HEP SCIENCE CURRICULUM

The Complete Curriculum Map and Rationale: Intent to Implementation

A practical guide to every core document in the HEP Science curriculum: what it is, why it exists, and how it connects to daily teaching.

1 THE WHY: LITERACY, EQUITY, AND THE MATTHEW EFFECT

Our curriculum begins with the recognition that literacy is the single strongest predictor of attainment in science. If a child cannot access scientific texts, they cannot access the content, creating a widening disadvantage gap, a cumulative effect often described as the Matthew Effect. Our framework is explicitly designed to counter this.

We know our learners. EAL and early readers are learning science and English at the same time. Lower attainers have partial understanding that falls apart when language becomes dense. Higher attainers over-generalise or use imprecise language. Pupils with SEND struggle to hold instructions, text and ideas in working memory. Every design decision in HEP Science is made with these learners in mind.

The Power of the Booklet

The Booklet is our main structural defence against this attainment gap. It contains the core scientific reading material and is deliberately structured to embed literacy and make knowledge accessible. This approach ensures four key supports are built into every unit:

> **Integrated Learning:** The Booklet combines rich text, comprehension questions, and visuals to teach reading development alongside content acquisition. Pupils answer five comprehension questions per lesson verbally in full sentences, building scientific vocabulary lesson by lesson.

> **Contextual Vocabulary:** Key scientific words (Tier 3 vocabulary) are introduced naturally in context within the reading material. Words like pupa, larva, abdomen, and thorax are taught through application, rather than as isolated lists. Pronunciation is modelled using phonetics.

> **Visual Support:** Images and diagrams are explicitly paired with text, placed right next to the words they illustrate, to transform abstract ideas into concrete visuals. For example, diagrams label the parts of the digestive system or illustrate the different states of matter.

> **Relevance (Hinterland):** The text includes real-world stories, diverse cultural connections, and fascinating applications to boost engagement and ensure children see themselves in the content. Examples include researching Mary Seacole's use of herbs or learning about complex communication through the waggle dance of bees.

Adaptive Reading

Teachers use an adaptive reading approach when planning each lesson. This is not an add-on: it is how the booklet is used in practice. Key techniques include:

> **Before reading:** Activate prior knowledge. Identify which pronunciations need emphasis. Decide which vocabulary needs teaching in context.

> **During reading:** Use *think-alouds* to model how a scientist reads and interprets text. Model close reading and annotation. Use visuals and props to make abstract ideas concrete.

> **After reading:** Pose text-dependent questions. Encourage discussion and collaboration. Draw out similarities and differences with previous learning.

The booklet supports literacy at three levels. At word level, scientific vocabulary is taught in context with pronunciation modelled. At sentence level, clear short sentences use joiner words to connect information and link cause and effect. At paragraph level, ideas are organised around main topics with supporting facts and step-by-step explanations.

2 OUR GUIDING PRINCIPLES: THE FOUR PILLARS

Our systematic curriculum is built on four non-negotiable pillars that govern content selection and delivery:

Scope: We cover all National Curriculum content with six units per year but prioritise application and depth over mere breadth. The curriculum highlights contributions from diverse historical figures and civilisations, such as the science of the Ancient Egyptians and the work of scientists like Copernicus and Galileo.

Sequence: Units are ordered based on pedagogical reasoning, ensuring pupils move from concrete and observable concepts to abstract and invisible ideas. This intentional ordering manages cognitive load. For instance, the Year 3 sequence begins with tangible Plants and Rocks before progressing to the invisible force of Magnetism.

Coherence: We build deliberate, planned links across science topics and other subjects. For example, learning about States of Matter in Year 4 prepares pupils for understanding how sound waves travel through different media in the Sound unit. Cross-curricular links, such as applying Maths skills to measure time and take averages from repeat readings, reduce confusion and support long-term retention.

Rigour: This ensures mastery and depth. It involves providing rich Hinterland and actively tackling misconceptions. Rigour is demonstrated when pupils can combine knowledge and enquiry and use precise scientific language to justify their findings. Misconceptions are treated as a normal and predictable part of learning: each unit includes a misconceptions report identifying the most common inaccurate ideas pupils bring, from everyday language (“plants eat soil”, “electricity is used up”) to over-generalisations (“all metals are magnetic”). Teachers are supported to surface these early through simple routines: prediction and explanation tasks, true/false “convince me” activities, odd-one-out sorting, and diagnostic questions.

3 THE CURRICULUM ECOSYSTEM: PLANNING AND IMPLEMENTATION

The curriculum is delivered through three tiers of documents, which coordinate the overall structure and guide daily teaching. This structure transforms isolated topic teaching into systematic knowledge building.

A Long-Term Planning: The Big Picture

Curriculum Map and Rationale (Y1–6): This provides the whole-school overview, breaking the National Curriculum into clear yearly steps. It explains the pedagogical reason for the sequence of units and shows how knowledge and enquiry develop together across all year groups. It keeps long-term progression visible and realistic for subject leaders.

EYFS–Y6 Progression Map: This is the curriculum spine, tracing the vertical development of concepts (like Forces or Plants) and Working Scientifically skills from the foundation stage to Year 6. It shows the journey in one document, making clear how concepts build from simple, concrete ideas to more abstract understanding. It makes clear what foundational knowledge must be secure before moving forward.

Preparing for Secondary Science: This Year 6 unit is specifically designed to revisit core concepts and language, ensuring pupils are ready for the expectations of KS3.

B Medium-Term Planning: The Coordination Layer

This is where the long-term intent becomes actionable. These documents coordinate the six lessons within a unit, ensuring coherence and purposeful practical work:

Year Curriculum Map and Rationale: This zoomed-in document explains the sequencing of the units within a specific year group.

Unit Progression Map: The heartbeat of medium-term planning. This lays out the flow of key learning, explicitly detailing objectives, vocabulary, and cross-curricular links.

Crucially, it lists the likely misconceptions for the unit and flags common errors, allowing teachers to plan explanations and retrieval quizzes proactively.

Scientific Enquiry Overview (SEO): This summarises the practical component of each lesson. It outlines the type of scientific enquiry (e.g., Comparative Testing, Fair Testing, Observing Over Time, Pattern Seeking, Identifying and Classifying, Research Using Secondary Sources), the necessary equipment, and the skills that will be applied in the final synoptic task. This ensures practical time is focused and efficient, and that enquiry is always linked to the concept being taught.

Misconceptions Reports: One per unit. These list the most common misconceptions pupils bring to each topic, with clear implications for teaching: what to model, which diagrams to use, which language to tighten. They support teachers to plan for misconceptions before they teach, not react to them after.

C Short-Term Materials: Daily Teaching

These tools are used in the daily classroom routine to deliver the curriculum and enact adaptive teaching:

Retrieval Quizzes: Diagnostic assessments given before a unit starts. They identify pupils' existing knowledge and are essential for surfacing misconceptions. The mark schemes identify the common incorrect ideas linked to wrong answers. Retrieval also appears at the start of every lesson: sometimes from the current unit, sometimes from a previous or unrelated topic, creating interleaving and spaced practice.

Lesson Presentations: These guide the consistent flow and pacing of every lesson, structured around: retrieval starter, teacher modelling, shared vocabulary, hands-on enquiry, and structured talk. They include real-world context and social learning opportunities and facilitate the use of adaptive reading strategies to ensure all pupils access the content.

Hands-on Investigations: Practical work is used to actively challenge misconceptions and develop disciplinary skills. For example, comparative tests investigate friction on different surfaces or test if different liquids break down simulated teeth. The six types of scientific enquiry: observing over time, pattern seeking, identifying and classifying, comparative testing, fair testing, and research using secondary sources are mapped across every year group so skills grow progressively.

4 THE ASSESSMENT SYSTEM: FOUR LAYERS

Assessment in HEP Science is designed to strengthen understanding rather than simply measure it. The curriculum uses a four-layer system that moves pupils from remembering knowledge, to understanding it, to applying it in new situations.

Layer 1 - Retrieval Quizzes: At the start of each unit, a short quiz checks what pupils already know. These are not graded: they are diagnostic. Multiple choice, true/false, odd one out, and matching formats keep them low-stakes and quick. Pupils can use mini whiteboards or answer in groups. They show teachers what pupils remember from previous learning and where to focus teaching.

Layer 2 - Comprehension Questions: Five questions are asked during or after each lesson as pupils read from the booklet. Pupils answer verbally in full sentences. Across the curriculum, this provides 65 comprehension checkpoints that build scientific vocabulary and help teachers spot who needs support straight away. Answering in full sentences gets pupils used to explaining their thinking clearly: a key skill for the synoptic assessment.

Layer 3 - End-of-Unit Assessment: On the final slide of Lesson 6, short tasks check what pupils have learned across the unit. Structure strips guide pupils through writing up investigations: aim, prediction, variables, method, results, hence scaffolding the working scientifically skills. These structure strips and investigation write-ups are the working scientifically assessment. No need to add more.

Layer 4 - Synoptic Assessment: At the end of each half-term, pupils complete an open-book synoptic assessment lasting 20–30 minutes. Each assessment presents a Big Question, a graphic organiser for Task 1 with sentence starters, and a Task 2 that asks pupils to apply their knowledge to a new, unfamiliar situation. Pupils can use their individual booklet: this is not a memory test. It reveals whether pupils truly understand the science or have simply memorised it.

Together, these four layers give teachers a complete, manageable assessment system. All assessments are low-stakes and accessible. Teachers use the outcomes to refine teaching, plan feedback and strengthen future units, ensuring that assessment drives learning rather than interrupts it.

5 SUPPORT AND INCLUSION: UNDERPINNING ACCESS

The curriculum provides dedicated resources to support both teacher subject knowledge and pupil inclusion:

Misconception Posters: Visual reminders of common scientific misunderstandings, used for discussion and clarification. They appear throughout resources, including in quizzes and booklets, to provide repeated exposure and challenge. Teachers use four key routines to surface misconceptions: prediction and explanation, true/false “convince me”, odd-one-out sorting, and diagnostic concept cartoons.

Support Templates (in Canva): Scaffolds such as gap-fills, sentence starters, and structure strips are provided for EAL and SEND learners. They help pupils structure written responses while ensuring the same core scientific rigour is maintained, just with added support.

Advisory Science YouTube Playlists: Curated videos matched to each unit. They support teacher subject knowledge and offer visual anchors for pupils, with guidance to pause and question frequently to check understanding.

CPD Overview and Reflection Sheets: These tools support staff development by helping science leads track teacher confidence and identify priorities for professional learning needs across the school.

6 SPIRITUAL, MORAL, SOCIAL AND CULTURAL DEVELOPMENT

The HEP Science curriculum contributes to pupils' spiritual, moral, social and cultural development through the way scientific ideas are explored, discussed and connected to the wider world.

Spiritual: The science curriculum aims to inspire awe and wonder as pupils relate to and make sense of the world around them. From the uniqueness of individual genetic makeup to the vastness of the universe, pupils move from the concrete to the abstract and learn that everything is connected in our physical world and beyond. In doing so, we also learn to accept that science cannot provide all the answers and that imagination and creativity can lead to new discoveries.

Moral: Some scientific advancements have had a positive effect on our world as a whole. Others have had a negative, even catastrophic impact on us and our environment. Moral decisions and discussion around these topics are an important part of the decision-making process pupils will use as they navigate their world. Pupils are encouraged to be unbiased and without prejudice. Modelling this through text, tasks and discussion encourages pupils to be open to a range of ideas and consider them from an informed, critical perspective.

Social: Much of the success of science depends on the input and feedback from other scientists to develop a shared understanding and evaluate data to make it more trustworthy. Working scientifically often depends on collaborative tasks and sharing of findings. As pupils build a greater understanding of science, it allows them to deepen their everyday social experiences and to better appreciate the positive and negative social impact of science in their homes, communities and our world.

Cultural: Pupils have opportunities to research the work of scientists from different backgrounds and examine how they have shaped our lives. Relevant topical issues are regularly taught and discussed. Pupils also make use of the environment around them, particularly when studying plants and animals. Historically and currently, science relies on contributions from around the world. Pupils appreciate the importance of acceptance from the scientific community and the shared standards that must be met before use by citizens. Pupils should experience a sense of enjoyment as they learn about themselves, others and the world around them.

APPENDIX 1

SUMMARY OF NATIONAL CURRICULUM FOR SCIENCE AT KEY STAGES 1 AND 2

KEY STAGE ONE: EARLY SCIENTIFIC THINKING

In Key Stage One, pupils learn science through rich first-hand experience. The HEP Science curriculum is built around sensory exploration, structured noticing and carefully guided talk so that pupils encounter scientific ideas in ways that feel concrete, familiar and meaningful. Storybooks provide predictable language, clear images and accessible explanations, allowing children to meet scientific vocabulary in context before they meet it in writing. Lessons follow a consistent pattern: a sensory or mystery-box starter, teacher modelling with images, shared vocabulary work, a short hands-on enquiry and structured partner talk.

These routines reflect the National Curriculum expectation that early science should be rooted in observing real phenomena, noticing similarities and differences, asking simple questions and using everyday language to describe what they find. Progression from noticing to observing closely, describing, comparing and classifying is mapped from EYFS through to Year 2, ensuring pupils build secure disciplinary habits. Scientific enquiry is always taught through the content of the unit, using the forms appropriate for this stage: observing closely, identifying and classifying, pattern seeking, simple comparative tests and the use of secondary sources. Retrieval before and during lessons revisits vocabulary, prior experiences and simple models so pupils can build clear, confident schemas.

Hinterland experiences (pets, food, clothing, weather, shadows and seasonal changes) are used intentionally to anchor new learning in everyday life.

LOWER KEY STAGE TWO: BROADENING SCIENTIFIC UNDERSTANDING

As pupils move into Years 3 and 4, the curriculum broadens their scientific view of the world. Reading, modelling, hands-on enquiry and structured talk continue to work together so pupils encounter ideas from multiple angles. Units are sequenced to revisit and extend earlier ideas, helping pupils make connections between living things, materials, states of matter, forces, sound and light. Vocabulary, explanation and representation become more precise, and enquiry becomes more purposeful.

The six types of scientific enquiry: observing over time, pattern seeking, identifying and classifying, comparative/controlled investigations and using secondary sources are woven through the lessons so pupils learn how scientific ideas are tested, refined and connected to evidence. Pupils begin to draw simple conclusions, interpret data and communicate their thinking using scientific language, meeting the expectations of the National Curriculum for this phase. Daily retrieval ensures knowledge builds cumulatively and misconceptions are addressed early.

UPPER KEY STAGE TWO: DEEPENING AND APPLYING SCIENTIFIC IDEAS

In Years 5 and 6, pupils encounter more abstract concepts and begin to recognise how scientific ideas help us understand and predict the world. Units build logically towards models of particles, electricity, evolution, reproduction and irreversible changes. Teaching follows a Gradual Release of Responsibility model: I do, we do, you do together, you do independently, so pupils move from guided reasoning to confident, independent explanation. Dialogic talk helps pupils justify claims, evaluate alternatives and refine the accuracy of their scientific language.

Synoptic tasks require pupils to apply models across different contexts, strengthening their ability to transfer understanding and reveal deeper misconceptions. Historical scientific ideas are used where appropriate so pupils recognise that scientific explanations develop over time. Representations, diagrams and structured writing opportunities ensure clarity of explanation meets National Curriculum expectations for this stage.

Climate, energy and environmental understanding are introduced through clear, age-appropriate models so pupils learn how scientific evidence helps us understand changes in the natural world.

NOTE: Statutory Content — Human Reproduction and Puberty (Year 5)

Human reproduction and puberty are taught in Year 5 as part of the statutory National Curriculum for science. Lessons focus on the physical and emotional changes that occur during growth and development and are taught in a clear, factual and age-appropriate manner. Because this content sits within the statutory science programme of study, parents and carers cannot withdraw their child from these lessons.

APPENDIX 2

HEP SCIENCE CURRICULUM MAP

Year	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
1	**Plants** Identify and describe common plants; observe plant parts and growth	**Human Body Parts** Identify and label basic body parts; associate body parts with senses	**Everyday Materials** Identify and classify everyday materials; describe and compare their properties	**Animal Groups** Identify and classify animals into groups (mammals, birds, fish, etc.); compare animal characteristics	**Animal Diets** Classify animals by diet (herbivores, carnivores, omnivores); relate physical characteristics to diet	**Seasonal Changes** Observe and describe seasonal changes; record weather patterns and how they affect living things
2	**Plants** Observe how seeds and bulbs grow; learn about plant needs (water, light, temperature)	**Uses of Everyday Materials** Compare the suitability of materials for different uses; explore how materials change shape	**Living or Non-Living?** Explore and compare the differences between things that are living, dead, and things that have never been alive; begin to understand the characteristics of living things	**Local Habitats** Identify that most living things live in habitats to which they are suited; identify and name plants and animals in their habitats, including micro-habitats; describe how habitats provide for basic needs	**Food Chains** Recall how animals can be grouped by diet (herbivores, carnivores, omnivores); describe how animals obtain food from plants and other animals using simple food chains; compare food chains across different habitats	**Animal & Human Needs** Understand basic needs of animals and humans (water, food, air); learn that offspring grow into adults; explore life cycles; describe stages of human growth; understand the importance of a balanced diet, exercise and hygiene
3	**Plants** Parts of plants, needs of plants and their life cycle	**Rocks** Comparing different rocks, fossils, soil formation	**Light** Light sources, how light is reflected off objects, how shadows form, changing shadows, eye protection	**Animals Including Humans** Nutrition, musculoskeletal system for support, movement, and protection	**Forces and Magnets** Non-contact forces, attraction and repulsion of magnets, magnetic materials and the N and S poles of magnets	**Bee Project** A look at the relationship between bees and their environment; importance in pollination, food and other resources
4	**States of Matter** Group materials based on their properties, changes of state, heating and cooling, the water cycle	**Animals Including Humans** Eating, teeth, digestive system and food chains, producers, predators and prey	**Sound** Making sounds, vibrations, the ear, changes in pitch and volume	**Living Things and Their Habitats** Classification, characteristics, and the effects of environmental changes	**Electricity** Appliances, building circuits and identifying components, circuit diagnostics, conductors and insulators	**The History of Science** This unit focuses on the development of scientific theories by a diverse range of scientists and inventors, both historical and contemporary
5	**Properties and Changes of Materials** Classifying materials, dissolving, separating and changes of state, uses of materials, reversible and irreversible changes	**Animals Including Humans** Life cycles, plant and animal reproduction, human life cycle	**Forces** Gravity, air resistance, water resistance and friction between moving surfaces, multiplying forces using levers, pulleys and gears	**Living Things and Their Habitats** Classifying living things, life cycles of mammals, amphibians, insects and birds	**Earth and Space** The movement of Earth, other planets and the Moon in relation to the Sun and each other, spherical bodies, night and day	**The Scientific Method** The unit looks at the steps that scientists follow when thinking about a problem and how to solve it
6	**Animals Including Humans** The circulatory system, lifestyle, health and disease; transport of water in animals	**Science of Light** How light travels, how we see objects, the shape of shadows	**Electric Circuits** The effects of changing the number and voltage of cells in a circuit; varying the function of components; representing circuits using symbols	**Evolution and Inheritance** What we learn by looking at fossils; variation, reproduction and adaptation.	**Classifying Living Things** Classifying microorganisms, plants and animals	**Preparing for Secondary Science** Introduction to cell biology, energy forms and transformations, properties of materials, forces, and basic principles of chemical reactions

APPENDIX 3

FROM PRINCIPLES TO PRACTICE

The HEP Science curriculum is driven by four design principles: Scope, Sequence, Coherence and Rigour. These shape every decision about what is taught, when, and how. The table below shows how each principle connects to the planning and teaching materials that schools use every day.

HEP Science Material	What It Does	Design Principles at Work
Curriculum Map and Rationale (Long-term)	• Breaks the National Curriculum into clear yearly steps across Year 1–6. • Shows how knowledge and enquiry develop together across all year groups. • Keeps long-term progression visible and realistic for subject leaders.	**Scope:** Ensures full National Curriculum coverage with six units per year. **Sequence:** Makes the order of topics deliberate so earlier learning supports later learning.
EYFS–Y6 Progression Map (Long-term)	• Shows the journey from EYFS to Year 6 in one document. • Makes it clear how concepts build from simple, concrete ideas to more abstract understanding. • Sequences knowledge to reduce cognitive load.	**Sequence:** Knowledge builds cumulatively from concrete to abstract. **Coherence:** Teachers can see how their year group connects to what came before and what comes next.
Unit Progression Map (Medium-term)	• One per unit. Shows the sequenced prior and substantive knowledge pupils need. • Flags common errors and misconceptions to inform retrieval planning. • Makes the coherence between lessons within a unit explicit.	**Sequence:** Prior knowledge is identified so teachers know exactly what to retrieve. **Rigour:** Misconceptions are flagged before teaching begins, not discovered after.
Scientific Enquiry Overview (Medium-term)	• Shows the enquiry focus of each lesson across the unit. • Details the equipment and preparation needed. • Specifies the skills that will be applied in the final synoptic task.	**Coherence:** Enquiry is always linked to the concept being taught, not bolted on. **Rigour:** Enquiry skills are mapped so they grow progressively across year groups.
Misconceptions Reports (Medium-term)	• One per unit. Lists the most common misconceptions pupils bring to the topic. • Includes implications for teaching: what to model, which diagrams to use, which language to tighten. • Supports teachers to plan for misconceptions before they teach, not react to them after.	**Rigour:** Misconceptions are treated as predictable and planned for, not left to chance. **Sequence:** Informs retrieval quiz design and helps teachers target the right prior knowledge.

HEP Science Material	What It Does	Design Principles at Work
Retrieval Quizzes (Short-term)	• Used at the start of each unit to check prior knowledge and surface misconceptions. • Also used at the start of every lesson: sometimes from the current unit, sometimes from a previous or unrelated topic. • Creates interleaving and spaced practice.	**Sequence:** Retrieval is deliberate, drawing on mapped prior learning. **Rigour:** Misconceptions are caught early and addressed through teaching.
Comprehension Questions (Short-term)	• Five questions asked during or after each lesson as pupils read from the booklet. • Pupils answer verbally in full sentences, building scientific vocabulary. • 65 comprehension checkpoints across the curriculum help teachers spot gaps immediately.	**Coherence:** Literacy and science are assessed together: pupils practise explaining their thinking in every lesson. **Rigour:** Lesson-by-lesson checks mean misunderstandings are caught and addressed straight away.
Booklets (Short-term)	• What pupils read and work from in lessons. • Builds curiosity through stories and real-world examples. • Accessible language with pictures and diagrams placed right next to text. • Tricky words are taught in context: teaches reading and science together.	**Scope:** Hinterland knowledge is woven in so abstract ideas are anchored in real life. **Coherence:** Literacy is embedded, not separate. Pupils learn to read, write and talk scientifically.
Lesson Presentations (Short-term)	• Consistent flow and pacing across all year groups and units. • Structured around: retrieval starter, teacher modelling, shared vocabulary, hands-on enquiry, structured talk. • Includes real-world context and social learning opportunities.	**Coherence:** Same lesson structure means pupils know what to expect and can focus on the science. **Rigour:** Every lesson is designed to surface and address understanding, not just cover content.
Synoptic Tasks (Short-term)	• End-of-unit assessments that ask pupils to apply knowledge in unfamiliar contexts. • Low-stakes and book-supported: pupils can use their booklet. • Reveals whether pupils truly understand or have just memorised.	**Rigour:** Tests transfer of understanding, not recall of isolated facts. **Sequence:** Feeds back into future retrieval planning and teaching.