

# **SCIENCE** at Elemore Hall School

## **Rationale**

Our experience of existence is defined by a myriad of laws, principles and processes which, when considered cumulatively, provide a 'rulebook' to explain our experiences. Science began as the fundamental study of 'the rules' which explain what has happened and is happening around us. However, as society moves forward, there is a demand for scientists to use their subject mastery to create 'new rules' and engineer opportunities for a new future.

At Elemore Hall School, Science seeks to create an inclusive environment where pupils enjoy their education and are supported and encouraged to achieve. All pupils are challenged to expand their skills, knowledge and understanding of science through varied curriculum opportunities. We are a school for pupils with SEMH difficulties, and so, through our curriculum, we aim to develop pupils' curiosity, wanting to know how things work and about the world around them. Through teaching the scientific theory, we hope to equip pupils with the knowledge to question and the ability to investigate.

## **INTENT**

The study of secondary science is centred on three disciplines; Biology - the study of organisms & their interdependence, Chemistry - the study of matter, and Physics - the study of fundamental interactions. From within these three disciplines, the 'big ideas' in science are distilled. By completing a secondary education in science, pupils will know of the behaviour of particles and matter, the reason and nature by which objects interact with each other when in contact and from afar, how our planet is structured and the place it holds in the universe, as well as the evolution of living organisms from one common ancestor and how these organisms depend on interactions to survive.

The core concepts within science will equip pupils with the knowledge they will need to give explanations to their experiences. Through understanding these concepts, pupils will be able to appreciate the integrity of science in everyday life and the opportunities afforded by scientific progress. The core threshold concepts are studied within the three disciplines. - The threshold concepts presented in Biology are: Cells are alive; Bodies are systems; Organisms are interdependent; Ecosystems recycle resources; Characteristics are inherited; Species show variation. The threshold concepts presented to in Chemistry are: Structure determines properties; Reactions rearrange matter; Earth systems interact. The threshold concepts presented to in Physics are: Forces predict motion; Fields produce forces; Energy is conserved; Electricity transfers energy; Radiation transfers energy. These concepts are underpinned by the ideology of the scientific method; that hypothesis leads to investigation and the data collected serves as proof for scientific theory. Scientific theory then allows us to create representative models to aid understanding, under the caveat that new data may refine these models over time.

Learning at KS3 is driven by prior knowledge and understanding of the KS1&2 curriculum. The acknowledgement of prior knowledge is crucial to ensure that every pupil can succeed. The science curriculum at KS3 follows a mastery approach, aspiring for all pupils to progress in every lesson. The KS3 curriculum embeds key foundational knowledge, allowing pupils to thrive when faced with high-level content at KS4. The development of knowledge over time will include exposure to scientific laws and discoveries, and will challenge pupils to tackle sophisticated ideas surrounding scientific processes and impacts.

The knowledge which is explicitly taught at the beginning of KS3 will advance pupils' fundamental KS2 maths and science enquiry understanding. Through explicit teaching, knowledge and skills are introduced in KS3, and embedded throughout rigorous practice. The refinement of scientific skills as

a mode of communication in KS3, means pupils will demonstrate exemplary 'scientific literacy' that will allow them to flourish in a KS4 curriculum. Throughout KS4, pupils will apply their skills analytically to deduce patterns, seek information and evaluate models. This will equip them to succeed in the highly rigorous KS5 science curricula as they further their subject exploration.

The key threshold concepts established in KS3 are enriched in KS4 where the development of models further lace together the overarching elements of science. Whilst science is a subject composed of three disciplines, these are heavily intertwined by the threshold concepts which support knowledge throughout. For example, when pupils develop their understanding of respiration and photosynthesis in biology, a knowledge of chemical reactions is a prerequisite. Without understanding the nature of electric current, we cannot explain electrolysis or the properties of graphite conductors. The interdependence of threshold concepts is closely mapped in order to support the development of internal schema.

We use the Pearson scheme of work. At key stage 3, this is through the prescribed curriculum *Mastery in Science*, providing the fundamental knowledge and understanding they need to gain their GCSE accreditation. At key stage 4 we use the Edexcel GCSE suite of awards and, for those who find GCSE too challenging, Entry Level in Science, which covers most of the same content, is also available. Our aim is for all the pupils to leave with an accredited award

The science curriculum is an ever changing entity, where ethical and moral questions about topics, such as obesity, are discussed and encouraged. It also enables pupils to explore current scientific stories, such as Covid19 and allows for a variety of SMSC topics to be examined - from the impact of global warming, to the rights and wrongs of abortion and the impacts of alcohol and drug use.

#### Key components that are revisited and built on throughout the curriculum:

| Big Ideas                   |                              |                    |
|-----------------------------|------------------------------|--------------------|
| Biology                     | Chemistry                    | Physics            |
| Cells & cellular processes  | Materials & their properties | Energy             |
| Biological systems for life | Chemical changes             | Forces & fields    |
| Organisms                   | Our earth & its atmosphere   | Matter & materials |

#### Curriculum Maps

|   | Autumn   | Spring   | Summer   |
|---|--|--|--|
| 7 | <b>Biology</b>   |  |  |
|   | 1- Introduction to microscopy<br>2- Cells & unicellular organisms  | 1- Movement<br>5- Reproductive systems<br>6- Gestation & Birth | 1- Ecosystems<br>2- Biodiversity & human influences                              |
|   | <b>Chemistry</b>   |  |  |
|   | 5- Solids, liquids & gases<br>6- Solutions<br>7- Mixtures          | 2- Acids & alkalis<br>3- Neutralisation                        | 4- The earth's atmosphere  |
|   | <b>Physics</b>   |  |  |
|   | 3- Measuring density<br>4- Different Forces                        | 4- Pressure  | 3- Current electricity<br>5- Energy stores & transfers<br>6- Understanding waves |
| 8 | Autumn   | Spring   | Summer   |
|   | <b>Biology</b>   |  |  |
|   | 1- Food groups & deficiency diseases<br>5- Ventilation<br>6- Drugs | 1- Respiration<br>2- Unicellular organisms & diffusion         | 1- Photosynthesis<br>2- Plant reproduction<br>3- Human impact                    |

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|--|--|---|---|
|  | <b>Chemistry</b>                                     |   |   |
|  | 2- Atoms & elements<br>3- Physical & chemical change | 5- Reactions of acids<br>6- Combustion        | 4- Metal alloys<br>5- Reactions of metals           |
|  | <b>Physics</b>                                       |   |   |
|  | 4- Solids, liquids & gases                           | 3- Light<br>4- Sound<br>7- Static Electricity | 6- The Earth & Space<br>7- Magnets & electromagnets |

|          |   |   |  |
|----------|---|---|--|
| <b>9</b> | <b>Autumn</b>   | <b>Spring</b>   | <b>Summer</b>  |
|          | <b>Biology</b>  |   |  |
|          | 1- Variation & adaptations<br>2- Evolution & extinction<br>3- Digestion | 1- The nucleus<br>2- Prokaryotic & eukaryotic cells<br>3- Microscopy & magnification<br>4- The movement of substances | 1- Enzymes<br>2- Dietary components  |
|          | <b>Chemistry</b>  |   |  |
|          | 4- Atomic structure<br>5- Water<br>6- Separations                       | 5- Bonding<br>6- The periodic table   | 3- The PH scale<br>4- Further reactions of acids<br>5- Solving problems with chemistry |
|          | <b>Physics</b>  |   |  |
|          | 7- Describing atoms   | 7- Heat energy transfer<br>8- Energy & efficiency   | 6- Describing motion<br>7- Waves & the electromagnetic spectrum<br>8- Forces & matter  |

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|-----------|--|--|--|
| <b>10</b> | <b>Autumn</b>  | <b>Spring</b>  | <b>Summer</b>  |
|           | <b>Biology</b>   |  |  |
|           | 1- The nervous system<br>2- Mitosis & growth<br>3- Stem cells & specialisation | 1- Pathogens, disease & medicines<br>2- Non-communicable diseases  | 1- Enzymes<br>2- Dietary components  |
|           | <b>Chemistry</b>   |  |  |
|           | 4- Groups in the periodic table<br>5- Salt preparations<br>6- Fuels            | 3- Rates of reactions  | 3- The PH scale<br>4- Further reactions of acids<br>5- Solving problems with chemistry |
|           | <b>Physics</b>   |  |  |
|           | 7- Waves & measurement of speed<br>8- Use of refraction & reflection           | 4- Forces & work done<br>5- Forces, energy, power & efficiency<br>6- Electric circuits<br>7- Uses of electricity<br>8- Power, domestic supply & static electricity | 6- Describing motion<br>7- Waves & the electromagnetic spectrum<br>8- Forces & matter  |

|           |  |  |  |
|-----------|--|--|--|
| <b>11</b> | <b>Autumn</b>  | <b>Spring</b>  | <b>Summer</b>  |
|           | <b>Biology</b>   |  |  |
|           | 1- Factors affecting photosynthesis<br>2- Plant transport<br>3- Respiration & exercise       | 1- Hormones<br>2- The menstrual cycle & controlling fertility                                | 1- Ecosystems<br>2- Human influences on ecosystems<br>3- Gas exchange & circulation              |
|           | <b>Chemistry</b>   |  |  |
|           | 4- Calculations involving masses<br>5- Heat energy changes<br>6- Electrolytic process        | /  | 4- Reversible reactions<br>5- Earth & atmosphere   |
|           | <b>Physics</b>   |  |  |
|           | 7- Properties of waves in the electromagnetic spectrum<br>8- Waves detection, uses & dangers | 3- Forces, work done & momentum<br>4- Forces & effects<br>5- Forces & motion<br>6- Magnetism | 6- Radioactive emissions<br>7- Radio half-lives & dangers of radioactivity<br>8- Forces & matter |

|  |  |   |  |
|--|--|---|--|
|  |  | 7- Electromagnetism<br>8- Electromagnetic induction |  |
|--|--|---|--|

|          | Autumn   | Spring  | Summer  |
|----------|--|---|---|
| <b>M</b> | <b>Entry Level</b> (year 1)                              |   |   |
|          | <b>Biology</b>   | <b>Physics</b>  | <b>Chemistry</b>  |
|          | Cells, genetics, inheritance & modification              | Forces, movement & energy                                     | Separating mixtures, breaking down substances, acids & metals |
|          | <b>Chemistry</b>   | <b>Biology</b>  | <b>Physics</b>  |
|          | Atoms, compounds & states of matter                      | Health, disease & the development of medicines                | Waves & radiation   |
|          | <b>Entry Level Further Science</b> (year 2)              |   |   |
|          | <b>Biology</b>   | <b>Physics</b>  | <b>Biology</b>  |
|          | Human Biology  | Forces, movement & energy                                     | Separating mixtures, breaking down substances, acids & metals |
|          | <b>Chemistry</b>   | <b>Chemistry</b>  | <b>Physics</b>  |
|          | Chemical reactions: patterns, energy & rates of reaction | Chemistry in our world: fossil fuels & the earth's atmosphere | Energy & particles  |

## IMPLEMENTATION

In Science, we acknowledge that pupils learn in different ways and we recognise the need to develop pedagogies which enable all to learn in ways which suit them best.

We offer a variety of methods to enable pupils to learn, including:

- investigation and problem solving
- open ended tasks
- reasoning
- research and finding out, with independent access to a range of resources
- group work, paired work and independent work
- effective questioning
- presentation and drama
- use of ICT
- visitors and educational visits
- creative activities, designing and making
- use of multimedia, visual or aural stimulus
- extra-curricular clubs and activities

The role of practical lessons allows pupils to learn kinaesthetically. Carrying out physical activities and hands-on experiential learning makes learning more fun and boosts the acquisition of knowledge. During practical work, our pupils learn to use the scientific process - how to predict outcomes, how to test their predictions, and how to analyse their findings.

We encourage pupils to be curious about natural phenomena and to be excited by the process of understanding the world around them. Key scientific terminology will be introduced each lesson and knowledge will be built upon throughout their journey. Pupils will be encouraged to work scientifically, carry out simple tests and experiments - using equipment and to gather and record data. Skills are taught and practised throughout and clearly linked to the content in the programme of study. Some higher tier topics, such as radioactivity, will be taught less extensively, in order to allow pupils to concentrate on the key concepts.

In our lessons, pupils acquire knowledge through:

- handling apparatus
- making measurements
- completing experiments and investigations safely
- following instructions
- observing, recording and reporting accurately
- seeking explanations
- drawing logical conclusions
- problem solving
- making decisions
- working co-operatively
- assuming different roles within a group

Common knowledge is shared between a number of subjects - most closely with Mathematics, but also with Physical Education, Food and Nutrition, and Resistant Materials, where pupils learn about how the muscles work, about different food groups, how to keep food safe and about different materials and recycling. Pupils also have opportunities to experience science outside the classroom.

### **Reading Development in Science**

Pupils have opportunities to read when presented with practical instructions in order to carry out experiments, and when completing worksheets, which contain activities such as comprehension, cloze activities, ordering activities, and question and answer activities. Key subject vocabulary is taught to ensure pupils are able to access subject content. In addition, pupils are taught to use and re-arrange simple equations, to plot and interpret graphical data, and to calculate mean values and area.

### **Additional Support & Stretch/Extend/Challenge**

Those who find learning more difficult are given targeted support to embed skills, to develop at their own pace and to learn in a style that best suits their individual needs. Learning Support Assistants are always available to aid pupils as and when needed. To enhance pupils' understanding of what is covered in the classroom, revision sessions are offered to year 10 and 11 pupils.

### **Enrichment**

We are committed to a broad educational offering, which means looking beyond the National Curriculum. Our enrichment programme, that draws upon a range of skills, is offered through LotC, school trips, visiting specialists, and themed days and weeks.

### **Links with evening activities**

Pupils, especially in year 11, are given the opportunity to attend an after school club session to revise topics they have been learning about, further deepen their scientific knowledge, and revise for their examinations.

### **Steps and Assessment**

To demonstrate progression and highlight any areas that may need to be revisited, pupils will be constantly monitored throughout and will complete a test at the beginning and again at the end of each term. The assessment at the beginning of each term is used to inform the planning and what topics need to be focused on more.

Pupil progression is monitored through Pearson's Markbook and an Excel spreadsheet, which highlights any missing data for each class and individual pupil.

Regular assessments, throughout the course, give pupils a sense of achievement as they complete each term and help improve self-esteem and confidence, whilst raising aspirations to succeed in their future learning.

## **IMPACT**

Depending on ability, we aim for every pupil to leave school with a Science accredited qualification, which will help them progress to the next stage of their learning. This could be a single award GCSE, a double award GCSE, an Entry Level qualification, or a combination of the above.

Furthermore, impact will also be measured by how effectively our curriculum helps pupils to:

- develop a better understanding of the environment and world in which they live
- develop communication skills
- improve their personal relationships
- develop strategies to solve problems
- develop logical, constructive, and sustained thought
- build confidence, initiative, and perseverance when tackling problems
- improve self-awareness, independence, self-reliance and self esteem
- develop ability to work with others and develop co-operation skills and concern for the views and attitudes of others
- use cross-curricular skills in reading, listening, recording, classifying, measuring, comparing and the evaluation of findings
- improve observation and manipulative skills
- develop skilful use of equipment in a correct and safe manner
- develop confident handling of hazardous situations
- improve understanding through practical experience
- develop an interest in science and skills which could be continued post school life
- develop into well - rounded individuals, who embody our values and carry with them the knowledge, skills, and attitudes which will make them lifelong learners and valuable future citizens.

## **Accreditation**

GCSE – combined Science

Separate science:

- Biology
- Chemistry
- Physics

Entry Level in Science

Entry level Further Science