old age. 	<p>Know that...</p> <ul style="list-style-type: none"> • Everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets. <p>Know how to...</p> <ul style="list-style-type: none"> • Can compare and use 	<p>Know that...</p> <ul style="list-style-type: none"> • Explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object. • Identify the effects of air resistance, water resistance and friction that act between moving surfaces. • Recognise that some mechanisms, including levers, pulleys and gears, 	<ul style="list-style-type: none"> • Children independently ask scientific questions. This may be stimulated by a scientific experience or involve asking further questions based on their developed understanding following an enquiry. • Given a wide range of resources the children decide for themselves how to gather evidence to answer

JBMS Science Concept Progression [based on PLAN / NC]

<ul style="list-style-type: none"> • Identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood. • Recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function. • Describe the ways in which nutrients are processed within the digestive system <p>Know how to...</p> <ul style="list-style-type: none"> • Can draw the life cycle of a range of animals identifying similarities and differences between the life cycles • Can explain the difference between sexual and asexual reproduction and give examples of how plants reproduce in both ways • Can explain the changes that takes place in boys and girls during puberty • Can explain how a baby changes physically as it grows, and also what it is able to do up to old age <ul style="list-style-type: none"> • Can describe the main parts of the circulatory system and explain their role • Can describe the main parts of the digestive system and explain their role • Can explain both the positive and negative effects of diet, exercise, drugs and lifestyle on the body 	<p>understanding of properties to explain everyday uses of materials, for example, how bricks, wood, glass and metals are used in buildings</p> <ul style="list-style-type: none"> • Give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic. 	<p>allow a smaller force to have a greater effect</p> <ul style="list-style-type: none"> • Describe the movement of the Earth, and other planets, relative to the Sun in the solar system. • Describe the movement of the Moon relative to the Earth. • Describe the Sun, Earth and Moon as approximately spherical bodies. • Use the idea of the Earth's rotation to explain day and night and the apparent movement of the Sun across the sky. <p>Know how to...</p> <ul style="list-style-type: none"> • Can demonstrate the effect of gravity acting on an unsupported object • Can give examples of friction, water resistance and air resistance • Can give examples of when it is beneficial to have high or low friction, water resistance and air resistance • Can demonstrate how pulleys, levers and gears work <ul style="list-style-type: none"> • Can show, using diagrams, the movement of the Earth and Moon • Can explain the movement of the Earth and Moon 	<p>a scientific question. They choose a type of enquiry to carry out and justify their choice. They recognise how secondary sources can be used to answer questions that cannot be answered through practical work.</p> <ul style="list-style-type: none"> • The children select measuring equipment to give the most precise results e.g. ruler, tape measure or trundle wheel, force meter with a suitable scale. • During an enquiry, they make decisions e.g. whether they need to: take repeat readings (fair testing); increase the sample size (pattern seeking); adjust the observation period and frequency (observing over time); or check further secondary sources (researching); in order to get accurate data (closer to the true value). • The children select from a range of practical resources to gather evidence to answer their questions. They carry out fair tests, recognising and controlling variables. They decide what observations or measurements to make over time and for how long. They look for patterns and
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JBMS Science Concept Progression [based on PLAN / NC]

	<ul style="list-style-type: none"> • Present information e.g. in a health leaflet describing impact of drugs and lifestyle on the body 		<ul style="list-style-type: none"> • Can show using diagrams the rotation of the Earth and how this causes day and night • Can explain what causes day and night 	<p>relationships using a suitable sample.</p> <ul style="list-style-type: none"> • The children decide how to record and present evidence. They record observations e.g. using annotated photographs, videos, labelled diagrams, observational drawings, labelled scientific diagrams or writing. They record measurements e.g. using tables, tally charts, bar charts, line graphs and scatter graphs. They record classifications e.g. using tables, Venn diagrams, Carroll diagrams and classification keys.
<h1>6</h1>	<p>Know that...</p> <ul style="list-style-type: none"> • Describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including micro-organisms, plants and animals. • Give reasons for classifying plants and animals based on specific characteristics. <ul style="list-style-type: none"> • Recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago. • Recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents. • Identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution. <p>Know how to...</p>	<p>Know that...</p> <ul style="list-style-type: none"> • Know that some materials will dissolve in liquid to form a solution and describe how to recover a substance from a solution. • Use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating. • Demonstrate that dissolving, mixing and changes of state are reversible changes. • 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 <p>Know how to...</p> <ul style="list-style-type: none"> • Can explain what dissolving means, giving examples 	<p>Know that...</p> <ul style="list-style-type: none"> • Recognise that light appears to travel in straight lines. • 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. • 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. • Use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them. <ul style="list-style-type: none"> • Associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit. • 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. 	<p>relationships using a suitable sample.</p> <ul style="list-style-type: none"> • The children decide how to record and present evidence. They record observations e.g. using annotated photographs, videos, labelled diagrams, observational drawings, labelled scientific diagrams or writing. They record measurements e.g. using tables, tally charts, bar charts, line graphs and scatter graphs. They record classifications e.g. using tables, Venn diagrams, Carroll diagrams and classification keys. • Children present the same data in different ways in order to help with answering the question. • Children answer their own and others' questions based on observations they have made, measurements they have taken or information they have gained from secondary sources. When doing this, they discuss whether other evidence e.g. from other groups, secondary sources and their scientific understanding, supports or refutes their answer. • They talk about how their scientific ideas change due to new evidence that they have gathered. • They learn and discuss how new

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<ul style="list-style-type: none"> • Can give examples of animals in the five vertebrate groups and some of the invertebrate groups • Can give the key characteristics of the five vertebrate groups and some invertebrate groups • Can compare the characteristics of animals in different groups • Can give examples of flowering and non-flowering plants • Can give examples of different types of micro-organisms, and their uses, and how to control • Can explain the process of evolution • Can give examples of how plants and animals are suited to an environment • Can give examples of how an animal or plant has evolved over time e.g. penguin, peppered moth • Give examples of living things that lived millions of years ago and the fossil evidence we have to support this • Can give examples of fossil evidence that can be used to support the theory of evolution 	<ul style="list-style-type: none"> • Can name equipment used for filtering and sieving • Can use knowledge of liquids, gases and solids to suggest how materials can be recovered from solutions or mixtures by evaporation, filtering or sieving • Can describe some simple reversible and non-reversible Key vocabulary changes to materials, giving examples 	<ul style="list-style-type: none"> • Use recognised symbols when representing a simple circuit in a diagram. Know how to... • Can describe, with diagrams or models as appropriate, how light travels in straight lines either from sources or reflected from other objects into our eyes • Can describe, with diagrams or models as appropriate, how light travels in straight lines past translucent or opaque objects to form a shadow of the same shape, and how these can be altered • Can make electric circuits and demonstrate how variation in the working of particular components, such as the brightness of bulbs, can be changed by increasing or decreasing the number of cells or using cells of different voltages • Can draw circuit diagrams of a range of simple series circuits using recognised symbols 	<p>discoveries change scientific understanding.</p> <ul style="list-style-type: none"> • In their conclusions, children: identify causal relationships and patterns in the natural world from their evidence; identify results that do not fit the overall pattern; and explain their findings using their subject knowledge. • They evaluate, for example, the choice of method used, the control of variables, the precision and accuracy of measurements and the credibility of secondary sources used. • They identify any limitations that reduce the trust they have in their data. • Children use the scientific knowledge gained from enquiry work to make predictions they can investigate using comparative and fair tests. • They communicate their findings to an audience using relevant scientific language and illustrations.
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JBMS Science Concept Progression [based on PLAN / NC]

7	<p>Know that...</p> <ul style="list-style-type: none"> - Living things are composed of cells, how cells build up to form more complex structures, and what parts plants and animal cells have. - How humans reproduce sexually, in terms of the processes of adolescence, fertilisation, gestation and birth - How living things reproduce asexually and the benefits and drawbacks of this strategy - The role of the major food nutrients, and the processes involved in digestion including enzyme action, microbial role and adaptations for absorption - The structure of the respiratory, digestive, reproductive and skeleton-muscular systems - Factors affecting healthy styles such as asthma, and drugs such as alcohol and smoking <p>Know how to...</p> <ul style="list-style-type: none"> - Use microscopes to examine specimens, be able to create slides of their own. 	<p>Know that...</p> <ul style="list-style-type: none"> - All materials are composed of particles, and how those particles affect processes such as state change, dissolving, diffusion and gas pressure - The purest chemicals are called elements and composed of a single type of atom, and how these combine to form compounds and mixtures - The basic structure of the periodic table is arranged by atom size and similar properties - Chemical reactions involve a change in atom arrangement and can be expressed in word and symbol equations - Earth has a layered structure - How igneous, metamorphic and sedimentary rocks form <p>Know how to...</p> <ul style="list-style-type: none"> - Use melting and boiling point data, and interpret heating curves 	<p>Know that...</p> <ul style="list-style-type: none"> - Forces affect the movement and shape of objects, in terms of types of forces, balance of forces and key forces - Speed is calculated by dividing distance by time taken - The main types of energy and how they get transferred from one type to another - The properties of light and sound waves; how light reflects and refracts, and how we see when light enters our eye - How the universe is structure - How electricity can be generated using renewable and non-renewable methods - How the matter model can be used to explain temperature, energy transfer and expansion <p>Know how to...</p> <ul style="list-style-type: none"> - Draw accurate force diagrams and explain how to control friction and other resistance forces - Calculate speed with the correct units, and draw and interpret Distance/ Time graphs 	<p>Through the content across all three major disciplines over KS3 [including Y9], pupils should be taught to:</p> <p><u>Scientific attitudes</u></p> <ul style="list-style-type: none"> - 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. <p><u>Experimental skills and investigations</u></p> <ul style="list-style-type: none"> - 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
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JBMS Science Concept Progression [based on PLAN / NC]

	<ul style="list-style-type: none"> - Extract genetic material from organic material - Explain the role of lifestyle choices during pregnancy - Explain the role of a balanced diet and the effect of diet imbalance - Explain what constitutes a healthy lifestyle - Explain reproductive issues such as fertility treatment and contraception 	<ul style="list-style-type: none"> - Separate different solutions using techniques like chromatography, distillation, filtering and evaporation - Use particles to explain physical changes like change of state and dissolving - Spot chemical reactions and express them with word and symbol equations - Describe the difference between rock types and their formation 	<ul style="list-style-type: none"> - Draw accurate diagrams to demonstrate how we see, and how reflection and refraction occur. - Explain the benefits and drawbacks on renewable and no-renewable electricity generation methods Use the particle model to explain phenomena like sound transmission, heat transfer and density 	<ul style="list-style-type: none"> - 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.
8	<p>Know that...</p> <ul style="list-style-type: none"> - Living things vary, including the types and causes of variation - The importance of biodiversity and the cause of extinction, and how this can be prevented - Energy is produced in living things in the processes of aerobic and anaerobic respiration - Plants produce their own food in the process of photosynthesis, and have adaptation in leaves and roots to facilitate this 	<p>Know that...</p> <ul style="list-style-type: none"> - What occurs in combustion, exo- and endothermic, and thermal decomposition reactions - What acids and alkalis are, how to test for them, and how they interact - Processes like such weathering and transportation affect rocks as part of the rock cycle - Patterns of reactivity exist on the periodic table, such as in noble gases, halogens and alkali metals 	<p>Know that...</p> <ul style="list-style-type: none"> - Mass and weight are different, and how they can be affected - Hooke's Law explains the extension of elastic materials - Depth affects water and atmospheric pressure - Circuit components have symbols to allow for accurate and simple drawing of circuits - The two main types of circuit: series and parallel, and their differences - The season on Earth are caused by the axial tilt 	<ul style="list-style-type: none"> - apply mathematical concepts and calculate results - present observations and data using appropriate <p><u>Analysis and evaluation</u></p>

JBMS Science Concept Progression [based on PLAN / NC]

	<ul style="list-style-type: none"> - How plants reproduce; flower structure, fertilisation [including importance of pollinators], seed dispersal - Food webs are a combination of food chains, and can be represented by ecological pyramids <p>Know how to...</p> <ul style="list-style-type: none"> - Explain the processes of genetic inheritance, natural selection and evolution - Examine how variations can be linked - Investigate the energy content of different foods - Show that light is necessary for photosynthesis - Explain the interdependence of living thing in habitats, in terms of population size, toxin accumulation and prey-predator interaction 	<ul style="list-style-type: none"> - The properties of metals and non-metals; how metals have differing reactivity with water, acids and in displacement reaction <p>Know how to...</p> <ul style="list-style-type: none"> - Describe combustion, exo- and endothermic, neutralisation, metal reactions, displacement reactions, and thermal decomposition reactions in terms of word and symbol equations - Investigate which is the most effective indigestion remedy and rock types - Predict metal displacement reactions using the reactivity series - Explain the causes and impacts of climate change 	<ul style="list-style-type: none"> - Different types of energy waves exist [longitudinal, transverse, ultrasound etc.] and have different properties - Which materials are magnetic, and how magnets and electromagnets are created, and have a magnetic field around them - Static electricity involves a transfer of electrons in insulating materials <p>Know how to...</p> <ul style="list-style-type: none"> - Calculate Pressure, Density, Moments of forces using the correct units - Draw accurate circuit diagrams - Explain how current and voltage differ in series and parallel circuits - Model circuit components, current and voltage using abstract examples - Interpret sound wave traces - Explain the role of gravity in the structure of the universe - Explain how human hearing work and can be protected, and how different living things have different auditory ranges 	<p>methods, including tables and graphs</p> <ul style="list-style-type: none"> - 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. <p><u>Measurement</u></p> <ul style="list-style-type: none"> - 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.
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<i>Future Knowledge and Skills (Y9 to GCSE)</i>				