

## SCIENCE

| Vision and Aims  |  |  |  |
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| OPPORTUNITY  | PURPOSE  | SUPPORT  | SUCCESS  |
| Pupils will have the opportunity to engage in education through bespoke, individualised timetables to re-engage in mainstream education and vocational learning. | Pupils will be encouraged to discover their purpose in education after being permanently excluded or at risk of being permanently excluded from mainstream settings to provide them with a clear direction for the future. | Pupils will be supported through their individual challenges to develop and improve their wellbeing, social interaction, academic progress and achievements. | Pupils will experience success through their curriculum pathways to fulfil their individual potential enabling them to secure positive and aspirational futures. |

### Science Curriculum Intent

Every pupil arrives at the academy at different points and all with differing experiences of Science. Therefore, we are challenged with providing a curriculum that allows pupils to bridge gaps but also provides an **opportunity** for them to develop their confidence with scientific enquiry. Our aim is to develop pupils' interest in the world and its processes and for them to understand the **purpose** of learning about scientific questioning and investigation. Pupils have the **opportunity** to investigate ideas, critically evaluate and question evidence through Biology, Chemistry and Physics. We provide a curriculum that enables pupils to develop their curiosity in the world and learn about how natural phenomena can be explained. Pupils will have the opportunity to experience **success** as rational and critical thinkers and learn to question concepts and not simply believe what they are told. We aim to **support** our pupils to develop as critical thinkers and consider sources of evidence.

Our curriculum ensures that pupils are ready for their future education, whether this is to return to mainstream, study GCSE Chemistry at our academy or move to post 16 education or employment. We aim for pupils to have the necessary scientific skills for them to experience individual **success** and secure the skills that they will need in their lives beyond our academy.

Our intent enables pupils to:

- Develop their knowledge and curiosity of the natural, physical and human world around them;
- Become confident to question evidence;
- Develop their analytical and critical thinking skills;
- Learn about the role that scientific enquiry plays in the wider world;
- Relate their scientific knowledge to its uses in society and in the future.

## Content

Science content is shared in the long -term curriculum plans below. Content is divided into 6 academic terms for pupils who are site based with a 3 yearly rotation of topics. Curriculum content is taken from elements of the National Curriculum or the qualification being studied.

## Implementation

Delivery of Science occurs via small site- based classes. This allows pupils to learn in an appropriate environment and positively promotes engagement in learning. We encourage learning with flexible and bespoke **support** strategies identified per individual pupil in their 'pupil information pack'. The sequencing of Science ensures that content is taught in a logical order so that pupils build on knowledge and skill. The curriculum is designed to allow for revisiting of content and transfer of knowledge into subsequent topics. This allows pupils to embed knowledge and skills and use these within other subjects to enhance learning and experience **success**. When pupils transition between our academy sites they are able to transfer their Science skills and apply these.

At KS4, Science is delivered via the GCSE Chemistry Single Science qualification at Sawley. Chemistry is delivered to allow pupils to experience the practical elements in a science lab and engage pupils through kinaesthetic activities. We aim for all pupils that are studying Science to make

maximum progress whilst with our academy. KS4 APT pupil's study towards vocational qualifications rather than a Science qualification, however many scientific skills are used within their varied qualifications.

## Assessment

All pupils in KS2 and 3 are assessed for progression in accordance with the whole academy bespoke assessment and tracking 14 Step Scale. All pupils will have a baseline and target set using the Science 14 Step Scales, regardless of site, age, ability or qualification being studied. This enables our academy to track progress in Biology, Chemistry and Physics and enables them to achieve individual **success** regardless of their starting point. This allows pupils to develop their confidence and self-esteem. Pupils are able to move between our academy sites if appropriate and we can continue to track knowledge and skill development through the 14 Step Tracking Scale. KS4 pupils working towards GCSE Chemistry will be assessed for progress against the Chemistry 14 Step Scale and also the GCSE Chemistry specification.

Use of the 14 Step Scale ensures that all pupils are set appropriate targets and work can be differentiated accordingly. Assessments are used as appropriate to each site to evidence progress towards targets. Pupils are continually assessed on their grasp of content covered and outcomes are set each lesson to support or extend their understanding. Formative teacher assessment will take place during each Science lesson through a variety of methods such as plenaries, quizzes, starters, discussions and self/peer assessments.

Summative assessments at the end of topics will be completed for all pupils not working towards formal qualifications. Summative assessment for KS4 pupils will be their formal exam result. KS4 pupils' working towards a Science qualification will complete mock exams which generate information in order to track their progress. Their performance is analysed and used to inform interventions required in preparation for their exam.

## Impact

We aim for pupils to experience individual **success** in Science through individual target setting, bespoke **support** strategies and use of high expectations. Pupils are encouraged to make maximum progress whilst on roll with short term and long -term target setting. Aspirational targets are also set. Pupils will be encouraged to work towards the next level qualification where time allows. Some pupils on are roll for very short periods such as 10 weeks.

Scientific skills developed are able to be transferred successfully to our vocational qualifications offered through our Alternative Provision commissioning process. Qualifications such as Digital Media will require pupils to use their scientific skills such as being able to analyse the development of concepts, question sources of evidence and evaluate their work. Pupils engaging in animal care and sport provisions will utilise their knowledge of biological processes. Pupils at catering will utilise their knowledge of chemical reactions, food storage, bacteria, hygiene and digestion. Pupils engaging in motor vehicle will incorporate their physics knowledge around pressure, particles, speed and friction.

### Career links with the Science Curriculum

The Science long-term plans have a careers focus for each term which links the topic to related Science based careers (see below). Throughout the curriculum, there are opportunities to link Scientific skills to ‘real life’ applications and build foundations for the next step.

Teachers discuss what careers are available involving a particular subject. Progression pathways, next steps training and post-16 education **opportunities** are identified. Pupils are given opportunities to research career pathways and expand their knowledge of different careers. They are encouraged to be aspirational and are exposed to a wide variety of careers. Careers is delivered by both teachers and teaching assistants and is also embedded in the timetabled curriculum at each academy site.

| SCIENCE QUALIFICATION PATHWAYS |               |               |               |                           |                           |
|--------------------------------|---------------|---------------|---------------|---------------------------|---------------------------|
|                                | Entry Level 1 | Entry Level 2 | Entry Level 3 | Level 1                   | Level 2                   |
| Sawley site                    |               |               |               | GCSE Chemistry grades 1-3 | GCSE Chemistry grades 4-9 |

### Additional Information

#### Chemistry Delivery from after Easter 2021

- Initial pre-knowledge chemistry paper for all pupils

- Results indicated very limited chemistry knowledge and scientific skill application from all pupils
- KS3 science gaps needed to be filled in chemistry alongside delivery of the more engaging GCSE content (that the pupils could access)
- Term 5 content included: Initial testing Naming lab. equipment / using lab equipment/ Practical skills-measuring with precision/ H&S/ Separation techniques: filtration/evaporation/ chromatography/ states of matter (KS3)/ elements/ compounds/ mixtures (KS3) /Purity/ The Periodic Table (KS3)/ chemical reactions (KS3) All pupils that took a mini re-test improved their scores in these areas.
- Term 6 content included:  
The Periodic Table (KS4) elements, compounds, mixtures (KS4), The structure of the atom, The development of the atom, Electron configuration, Group 1 Metals, Group 7 The Halogens, Transition Metals,

### Science Long Term Plan 2021 - 2022

| Autumn 1  | Autumn 2  | Spring 1  | Spring 2   | Summer 1   | Summer 2  |
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| <p><b><u>KS2</u></b><br/><b>Animals including Humans</b><br/>Grouping animals with and without skeletons; function of muscles; describe the ways in which nutrients and water are transported within animals, including humans</p> <p><b><u>KS3</u></b><br/><b>The Human Body</b></p> | <p><b><u>KS2</u></b><br/><b>Plants</b><br/>Identify parts of plants and their functions including flowering plants and the part they play in the life cycle</p> <p><b><u>KS3</u></b><br/><b>Cell structures</b><br/>Cells as the fundamental unit of living organisms; observe, interpret and record cell</p> | <p><b><u>KS2</u></b><br/><b>Rocks and Soils</b><br/>Compare and group different kinds of rocks and soils; understand how fossils are formed</p> <p><b><u>KS3</u></b><br/><b>Space</b><br/>gravity force and equations; gravity forces between Earth and Moon, and between Earth and sun (qualitative only);</p> | <p><b><u>KS2</u></b><br/><b>Forces and Magnets</b><br/>Compare how things move on different surfaces; notice that some forces need contact between 2 objects; understand magnetic forces and the poles; how magnets attract or repel each other and attract some materials and not others; explain Gravity; identify the</p> | <p><b><u>KS2</u></b><br/><b>STEM Thinking Scientifically</b><br/>Create and conduct an investigation with a focus on making predictions and asking questions</p> <p><b><u>KS3</u></b><br/><b>Metals and Acids</b><br/>The order of metals and carbon in the reactivity series;</p> | <p><b><u>KS2</u></b><br/><b>Light</b><br/>Recognise that they need light in order to see things and that dark is the absence of light; understand reflection, and how shadows are formed. Understand the dangers of sunlight; Recognise that light appears to travel in straight lines; explain that objects are seen because they give out</p> |

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| <p>The structure and functions of the human skeleton, to include support, protection, movement and making blood cells; Biomechanics; the function of muscles and examples of antagonistic muscles</p> <p><b><u>KS4 GCSE Chemistry</u></b><br/><b>Atomic structure and the periodic table</b><br/>A simple model of the atom consisting of the nucleus and electrons, relative atomic mass, electronic charge and isotopes</p> | <p>structure using a light microscope the functions of the cell wall, cell membrane, cytoplasm, nucleus, vacuole, mitochondria and chloroplasts; similarities and differences between plant and animal cells; diffusion; the hierarchical organisation of multicellular organisms; Cell Respiration; plants photosynthesis and gaining mineral nutrients and water from the soil via their roots</p> <p><b><u>KS4 GCSE Chemistry</u></b><br/><b>Chemical Changes</b><br/>Determination of empirical formulae from the ratio of atoms of different kinds balanced</p> | <p>our sun as a star; stars in our galaxy; other galaxies; the seasons and the Earth's tilt; day length; the light year as a unit of astronomical distance</p> <p><b><u>KS4 GCSE Chemistry</u></b><br/><b>Carbon Compounds</b><br/>Carbon compounds as fuels and feedstock; recognise crude oil, hydrocarbons and alkanes formulae: methane, ethane, propane, butane; Fractional Distillation and petrochemicals; Properties of hydrocarbons; cracking and alkenes;</p> | <p>effects of air resistance, water resistance and friction</p> <p><b><u>KS3</u></b><br/><b>Forces</b><br/>Forces as pushes or pulls; using force arrows in diagrams; adding forces in 1 dimension, balanced and unbalanced forces; forces associated with deforming objects; friction between surfaces; resistance to motion of air and water forces; stretch and compression; force-extension linear relation; Hooke's Law; gravity forces acting at a distance on Earth and in space, forces between magnets, and forces due to static electricity; opposing</p> | <p>the use of carbon in obtaining metals from metal oxides; properties of ceramics, polymers and composites</p> <p><b><u>KS4 GCSE Chemistry</u></b><br/><b>Chemistry of the atmosphere</b><br/>Evidence for composition and evolution of the Earth's atmosphere since its formation evidence, and uncertainties in evidence, for additional anthropogenic causes of climate change potential effects of, and mitigation of, increased levels of carbon dioxide and methane on the Earth's climate common atmospheric</p> | <p>or reflect light into the eye</p> <p><b><u>KS3</u></b><br/><b>Light</b><br/>The similarities and differences between light waves and waves in matter; light waves travelling through a vacuum; speed of light; absorption; diffuse scattering and specular reflection at a surface; use of ray model to explain imaging in mirrors; the pinhole camera; the refraction of light and action of convex lens in focusing; the human eye; light transferring energy from source to absorber, leading to chemical and electrical effects; photosensitive material in the retina</p> |
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| <p>the number of particles in a given mass of a substance</p> <p>the modern Periodic Table, showing elements arranged in order of atomic number</p> <p>position of elements in the Periodic Table in relation to their atomic structure and arrangement of outer electrons</p> <p>properties and trends in properties of elements in the same group</p> <p>characteristic properties of metals and non-metals</p> <p>chemical reactivity of elements in relation to their position in the Periodic Table.</p> | <p>chemical equations, ionic equations and state symbols</p> <p>identification of common gases</p> <p>the chemistry of acids; reactions with some metals and carbonates</p> <p>pH as a measure of hydrogen ion concentration</p> <p>and its numerical scale</p> <p>electrolysis of molten ionic liquids and aqueous ionic solutions</p> <p>reduction and oxidation in terms of loss or gain of oxygen.</p> | <p>Reactions of alkenes and alcohol: ethene, propene, butene, pentene; describe the reactions and conditions for the addition of hydrogen, water and halogens to alkenes; draw fully displayed structural formulae of the first four members of the alkenes.</p> | <p>forces and equilibrium</p> <p><b><u>KS4 GCSE Chemistry</u></b></p> <p><b>Carbon Compounds</b></p> <p>Fermentation; recognise alcohol from given formulae; Carboxylic acids; synthetic and naturally occurring polymers; addition polymerisation; condensation polymerisation; Amino Acids; DNA.</p> | <p>pollutants: sulphur dioxide, oxides of nitrogen, particulates and their sources</p> <p>the Earth's water resources and obtaining potable water.</p> | <p>and in cameras; colours and the different frequencies of light, white light and prisms; differential colour effects in absorption and diffuse reflection</p> <p><b><u>KS4 GCSE Chemistry</u></b></p> <p><b>Using resources</b></p> <p>Distinguish between finite and renewable resources given appropriate information; potable water and pure water; the treatment of ground water and salt water; waste water treatment; alternative methods of extracting metals; corrosion and its prevention; alloys as useful materials; The Haber Process and the use of NPK fertilisers.</p> |
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| Materials Scientist<br><br>Medicinal chemistry<br>Chemistry Teacher | Metal processor<br>Metallurgist<br>Alloy development | Science communicator<br>Research chemist<br>Scientist - Catalysis | Analytical technician- plastics<br>Bioplastics | Chemical analysis<br>Geochemist<br>Mineral surveyor<br>Environment Agency<br>Hazardous waste chemist<br>Environmental science<br>Marine biogeochemist<br>Alloy development | Environmental science<br>Marine biogeochemist<br>Alloy development |
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