

## Science

### Curriculum Principles

#### **By the end of their education, students at Dixons Manningham will:**

- Know the essential principles from biology, chemistry and physics that will provide a foundation for understanding and navigating the world.
- Understand the five processes of scientific enquiry and choose the best type of investigation to answer a particular question. Students will understand how science can be used to explain observations and make predictions about natural phenomena.

#### **In order to achieve a true understanding of science, topics have been sequenced based on the following rationale:**

- Scientific knowledge is broadly hierarchical in nature – students must have a secure understanding of each key block of knowledge before progressing onto the next stage. Therefore, to support this, topics have been meticulously planned and ordered to ensure that students are always building on and deepening their previous learning.
- All students are expected to work scientifically in every key stage, and undertake an investigation in each science topic. In EYFS the students begin to make observations and discuss changes they have noticed, as well as sorting and classifying in a variety of areas. KS1 students are introduced to the full range of scientific enquiries and given opportunities to ask and answer simple questions. This range of skills is then consolidated throughout KS2.

#### **The science curriculum will address social disadvantage by addressing gaps in students' knowledge and skills:**

- We are careful not to assume any prior general knowledge or cultural capital – instead we aim to promote knowledge through explicit teaching and the recall of knowledge through regular low stakes testing.
- All students are taught the same rigorous curriculum. All teachers have the same high expectations of all students – we do not narrow or dilute the curriculum, although staff do understand the need to scaffold or model for particular students

#### **We fully believe science can contribute to the personal development of students at DMN:**

- The social development of our students is nurtured through the practice of effective teamwork and communication skills when working in small groups for scientific investigations as they learn to effectively collaborate with others who may be from different backgrounds or from outside of their friendship circle.
- As children carry out scientific enquiry they develop a host of skills and competencies, knowledge and understanding. Scientific enquiry increases children's capacity to problem solve. Rich opportunities are provided where children explore their own ideas, develop and deepen conceptual understanding.
- Science promotes independent thinking and reasoning alongside a host of qualities, including resilience, determination and confidence.
- Science allows students to develop effective communication skills. It broadens and deepens their vocabulary as both technical and scientific vocabulary is learned, practised and used. Children are then able to communicate this evidence in a variety of ways to a range of different audiences.
- When teaching topics such as the theory of evolution, this provides a chance to develop students' cultural awareness as we can discuss viewpoints of these theories from different religions and cultures.
- Science lessons also provide cross-curricular opportunities to understand and improve physical and mental health. When teaching about the circulatory system, students are able to explore the benefits of regular exercise and the implications of heart disease. When teaching about the digestive system, students are taught about the importance of a balanced diet and how to interpret nutritional information on food labels.



## **Opportunities are built in to make links to the world of work to enhance the careers, advice and guidance that students are exposed to:**

- Key individuals are highlighted in every topic. This ensures that students are able to study a range of positive role models from a variety of careers. These are designed to challenge gender and race bias.
- On educational enhancement visits, attention is drawn to the particular roles of people encountered by the students.
- Visitors are invited into school to speak to KS2 students about their careers and the path to successfully achieving goals.
- A true love of science involves learning about various cultural domains. We teach beyond the specification requirements, but do ensure students are well prepared to be successful in the transition to secondary school:
- Opportunities to explore the history and philosophy of science are embedded into the curriculum. These key individuals are highlighted to draw students' attention, usually through reciprocal reading. For example, in KS1 students investigate the work of David Attenborough, and in KS2, Mary Anning, Harry Brearley and Jane Goodall.
- Students that wish to develop their science knowledge beyond the curriculum can select to attend an after school Science Club. There is also a growing collection of science based non-fiction books in the library which are very popular with our students, as well as science themed magazines
- Each topic has a book box for classrooms which contains non-fiction texts as well as linked novels and picture books to further develop knowledge and enthusiasm.
- Science experiment bags are available as part of the playground equipment which allows students to engage in scientific enquires they have designed outside of learning time.

### **Further information:**

- Medium term plans
- Knowledge Organisers



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## Curriculum overview

	Cycle 1	Cycle 2	Cycle 3
Reception	<p><b>Baking Bread: links to geography, English</b> Observe and discuss what happens to materials during bread making process. <i>Vocabulary: wheat, flour, sow, harvest, grind, knead, bake</i> <b>Investigation: How does The Little Red Hen make her bread?</b></p> <p><b>The Seasons: Autumn - links to Geography and Art</b> Develop an understanding of growth, decay and changes over time. Talk about some of the things they have observed. <i>Vocabulary: trees, leaves, autumn, winter, orange, yellow, red, brown, conker, acorn, pine cone</i> <b>Investigation: Where have all the green leaves gone?</b></p>	<p><b>Freezing and melting: links to geography</b> Look closely at similarities, differences, patterns and change whilst exploring what happens in winter. Talk about features of their own environment and how environments might vary from one another: hot and cold places. <i>Vocabulary: freeze, melt, solid, liquid, hot, cold</i> <b>Investigation: How can we free penguin from the ice?</b></p> <p><b>Healthy Me: links to PD</b> Show some understanding that good practices with regard to exercise, eating, sleeping and hygiene can contribute to good health. <i>Vocabulary: fit, healthy, exercise, well, sick, active</i> <b>Investigation: How do we keep fit and healthy?</b></p>	<p><b>Plants and animals</b> Observe animals and plants and explain why some things occur, and talk about changes. <i>Vocabulary: sow, grow, seed, fruit, stem, flower, bud, egg, chrysalis, caterpillar, butterfly, hatch, chick</i> <b>Investigation: Where do plants come from? Who lives at the bottom of the garden?</b></p> <p><b>The Seasons: Spring/Summer - links to Geography, Art, Maths and PD</b> Develop an understanding of growth, decay and changes over time. Talk about similarities and differences in relation to living things. <i>Vocabulary: sun, shade, shadow, cloud, light, dark, long, tall, short, wide, small, big, in front, behind</i> <b>Investigation: Where has my shadow gone?</b></p>
YEAR 1	<p><b>Everyday materials: links to History</b> Identify, name and sort everyday materials; describing properties of everyday materials. <i>Vocabulary: waterproof, not waterproof; opaque, transparent; stretchy, not stretchy; flexible; strength</i> <b>Investigation: Controlled comparative and fair testing.</b> <b>E.g. Which material is the most waterproof? Which material makes the best toys for 5 year olds?</b></p> <p><b>Seasons &amp; Night and Day; links to Geography</b> Identify seasonal and daily weather patterns in the United Kingdom. Identify the location of hot and cold areas of the world in relation to the Equator and the North and South Poles <i>Vocabulary; equator, forecast, meteorologist, polar regions, cirrus, strata, cumulus</i> <b>Investigation: Observation over time</b> <b>E.g. How much rain falls in December?</b></p>	<p><b>Animals: links to Geography</b> Grouping animals; compare the structure of common animals; carnivores; herbivores and omnivores. Identify features of mammals, amphibians, birds, fish and reptiles. Identify the parts of the human body and link to the 5 senses. <i>Vocabulary: Skeleton, gills, vertebrate, invertebrate, carnivore, herbivore, omnivore</i> <b>Investigation: Pattern Seeking/ Identifying and Classifying</b> <b>E.g. What animals live in the school grounds? What parts of the human body are the same length?</b></p> <p>Key Figure: David Attenborough</p>	<p><b>Our local area plants: links to Geography &amp; Art</b> Naming common plants including flowers and trees; gardening; identifying fruits and vegetables; parts of the plant. Understanding the properties of plants and what they need to grow. Identify which foods come from other countries and why. <i>Vocabulary: deciduous, evergreen, seed, root, stem, environment</i> <b>Investigation: Comparative and fair testing</b> <b>E.g. What is the best way to grow runner beans?</b></p> <p>Key Figure: Andy Goldsworthy</p>
YEAR 2	<p><b>Seasides: links to History and Geography</b>  (Habitats) identify suitable habitats that provide for different living things basic needs; know a variety of local plants and animals including microhabitats  <i>Vocab: cliff, beach, food, water, shelter</i></p>	<p><b>Healthy Me/ Habitats and Living Things: links to DT &amp; Art</b>  Babies; growing and changing; basic needs; healthy eating; exercise; keeping clean. Balanced diet and effect of exercise on the body; differences between living, dead and never been alive; describe simple food chains and identify different sources of food.</p>	<p><b>Animals: links to History and Geography Geography (Commotion in the Ocean)</b>  Habitats) identify suitable habitats that provide for different living things basic needs; know a variety of local plants and animals including microhabitats;  <i>Investigation: Research</i></p>



	<p><i>Investigation: Identifying and Classifying</i></p> <p><b>E.g. What type of animals live at the coast?</b></p> <p><b>Key Figure: Billy Butlin</b></p> <p><b>Materials: links to History (Great Fire Of London)</b> Understand how and why certain materials were used historically in building houses and the effect that fire and water had on the buildings.</p> <p><i>Vocabulary: pitch, combustible, firebreak, natural, man-made</i></p> <p><b>Investigation: Research:</b></p> <p><b>E.g. Why did the fire of London spread so quickly?</b></p> <p><b>Key Figure: Samuel Pepys</b></p>	<p>Vocabulary; nutrition, respiration, excretion, fatigue, balanced, pulse, predator, microhabitat, prey, depend (independence, dependant)</p> <p><b>Investigation: Observing over time</b></p> <p><b>E.g. How does our skin change as we get older?</b></p> <p><b>Key Figure: Elizabeth Blackwell</b></p>	<p><i>E.g. Will my fish survive in the woods?</i></p> <p><i>Key Figure: David Attenborough, Rachel Carson, Eugenie Clark</i></p> <p><b>Floating and Sinking: links to DT</b> Identify and compare suitability of everyday materials for particular uses; find out how the shapes of solid objects made from some materials can be changed; objects float or sink depending on their density</p> <p><i>Vocabulary: float, sink, density, heavy, light</i></p> <p><b>Investigation: Fair testing</b></p> <p><b>Key Figure: Grace Darling</b></p>
YEAR 3	<p><b>Rocks: links to History</b> Types of rocks; grouping rocks; fossils and types of fossils; soil formation. Understand how fossils are formed.</p> <p><i>Vocabulary: metamorphic, igneous, sedimentary, permeable, impermeable, absorbant</i></p> <p><b>Investigation: Comparative and Fair Testing</b></p> <p><b>E.g. which soil is the most permeable?</b> Key figure: Mary Anning</p> <p><b>Light &amp; Shadow: links to DT</b> A light source produces light and can be natural or man-made, light always travels in straight line. Shadows are formed when the light source is blocked by an opaque figure and can change in size. Time zones are based on meridian lines.</p> <p><i>Vocabulary: man-made, natural, opaque, translucent, meridian line</i></p> <p><b>Investigations: Pattern Seeking</b></p> <p><b>E.g. Does the distance between an object and a light source affect the length of the shadow? Can light be reflected around corners?</b> Key figure: Ibn Al-Haytham</p>	<p><b>Animals (including humans) &amp; Diet</b> Animals, including humans, need the right types of nutrition; understand differences in teeth and how digestion occurs. Name the parts and functions of the skeleton and muscles.</p> <p><i>Vocabulary: contract, relax, posture, endoskeleton, exoskeleton, protein</i></p> <p><b>Investigation: Pattern Seeking</b></p> <p><b>E.g. Are crisps which have a high fat content saltier?</b> Key Figure: Marie Curie, Clayton Donaldson</p> <p><b>Plants &amp; Rainforests: links to Geography</b> Identify and describe the function of different parts of flowering plants. Understand the way in which water and nutrients are transported within plants. Explore the part that flowers play in the life cycle of flowering plants; pollination, seed formation, seed dispersal.</p> <p><i>Vocabulary: nutrients, reproduce, pollen, fertilisation, transpiration</i></p> <p><b>Investigation: Observation over time</b></p> <p><b>E.g. How is water transported in plants?</b> Key Figure: Jane Goodall</p>	<p><b>Forces and Magnets : links to DT</b> What are magnets; sorting magnetic and non-magnetic materials; how surfaces effect motion (friction); identify forces on different objects (pushing and pulling). Describing different forces acting on an object; gravity; air resistance; water resistance; friction; forces in mechanisms (leavers; pulleys and gears)</p> <p><i>Vocabulary: contact, no-contact, friction, attract, repel, poles, field, resistance, gravity</i></p> <p><b>Investigation: Comparative and Fair Testing</b></p> <p><b>E.g. Why do some metals attract and others repel? How does friction affect distance?</b> Key figure: Sir Isaac Newton</p>
YEAR 4	<p><b>Solids, Liquids and Gases: links to Art</b> Identifying everyday solids; liquids and gases and their properties; melting and freezing; using thermometres to measure. Identify the part condensation and evaporation play in the water cycle and the association to temperature.</p> <p><i>Vocabulary: state, solidify, precipitation, evaporation, condensation,</i></p> <p><b>Investigation: Comparison and Fair Testing</b></p> <p><b>E.g. How rapidly does 100ml of water evaporate, in different environments? Is there a difference in the weight of drinks which are fizzy?</b> Key Figure: Dmitry Mendeleev</p>	<p><b>Electricity: links to DT</b> Construct a simple series of electrical circuits. Sort appliances which use mains or battery; complete and incomplete circuits using buzzers; bulbs and motors; conductors and insulators; switches.</p> <p><i>Vocabulary: circuit, conductor, insulator, switch, series, components</i></p> <p><b>Investigation: Pattern Seeking/ Identifying and Classifying</b></p> <p><b>E.g. Which material conducts electricity? When and why does a circuit not conduct electricity?</b> Key Figure: Hertha Ayrton</p>	<p><b>Sound: links to Music &amp; DT</b> Identify how sounds are made and find patterns between the pitch of a sound and features of the object that made it. Explore how sound travels in solids; liquids; gases; anatomy of the ear</p> <p><i>Vocabulary: vibration, pitch, timbre, tone, frequency, sound waves, amplify, decibel, muffle</i></p> <p><b>Investigation: Comparative and Fair Testing</b></p> <p><b>E.g. Which materials does sound travel through easily? Which materials block/muffle sound? Which objects produce a high pitch and why?</b> Key Figure: Aristotle, Gallileo, Robert Boyle</p>
YE AP	<b>Space and Forces: links to Geography</b>	<b>Materials: links to DT</b>	<b>Life Cycles: links to Art</b>



	<p>Describe the movement of the Earth and other planets relative to the Sun. Use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun/moon across the sky.</p> <p>Understand how gravity is different on the Moon and Earth; identify the effects of air/water resistance between oving surfaces. Recognise that some mechanisms allow a smaller force to have a greater effect.</p> <p><i>Vocabulary: centric (helio-, geo-), lubricant, solar, lunnar, fulcurem, ratio, gear</i></p> <p><b>Investigation: Research/ Comparative and Fair Testing</b></p> <p><b>E.g. Why does the Sun move across the sky? Investigate water resistance on boats.</b></p> <p>Key Figure: Zhang Heng</p>	<p>Compare and contrasting materials based on the properties; thermal conductors and insulators; electrical conductors; dissolving; separating mixtures; irreversible changes and responses to magnets.</p> <p>Know that some materials will dissolve in liquid to form a solution and describe how to recover a substance from a solution.</p> <p><i>Vocabulary: soluble, reversible, irreversible, tensile, thermal conductors</i></p> <p><b>Investigation: Pattern Seeking</b></p> <p><b>E.g. What happens when I mix different substances together?</b></p> <p>Key Figure: Harry Brearley</p>	<p>Sexual and asexual reproduction; different plan reproduction; fertilization; life cycles of different mammals; amphibians; insects and birds; metamorphosis. Changes in humans: foetus / baby/ child / adolescence and puberty/ adult/ old age/ death</p> <p><i>Vocabulary: puberty, arachnids, molluscs, species, germinate</i></p> <p><b>Investigation: Observation over time/ Identifying and Clarifying</b></p> <p><b>E.g. How does frogspawn turn into a frog? How are living things classified?</b></p> <p>Key Figure: Carl Linneaus</p> <p>Note: Puberty talks are delivered by the School Nurse and may be delivered at a different time of the year</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">YEAR 6</p>	<p><b>Light &amp; Electricity: links to DT</b></p> <p>Light travels in straight lines; reflecting light; refraction; prisms and the spectrum of light; seeing colours; shadows</p> <p>Make associations between the brightness of a bulb/ sound of a buzzer with the number of voltage of cells used in the circuit. Compare variations in how components function; use recognised symbols when representing a simple circuit.</p> <p><i>Vocabulary: vacuum, emit, parallel, positive/negative terminal, fluctuate, resist, transmit</i></p> <p><b>Investigation: Comparative and Fair Testing</b></p> <p><b>E.g. Does the thickness of a wire affect the brightness of a bulb?</b></p> <p>Key Figure: Thomas Edison/ Nikolai Tesla</p>	<p><b>Evolution and Adaptation</b></p> <p>Identify how living things can be classified into broad groups. Evolution; recognise that living things change over time and that fossils provide information on living things in the past. Adaptation; identify how animals and plants have adapted to suit their environment and that this may lead to evolution.</p> <p><i>Vocabulary: inheritance, genus, paeleantology/ist, mutation, biome</i></p> <p><b>Investigation: Research/ Observation over Time</b></p> <p><b>E.g. How are living things adapted to their environment?</b></p> <p><b>How have horses/ whales evolved over millennia?</b></p> <p>Key Figure: Charles Darwin, Mary Leakey</p>	<p><b>Circulatory and Respiratory System</b></p> <p>Understand the circulatory system parts and functions; transporting water and nutrients; healthy life styles; drugs and alcohol including smoking. Understand that the heart is a pump and is oxygenated by the lungs and delivers oxygen to every cell.</p> <p><i>Vocabulary: arteries, veins, circulation, nutrients, hormones, villi, eliminate, oxygen, deoxygenate, oxidise</i></p> <p><b>Investigation: Pattern Seeking</b></p> <p><b>Can I find the four chambers of the heart - dissection.</b></p> <p>Key figure: William Harvey</p>

