**Essential Characteristics of scientists:**

* The ability to think independently and raise questions about working scientifically and the knowledge and skills that it brings.
* Confidence and competence in the full range of practical skills, taking the initiative in, for example, planning and carrying out scientific investigations.
* Excellent scientific knowledge and understanding which is demonstrated in written and verbal explanations, solving challenging problems and reporting scientific findings.
* High levels of originality, imagination or innovation in the application of skills.
* The ability to undertake practical work in a variety of contexts, including fieldwork.
* A passion for science and its application in past, present and future technologies.

|  |  |
| --- | --- |
| **Breadth of Study: Key Stage 2**  **Working scientifically**   * Documented in the progress section for each year group.   **Plants**   * Look at the function of flowering plants, requirements of growth, water transportation in plants, life cycles and seed dispersal.   **Evolution and inheritance**   * Resemblance in offspring. * Differences in offspring. * Changes in animals over time. * Adaptation in environments. * Adaptation and evolution. * Changes to the human skeleton over time.   **Animals and humans**   * Nutrition, transportation of water and nutrients in the body and the muscle and skeleton system of humans and animals. * The digestive system in humans. * Teeth. * Human circulatory system.   **All living things**   * Identify and name plants and animals. * Classification keys. * The life cycle of animals and plants. * Classification of plants, animals and micro organisms. * Reproduction in plants and animals and human growth and changes. * The effect of diet, exercise and drugs. | **Rocks and fossils**   * Compare and group rocks and describe the formation of fossils.   **States of matter**   * Solids, liquids, gases, changes of state, evaporation, condensation and the water cycle.   **Materials**   * Properties of materials using various tests. * Solubility and recovering dissolved substances. * Separate mixtures. * Examine changes to materials that create new materials that are usually not reversible.   **Light**   * Sources, seeing, reflections and shadows. * Explain how light appears to travel in straight lines and how this affects seeing and shadows.   **Sound**   * Sources, vibration, volume and pitch.   **Electricity**   * Appliances, circuits, lamps, switches, insulators and conductors. * Circuits, the effect of voltage in cells and the resistance and conductivity of materials.   **Forces and magnets**   * Contact and distant forces, attraction and repulsion, comparing and group materials. * Poles, attraction and repulsion. * The effect of gravity and drag forces. * Transference of forces in gears, pulleys, levers and springs.   **Earth and space**   * Movement of the Earth and the Moon. * Explain day and night. |

**Working Scientifically** (taught alongside Curriculum Strands)

| **Strand** | **Year 3** | **Year 4** | **Year 5** | **Year 6** |
| --- | --- | --- | --- | --- |
| **Asking questions and recognising that they can be answered in different ways.** | |  | | --- | | 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. | | Given a wide range of resources the children decide for themselves how to gather evidence to answer a scientific question.  They choose a type of enquiry to carry out and justify their choice.  They confidently use secondary sources to answer questions that cannot be answered through practical work.   |  | | --- | |  | | |  | | --- | | 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. | |
| **Making observations and taking measurements** | The children make systematic and careful observations. | The children use a range of equipment for measuring length, time, temperature and capacity when making observations.  They use standard units for their measurements. | 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, children make decisions e.g. whether they need to: take repeat observational readings (fair testing); increase the sample size (pattern seeking); adjust the observation period and frequency (observing over time); check further secondary sources (researching) in order to get accurate data (closer to the true value). |
| **Engaging in practical enquiry to answer questions** | Children select from a range of practical resources to gather evidence to answer questions generated by themselves or the teacher.  They carry out simple fair tests. | Children use questions either they or the teacher has generated to follow a plan and carry out observations and tests to classify.  They make comparative test (changing a qualitative variable) and simple fair test (changing a quantitative variable) as well as observations over time and pattern seeking. | 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. | Children decide what observations or measurements to make over time and for how long when carrying out comparative and fair tests in response to their own questions.  They look for patterns and relationships using a suitable sample. |
| **Recording and presenting evidence** | Children sometimes decide how to record and present evidence.  They record their observation e.g. using photographs, videos, pictures, labelled diagrams or writing. | Children record their measurements e.g. using tables, tally charts and bar charts (using given templates if required).  They record classifications e.g. using tables, Venn diagrams, Carroll diagrams.  Children are supported to present the same data in different ways in order to help with answering a question. | Children decide how to record and present evidence.  They record observations e.g. using annotated photos, videos, labelled diagrams, observational drawings, labelled scientific diagrams or writing.  They record measurements e.g. using tables, tally charts, bar charts independently and line graphs (using a template if required). | Children make well-informed decisions when recording and presenting evidence.  They record their observations and measurements using a range of annotated photos, videos, labelled diagrams, tally charts, bar charts, line graphs and scatter graphs.  They record classifications e.g. using tables, Venn diagrams, Carroll diagrams and classification keys and confidently present the same data in several different ways in order to answer a question. |
| **Answering questions and concluding** | Children answer their own and others’ questions based on observations they have made and measurements they have taken.  Children interpret their data to generate simple comparative statements based on their evidence. | Children answer their own and others’ questions based on observations they have made and measurements they have taken or information they have gained from secondary sources. The answers are consistent with the evidence.  When interpreting their data, children begin to identify naturally occurring patterns and causal relationships. | Children answer their own and others’ questions based on observations they have made and 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.  When interpreting their data, children begin to draw conclusions based on their evidence and current subject knowledge. | Children answer their own and others’ questions based on observations they have made and measurements they have taken or information they have gained from secondary sources.  When doing this, they talk about how their scientific ideas change due to new evidence that they have gathered.  They talk about how new discoveries change scientific understanding.  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. |
| **Evaluating, raising further questions and prediction and communicating findings** | Children identify ways in which they adapted their method as they progressed or how they would do it differently if they repeated the enquiry.  Children communicate their findings to an audience both orally and in writing, using appropriate scientific vocabulary. | Children 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.  Following a scientific experience, the children ask further questions which can be answered by extending the same enquiry.  Children choose the most useful approach to communicating their findings to an audience, using appropriate scientific vocabulary. | Children 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.  Children communicate their findings to an audience using a range of relevant language and illustrations. | When evaluating, children identify any limitations that reduce the trust they have in their data.  They use the scientific knowledge gained from enquiry work to make predictions they can investigate using further comparative and fair tests.  Children communicate their findings to an audience using a range of relevant language, illustrations and using different media. |

**Curriculum Strands** (note: some skills are repeated in order to cover that particular strand effectively)

| **Strand** | **Year 3** | **Year 4** | **Year 5** | **Year 6** |
| --- | --- | --- | --- | --- |
| **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. | | |  | | --- | | 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 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 micro-organisms, plants and animals.  Give reasons for classifying plants and animals based on specific characteristics. |
| **Living things and their habitats** | Explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal. | 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.  Construct and interpret a variety of food chains, identifying producers, predators and prey. | 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.  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. |
| **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. | 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.  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. | 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.  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. |
| **Evolution and inheritance** | Describe in simple terms how fossils are formed when things that have lived are trapped within rock.  Explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal. | Recognise that environments can change and that this can sometimes pose dangers to living things. | Describe the life process of reproduction in some plants and animals. | 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. |
| **Materials** | Skills taught through Rocks and Forces strand. | 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.  Recognise some common conductors and insulators, and associate metals with being good conductors. | 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. | Curriculum strand not taught in this year group. |
| **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. | Curriculum strand not taught in this year group. | Curriculum strand not taught in this year group. | Recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago. |
| **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. | Curriculum strand not taught in this year group. | 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. | 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. |
| **Forces** | 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. | Curriculum strand not taught in this year group. | 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. | Curriculum strand not taught in this year group. |
| **Sound** | Curriculum strand not taught in this year group. | 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. | Curriculum strand not taught in this year group. | Curriculum strand not taught in this year group. |
| **Electricity** | Curriculum strand not taught in this year group. | 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. | Curriculum strand not taught in this year group. | 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. |
| **Earth and space** | Curriculum strand not taught in this year group. | Curriculum strand not taught in this year group. | 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. | Curriculum strand not taught in this year group. |