**Science**

**Intent:**

Science at Bocking is a practical subject that stimulates curiosity, discussion and investigation. It develops children’s independent thinking skills and encourages them to develop a resilient approach to problems and develops children’s independent thinking skills and encourages them to develop a resilient approach to problems and develops an open-minded approach to the views of others. Children will develop their knowledge of key scientific principles and processes and how these relate to the real world. Our vision is to inspire enquiring minds for the future.

**Aims:**

In teaching science there are a number of key skills and attributes that we will develop. All pupils will:

* Develop scientific knowledge and conceptual understanding of the scientific processes and key concepts of Science
* Develop an understanding of scientific processes through enquiry and investigation;
* Observe, measuring and undertake a variety of tests;
* Read and using scientific vocabulary precisely;
* Analyse functions, relationships and interactions;
* Answer science questions using different types of scientific enquiry, testing and developing ideas;
* Understanding the uses and implications of science, today and for the future;
* Develop an enjoyment and fascination with science.

**Implementation:**

* Science is mostly taught in topics although not every topic has science explicitly linked. Teachers have freedom to place their science units anywhere over the school year.
* When placing units in year groups, science units are matched to the maturity, conceptual and mathematical understanding of the pupils. For instance, the complex area of energy is in Y6 by which point children have a full understanding of electricity.
* The curriculum is split into the aspects of knowledge, skills and attitudes for scientific enquiry. Knowledge is split into discrete units exposing children to the various fields of science whereas skills and attitudes are taught and developed throughout the year.

**Skills Progression**

Statements in bold represent National Curriculum statements and summarise the scientific skill progression.

**Asking Questioning**

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| **Year 1 & 2** | **Year 3 & 4** | **Year 5 & 6** |
| **Asking simple questions and recognising that they can be answered in different ways** | **Asking relevant questions and using different types of scientific enquiries to answer them** | **Planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary** |
| Develop the ability to ask questions (such as what something is, how things are similar and different, the ways things work, which alternative is better, how things change and how they happen) and where appropriate, they answer these questions. | Can consider their prior knowledge when asking questions. Where appropriate, they answer these questions. | Can independently ask scientific questions stimulated by a scientific experience or involve asking further questions based on their developed understanding following an enquiry. |
| Can answer questions developed with the teacher often through a scenario. | Can independently use a range of question stems. | Decide for themselves how to gather evidence to answer a scientific question. |
| Recognise that there are different ways in which questions can be answered. | Can decide for themselves how to gather evidence to answer the question when given a range of resources. | Can choose a type of enquiry to carry out and justify their choice. |
|  | Can recognise when secondary sources can be used to answer questions that cannot be answered through practical work. | Can recognise how secondary sources can be used to answer questions that cannot be answered through practical work. |

**Making Observations and Taking Measurements**

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| **Year 1 & 2** | **Year 3 & 4** | **Year 5 & 6** |
| **Observing closely, using simple equipment** | **Making systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment, including thermometers and data loggers** | **Taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate** |
| Can make careful observations to support identification, comparison and noticing change. | Can make systematic and careful observations. | Can select measuring equipment to give the most precise results e.g. ruler, tape measure or trundle wheel, force meter with a suitable scale. |
| Can use appropriate senses, aided by equipment such as magnifying glasses or digital microscopes, to make their observations. | Can use a range of equipment for measuring length, time, temperature and capacity. They use standard units for their measurements. | Can 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). |
| Can begin to take measurements, initially by comparisons, then using non-standard units. |  |  |

**Practical Enquiry**

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| **Year 1 & 2** | **Year 3 & 4** | **Year 5 & 6** |
| **Performing simple tests** | **Setting up simple practical enquiries, comparative and fair tests** | **Planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary** |
| Can use practical resources provided to gather evidence to answer questions generated by themselves or the teacher. | Can select from a range of practical resources to gather evidence to answer questions generated by themselves or the teacher. | Can select from a range of practical resources to gather evidence to answer their questions. |
| Can carry out: tests to classify; comparative tests; pattern seeking enquiries; and make observations over time. | Can follow a plan to carry out observations and tests to classify; comparative and simple fair tests; observations over time; and pattern seeking. | Can carry out fair tests, recognising and controlling variables. |
| Can use observations and testing to compare objects, materials and living things. |  | Can decide what observations or measurements to make over time and for how long. |
| Can sort and group things, identifying their own criteria for sorting. |  | Can look for patterns and relationships using a suitable sample. |
| Can use simple secondary sources (such as identification sheets) to name things. |  |  |
| Can describe the characteristics they used to identify a thing. |  |  |

**Recording and Presenting Evidence**

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| **Year 1 & 2** | **Year 3 & 4** | **Year 5 & 6** |
| **Gathering and recording data to help in answering questions** | **Gathering, recording, classifying and presenting data in a variety of ways to help in answering questions** | **Recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs** |
| Can record observations e.g. using photographs, videos, drawings, labelled diagrams or in writing. | **Recording findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables** | Can decide how to record and present evidence. |
| Can record their measurements e.g. using prepared tables, pictograms, tally charts and block graphs. | With support, can decide as a group how to record and present evidence. | Can record observations e.g. using annotated photographs, videos, labelled diagrams, observational drawings, labelled scientific diagrams or writing |
| Can classify using simple prepared tables and sorting rings. | Can record observations e.g. using photographs, videos, pictures, labelled diagrams or writing. | Can record measurements e.g. using tables, tally charts, bar charts, line graphs and scatter graphs |
|  | Can record their measurements e.g. using tables, tally charts and bar charts (given templates, if required, to which they can add headings) | Can record classifications e.g. using tables, Venn diagrams, Carroll diagrams and classification keys. |
|  | Can record classifications e.g. using tables, Venn diagrams, Carroll diagrams. | Can present the same data in different ways in order to help with answering the question. |

**Answering Questions and Concluding**

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| **Year 1 & 2** | **Year 3 & 4** | **Year 5 & 6** |
| **Using their observations and ideas to suggest answers to questions.** | **Using straightforward scientific evidence to answer questions or to support their findings.** | **Identifying scientific evidence that has been used to support or refute ideas or arguments.** |
| Can use their experiences of the world around them to suggest appropriate answers to questions. | Can answer their own and others’ questions based on observations they have made, measurements they have taken or information they have gained from secondary sources. | Can answer their own and others’ questions based on observations they have made, measurements they have taken or information they have gained from secondary sources. |
| With support, can answer questions relating to their evidence e.g. observations they have made, measurements they have taken or information they have gained from secondary sources. | Can provide answers that are consistent with the evidence | Can discuss how their scientific ideas have changed due to new evidence that they have gathered. |
|  |  | Can discuss how new discoveries change scientific understanding. |
|  |  | Can discuss whether other evidence e.g. from other groups, secondary sources and their scientific understanding, supports or refutes their answer. |
| **Using their observations and ideas to suggest answers to questions** | **Identifying differences, similarities or changes related to simple scientific ideas and processes** | **Reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and degree of trust in results, in oral and written forms such as displays and other presentations** |
| Can recognise ‘biggest and smallest’, ‘best and worst’ etc. from their data. | Can interpret their data to generate simple comparative statements based on their evidence. | In their conclusions, can identify causal relationships and patterns in the natural world from their evidence. |
|  | Can begin to identify naturally occurring patterns and causal relationships. | Can identify results that do not fit the overall pattern and explain findings using their subject knowledge. |
|  | Can draw conclusions based on their evidence and current subject knowledge. |  |

**Evaluating and Raising Further Questions and Predictions**

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| **Year 1 & 2** | **Year 3 & 4** | **Year 5 & 6** |
| Can use his/her ideas of the world to say what they think will happen. | **Using results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions** | **Reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and degree of trust in results, in oral and written forms such as displays and other presentations** |
| Can talk about their ideas and using their everyday experience they make simple predictions. | Can identify ways in which they adapted their method as they progressed or how they would do it differently if they repeated the enquiry. | Can 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. |
| Can refer back to the prediction, discuss accuracy and begin to reason why | Can use their evidence to suggest values for different items tested using the same method e.g. the distance travelled by a car on an additional surface. | Can identify any limitations that reduce the trust they have in their data. |
|  | Following a scientific experience, can ask further questions which can be answered by extending the same enquiry. | **Using test results to make predictions to set up further comparative and fair tests** |
|  |  | Can use the scientific knowledge gained from enquiry work to make predictions they can investigate using comparative and fair tests. |

**Communicating Their Findings**

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| **Year 1 & 2** | **Year 3 & 4** | **Year 5 & 6** |
| Communicate his/her ideas. What he/she did and what he/she found out in a variety of ways. | **Reporting on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions.** | **Reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and degree of trust in results, in oral and written forms such as displays and other presentations.** |
|  | Can communicate their findings to an audience both orally and in writing, using appropriate scientific vocabulary. | Can communicate their findings to an audience using relevant scientific language and illustrations. |

**Attitudes**

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| **Scientific Attitude** | **Year 1 & 2** | **Year 3 & 4** | **Year 5 & 6** |
| **Co-operation** | Able to take turns  Able to listen to others  Recognise as a group they can achieve more  Able to offer an opinion | Listens and respects the ideas of others  Draw upon the strengths of others within a team  Able to offer an opinion and justify | Using own and others ideas to solve problems  Work as part of a team, deciding upon roles  Have a confidence in themselves and trust in others |
| **Open Mindedness** | Able to listen to other people’s views | Be empathetic to others even when you disagree with them.  Being open and receptive to all ideas and arguments | Being prepared to investigate others ideas  Being able to change one’s own beliefs based on evidence  Be able to reserve judgments till all claims and evidence is heard. |
| **Responsibility** | Be able to give a truthful report of observations  Being fair to others | Consider results rather than being swayed by opinions  Being fair to others you are co-operating with | Have a respect for evidence that contrary opinion  To know that sidestepping responsibility made lead to delayed results and conclusions  Know that scientists must conduct research ethically |
| **Perseverance** | Have to patience to complete a science investigation to its conclusion  Able to encourage others  Able to follow a given plan | Be able to continue a project despite obstacles and failures  Able to stick to a formulated plan  Begin to take risks | Will replicate experiments to obtain accurate results.  Able to follow a plan and adjust when presented with an obstacle.  Learn from mistakes and develop new ideas from them |
| **Self-Discipline** | Have patience to wait for results  Able to focus on the task given | Able to suspend judgement till conclusions can be drawn  Able to examine claims (their own and those of others) to be certain that there is sufficient evidence to back them up.  Avoid temptation to change results to match original prediction | Able to make meticulous attention to detail and accuracy.  Remain objective when performing scientific inquiry and research  Being able to independently conduct research and investigations |
| **Curiosity** | Looking at equipment and investigating  Able to investigate problems and phenomena  Be curious about the world around them | Shows interest and pays particular attention to objects or events  Begin to question the validity of results  Showing interest in scientific events and question how they relate to their lives | Leading an enquiry in a new direction following on from their results  Able to question validity of results  Take satisfaction in being able to see what science does to resolve mysteries |
| **Creativity** | Suggest ways to solve a problem  Able to generate a range of ideas for a given problem | Create own ideas for an investigation  Able to adapt ideas to overcome failure | Create own ideas for an investigation and justify why it is a valid way to investigate  Able to determine which smaller questions are likely to yield results, imagine possible answers to questions, and devise ways to test those answers |

**Unit Planner**

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| Year | Units |
| 1 | Seasonal Change running throughout the year  Plants  Seasonal Change Weather  Materials  Animals including Humans |
| 2 | Everyday materials  Living things and their Habitats  Animals including Humans  Plants |
| 3 | Rocks and Soils  Forces including Magnets  Light  Plants  Animals including Humans |
| 4 | Materials- States of Matter  Electricity  Animals including Humans  Sound  Living things and their Habitats |
| 5 | Space  Materials - Change of State  Forces  Living things and their Habitats  Animals including humans |
| 6 | Evolution and Inheritance  Living things and their Habitats  Light  Electricity  Animals including Humans |

**Knowledge Tables**

**Animals including Humans**

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| **Year 1** | **Year 2** | **Year 3** | **Year 4** | **Year 5** | **Year 6** |
| Identify and name a variety of common animals including fish, amphibians, reptiles, birds and mammals  Identify, name, draw and label the basic parts of the human body and say which part of the body is associated with each sense. | Notice that animals, including humans, have offspring which grow into adults.  Find out about and describe the basic needs of animals, including humans, for survival (water, food and air).  Describe the importance for humans of exercise, eating the right amounts of different types of food, and hygiene. | 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. | Describe the simple functions of the basic parts of the digestive system in humans.  Identify the different types of teeth in humans and their simple functions  Construct and interpret a variety of food chains, identifying producers, predators and prey. | Describe the changes as humans develop to old age. | 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 and water are transported within animals, including humans. |

**Evolution and Inheritance**

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| **Year 6** |
| 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. |

**Living things and their habitats**

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| **Year 2** | **Year 4** | **Year 5** | **Year 6** |
| Explore and compare the differences between things that are living, dead, and things that have never been alive.  Identify that most living things live in habitats to which they are suited and describe how different habitats provide for the basic needs of different kinds of animals and plants, and how they depend on each other.  Identify and name a variety of plants and animals in their habitats, including microhabitats.  Describe how animals obtain their food from plants and other animals, using the idea of a simple food chain, and identify and name different sources of food. | Recognise that living things can be grouped in a variety of ways.  Explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment.  Recognise that environments can change and that this can sometimes pose dangers to living things. | 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 how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including microorganisms, plants and animals.  Give reasons for classifying plants and animals based on specific characteristics. |

**Plants**

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| **Year 1** | **Year 2** | **Year 3** |
| |  | | --- | | Identify and name a variety of common wild and garden plants, including deciduous and evergreen trees.  Identify and describe the basic structure of a variety of common flowering plants, including trees. | | |  | | --- | | Observe and describe how seeds and bulbs grow into mature plants.  Find out and describe how plants need water, light and a suitable temperature to grow and stay healthy. | | 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. |

**Seasonal Change**

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| **Year 1** |
| Observe changes across the four seasons.  Observe and describe weather associated with the seasons and how day length varies. |

**Materials**

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| **Year 1** | **Year 2** | **Year 4** | **Year 5** |
| Identify and name a variety of common wild and garden plants including deciduous and evergreen trees.  Identify and describe the basic structure of a variety of common flowering plants, including trees. | Identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses.  Find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching. | 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. | Compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets.  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.  Give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic.  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. |

**Rocks and Soils**

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| **Year 3** |
| 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. |

**Earth and Space**

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| **Year 5** |
| 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. |

**Electricity**

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| **Year 4** | **Year 6** |
| Identify common appliances that run on electricity.  Construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers.  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.  Recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit.  Recognise some common conductors and insulators, and associate metals with being good conductors. | 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.  Use recognised symbols when representing a simple circuit in a diagram. |

**Forces and Magnets**

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| **Year 3** | **Year 5** |
| Compare how things move on different surfaces.  Notice that some forces need contact between two 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 two poles.  Predict whether two magnets will attract or repel each other, depending on which poles are facing. | 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, allow a smaller force to have a greater effect |

**Light**

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| **Year 3** | **Year 6** |
| 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 | 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. |

**Sound**

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| **Year 4** |
| 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. |