Curriculum and Assessment in Science at KS3

Curriculum Statement: Science

Genius is 1% talent and 99% hard work.
- Thomas Edison

Powerful Knowledge in Science

Physics:

- Manipulation of equations. units etc.
- Force arrows and what they represent (and so motion and newton's laws)
- Models of voltage and current. (electricity)
- What a wave is (wavelength, frequency amplitude etc.) - Conservation of energy (linking to stores and formula).

Chemistry:

- Particle model: How particles behave in solids, liquids and gases. How particles behave in chemical and physical changes.
- Law of conservation of mass, including balancing equations.
- General Equations
- Atomic Structure, including sub-atomic particles.
- RAM/RFM
- The Periodic Table. How it links to atomic structure.
- Types of mixtures and separating techniques theory
- Collision Theory
- Opposites attract (KS4)
- Moles (KS4)

Biology:

- Cells & the cell cycle - plant cells, animal cells, bacterial cells. Mitosis & Meiosis
- Movement across membranes - including osmosis diffusion and active transport
- Biological Systems – mass transport in animals (incl. the heart, lungs, circulatory system) in plants (including transpiration & translocation), nervous system, reproductive system, endocrine system, respiratory system) - Biochemistry and cycling of elements - Monomers and polymers of lipids, carbohydrates and proteins - Maintenance of a constant internal environment – homeostasis (blood glucose levels, temperature, water regulation)
- Genes/inheritance - DNA structure, Monohybrid inheritance, Uses of DNA in protein synthesis
- Reproduction – hormones involved, contraception, infertility and treating infertility
- Chemical reactions in Biology -Photosynthesis and respiration

Curriculum features

- Taught in specialisms; Biology, Chemistry and Physics.
- Covers the national curriculum but focuses on identified *threshold concepts / powerful knowledge* (see above). More time is devoted to these concepts and a mastery learning philosophy is promoted.
- There is a large focus on understanding concepts through; ○ Testing prior knowledge,
    - ○ Explanation, ○ Questioning ○ Practice, ○ Formative assessment / Feedback.
- Interleaving and self-testing are a feature of the curriculum and independent study.

Practical Work

- There is always a focus to practical work; ○ Knowledge,
    - ○ Procedure and techniques, ○ Scientific enquiry.

Marking

- Marking of threshold concepts identified within individual schemes of work (Approx. 1 in 6 lessons). May take the form of: ○ Low stake testing, ○ 6-mark Questions, ○ Practical/Data Questions, ○ Other.
- Tests; ○ Periodic Tests for Assessment.
    - ○ Ad hoc Tests for Learning

Co Curriculum enrichment

We provide a variety of enrichment for a number of reasons;

- To promote a love of the subject.
- Increase at uptake at KS4, 5 and beyond.
- Narrow attainment gaps.
- Promoting STEM Careers.
- Stretch / Challenge / Aspirations.
- Promote oracy / rhetoric.

Curriculum Overview

Science

Science Curriculum at KS3 – An Overview

Physics

Year 7

Students will learn the fundamentals of forces and motion, including what happens when the forces on an object are balanced and unbalanced. Students will learn how to calculate the speed of an object and how to interpret distance-time graphs. Students will learn about stores of energy and how energy can be shifted between these stores by doing work. Students will learn about electrical circuits and the differences between simple series and parallel circuits. Students will learn about the properties of magnets and investigate the factors that affect the strength of an electromagnet. Students will learn in detail about the properties of waves and investigate the behaviour of sound and light. Students will also learn about the Solar System, including the dynamics of the Earth and the Moon and the differences between planets in our Solar System.

Year 8

Students will extend their knowledge of motion and will learn how to interpret both distance-time and speed-time graphs. Students will also learn about electrical circuits in more depth and investigate factors that affect the resistance of a wire. Students will learn in detail about energy transfers and investigate the efficiency of simple energy transfers. Students will also learn about the methods of thermal energy transfer and investigate methods of reducing heat loss from objects.

Year 9

Students will have an introduction to GCSE Physics in year 9 whilst building on prior knowledge. Students will learn about Newton's laws of motion and how to apply these laws to a range of situations. Students will also be introduced to methods of electricity generation and how electricity is distributed using the National Grid, with a particular focus on the role of generators and transformers. Students will also be introduced to nuclear physics and will learn about the properties of the different types of nuclear radiation, including their uses and dangers. Students will also learn about simple machines such as levers and hydraulics, and investigate how the extension of a spring is related to the applied force. Students will build upon their prior knowledge of waves from year 7 and 8 and learn about the electromagnetic spectrum and the properties of its waves. Students will learn how studying electromagnetic waves from stars and galaxies can help further our understanding of the universe.

Chemistry

Year 7

Students will be able to interpret particle models and recognise the difference between elements, compounds and mixtures. Students will develop their laboratory skills through practical work, using a range of techniques and apparatus. Students will be able to state both word and symbol equations and balance them. Students will learn in detail about the importance of acids, bases and neutralisation, and will be able to define the terms acid and bases and apply these definitions to everyday examples. Students start to look at trends and patterns within the Periodic Table of Elements.

Year 8

Students will study and carry out a variety of chemical reactions with metals, such as combustion, thermal decomposition, oxidation and displacement reactions. Students will design experiments regarding these chemical reactions, implement them and explain them. Students will be able to understand the implications of burning fuel and explain how this process can affect the atmosphere. Students will be able to recognise the difference between compounds and mixtures and use this knowledge to explain processes such as distillation and chromatography. Students will learn how to distinguish differences in rocks and apply this to the rock cycle and learn the structure of the earth and explain its structure.

Year 9

Students will study a range of topics in preparation for GCSE Science such as the history of the atom and the structure of the atom. Students will be able to predict the patterns of reactions in the Periodic Table and understand the properties of metals and non-metals. Students will be able to explain the concepts of rate of reactions and how different circumstances affect the rate of a reaction, such as the addition of a catalyst to a reaction. Students will use practical skills to demonstrate separating techniques and be able to explain how certain mixtures can be separated to identify pure substances. Students will also learn complete various chemical reactions and use their scientific knowledge to explain and evaluate the reactions.

Biology

In **Year 7**, students will learn to interpret cell structure and understand the simple functions of different cells, using microscopes to study them. Students will be able to explain why we need a balanced diet and understand the importance of each food group. Students will study the importance of the digestive system and be able to explain how it works. Students will study human fertilisation and be able to describe the structure and function of the male and female reproductive systems and the stages of pregnancy. Students will also study photosynthesis and transport in plants. This will then build on KS2 knowledge to study the environment and feeding relationships between organisms.

In **Year 8**, the learning that will take place will build on concepts that the students have learnt in Year 7. Students will learn about the process of Respiration and the factors associated with being 'Fit and Healthy'. Ecology will be studied in more depth, specifically looking at the environment different organisms live in and how they are adapted to survive there. The study of plants will take place in more detail and the chemical processes that take place inside plants are introduced. The importance of plants will also be considered.

Students will have an introduction to GCSE Biology in **Year 9**. Key concepts that are fundamental to understanding key sections of the KS4 course are introduced, whilst building on learning from Year 7 and 8. The human body is studied in more detail so that students have an understanding of how specific body systems work and how genes and enzymes are of central importance to the body. The theory of evolution and natural selection are introduced and the impact that humans have on the environment is also studied.

KASH Reporting Criteria
Science

KASH Reporting Criteria in Science: Knowledge and Skills at KS3

Year 7:

Students will develop their **KNOWLEDGE** of:

Biology –

- cells as the fundamental unit of living organisms.
- the structure and function of plant and animal cells and the hierarchical organisation of multicellular organisms
- the process of cell division to allow growth and repair
- reproduction in humans (as an example of a mammal) including the structure and function of the male and female reproductive systems, changes to the body during puberty, the process of fertilisation and the events of pregnancy.
- respiration provides organisms with energy
- the structure and function of different plant tissues and organs, including their adaptations
- how photosynthesis provides a source of food for plants
- how farming practices can impact the environment and plant growth
- the variation between species and within species and how humans have used this to their advantage through selective breeding
- the components of a healthy diet and why each is needed.
- students also will understand the tissues and organs of the human digestive system, including adaptations to function
- the role of enzymes in digestion
- how having an unbalanced diet can lead to health problems

Chemistry –

- safety in the laboratory and using hazardous chemicals
- fundamental chemistry theory such as atoms and their behaviour and elements and their arrangement in the Periodic Table
- the importance of practical skills
- particle models
- how atoms and elements can interact in order to form compounds and mixtures
- acids and bases, the pH scale and neutralization
- how to formulate word and balanced symbol equations
- key fundamental chemical reactions

Physics –

- investigating forces, a topic students are familiar with from primary school, but move their thinking on to more challenging situations including speed calculations
- understanding how energy is transformed whenever forces are involved, and how energy is stored, transformed and conserved.
- electric circuits, again a subject covered in primary school but now to stretch their understanding of how a circuit works with the ideas of voltage, current and resistance.
- the physics behind magnets and electromagnets, looking at their differences and similarities.
- The fundamental concept of a wave in Physics and contrasting the behavior of light and sound waves

- the empire of the sun, which covers everything under the influence of our closest star, from the moon and seasons to why Pluto isn't a planet anymore. If it's in our solar system, it is covered!

Students will develop their **SKILLS** in:

Biology -

- how to use a light microscope to observe, interpret and record cell structure
- the use of stains in microscopy
- how to Apply numeracy skills to calculate magnification
- evaluating the extent to which technology has increased our understanding of biology at the cellular level
- how to calculate % change
- how to apply numeracy skills by calculating the daily energy requirement of a healthy diet.
- how to differentiate between quantitative and qualitative data
- how to comment on accuracy and reliability of experiments and suggest improvements
- how to calculate averages e.g. the mean result
- how to describe and explain trends in data
- how to differentiate between discontinuous and continuous data
- how to draw line and bar graphs

Chemistry –

- how to work safely in a laboratory
- Students will also use models to further their understanding of particles and their behaviour
- to use their practical skills to work precisely and accurately in the laboratory
- how to apply numeracy skills to science models by writing and balancing symbol equations
- to demonstrate a range of fundamental chemical reactions safely and accurately in the laboratory
- investigative skills that they first learn in primary school by forming hypothesis, identifying variables, carrying out controlled investigations, analysing results, drawing conclusions and evaluating their investigative methods

Physics –

- how to use and manipulate mathematical formulae including appropriate use of units. This is the foundation of the GCSE course and students start making sure that they can do this as a priority

investigative skills that they first learn in primary School by; forming hypothesis, identifying variables, carrying out controlled investigations, analysing results, drawing graphs, drawing conclusions and evaluating their investigative methods

KASH Reporting Criteria in Science: Knowledge and Skills at KS3

Year 8:

Students will develop their **KNOWLEDGE** of:

Biology –

- aerobic and anaerobic respiration in living organisms necessary for life
- what it means to be 'fit and healthy' as students study the structure and function of the human skeleton and consider the effects of recreational drugs
- the genetic basis for variation
- the dependence of almost all life on Earth on the ability of photosynthetic organisms, such as plants and algae, to use sunlight in photosynthesis to build organic molecules

Chemistry –

- compounds and mixtures that they gained in year 7 and look at 2 separating techniques; simple distillation and chromatography
- the structure of the Earth and rock types
- metals and their properties, uses, behaviour and reactions as well as how they are extracted from the Earth
- Environmental Chemistry which involves learning about the impact of human contributions on the environment

Physics –

- the helical learning model. Students will cover the same general topics in year 8 as in year 7. Each unit generally starts as a refresher of year 7 knowledge before, deepening that understanding or delving into a new aspect of the topic
- the forces involved in motion. Students calculate and investigate different aspects of speed, velocity and acceleration. Students will review the basics of series and parallel circuits before moving on to more complex ideas of electricity such as static electricity and resistance.
- investigating energy changes, and students will learn what the differences are between energy, work and power. This will lead students on to the thermal physics topic, which after linking heat energy and temperature students will look at how energy can be transferred by conduction, convection and radiation.
- the waves unit. Students will revise what they learnt about waves in the light unit of year 7 and compare and contrast that learning with the new topic of sound waves
- gravitational forces, looking at the solar system from the point of view of the forces acing on people, satellites and planets

Students will develop their **SKILLS** in:

Biology -

- considering the discovery of DNA and beginning to understand that scientific methods and theories develop as earlier explanations are modified based on new evidence
- making predictions using scientific knowledge such as considering number and density of stomata on a leaf. Students will then further build on their investigative skills through selecting, planning and carrying out scientific enquiries

Chemistry –

- research as they find out about the extraction of metals. Students will also use models to help them understand abstract theory
- research as they independently learn about the impact of human contributions to pollution.
- Investigation and will further develop skills learnt in year 7 by forming hypotheses, identifying variables, carrying out controlled investigations, analysing results, drawing conclusions and evaluating their investigative methods

Physics –

- how to use and manipulate formulas, including appropriate use of units. Students develop these skills through practice in many new situations
- investigation by developing those learnt in year 7 by; forming hypotheses, identifying variables, carrying out controlled investigations, analysing results, drawing graphs, drawing conclusions and evaluating their investigative methods.

KASH Reporting Criteria in Science: Knowledge and Skills at KS3

Year 9:

Students will develop their **KNOWLEDGE** of:

Biology –

- learning that heredity is a process that transmits genetic information from one generation to the next
- considering a simple model of chromosomes, genes and DNA in heredity, including the part played by Watson, Crick, Wilkins and Franklin
- developing their understanding of variation, to identify that some organisms compete more successfully, driving natural selection.
- how enzymes act as biological catalysts and are responsible for processes such as photosynthesis and respiration that they learnt in Year 8

Chemistry –

- consolidating their understanding of some basic chemistry fundamentals learnt in earlier years. Students will quickly move on to learn about chemical reactions and build upon their knowledge of this topic first covered in year 7. Towards the end of the first term, students will be introduced to the structure **of** the atom and sub-atomic particles
- continuing to learn about the structure of atoms and discover how this links in with the arrangement of elements in the periodic table. Students will look at group 1, group 7 and transition group elements in more detail
- the rates of chemical reactions. Students will learn how to measure the speed of a chemical reaction using various techniques and how different factors can affect the rate
- building upon ideas first met in Year 7 when they look at different separating techniques including fractional distillation and chromatography

Physics –

- reviewing their understanding of forces and electricity then advancing that understanding using the contexts of Newton's laws of motion and generating electricity
- Simple Machines which covers the topics of pressure, moments and Hooke's Law. These are all essential basics for how this works and also present lots of mathematical skills that are the basis of much of Physics at KS4
- Nuclear Physics covering the basics of alpha, beta and gamma radiation as well as the processes involved in nuclear power
- starlight. Students will combine knowledge of cosmological principles such as the life cycle of stars and the Big Bang theory with how we know anything about space, the light emitted by stars

Students will develop their **SKILLS** in:

Biology –

- an ability to represent continuous and discontinuous data through considering variation between individuals
- developing their practical investigation skills through completing a piece of controlled assessment. They will select, plan and carry out the scientific enquiries to test hypotheses, including identifying independent, dependent and control variables
- developing their sampling techniques and record observations through the

‘Ecology and Environment’ topic

Chemistry –

- learning about several different types of chemical reactions, which involve using practical skills and teamwork in order to carry out reactions safely
- carrying out experiments in order to investigate rates of reactions. They will focus on analysing data and interpreting graphs. The students also use conventional models to learn about atomic structure

Physics –

- the practical skills of previous years looking at forces and electric circuits, and develop practical skills involving beams of light, springs and pivots. The expectations of how the data is presented (e.g. table of results and graphs) is to KS4 standard
- calculation - students’ skills are also developed through the practise of various formulae

Foundation Stages – Assessment Criteria

Science

Foundation Stages in Science – Assessment Criteria at KS3

SCIENCE – BIOLOGY

Pre-Foundation Stage

- Students use their knowledge about living things to describe the basic conditions [for example, a supply of food, water, air, light] that animals and plants need in order to survive.
- They **recognise** that living things grow and reproduce through the study of plant, animal reproduction. Students should be able to name the main organs involved in plant and animal reproduction.
- They sort living things into groups, using simple features. They describe the basis for their groupings [for example, number of legs, shape of leaf]. Identifying objects as living or non-living using MRSGREN.
- They **recognise** that different living things are found in different places [for example, ponds, woods].
- Students use their knowledge and understanding of basic life processes [for example, growth, reproduction] when they **describe** differences between living and non-living things.
- Recognise and provide simple explanations for changes in living things [for example, diet affecting the health of humans or other animals, lack of light or water altering plant growth, drug and alcohol affecting growth of foetus].
- They **identify** ways in which an animals and plants are suited to their environment [for example, a fish having fins to help it swim, Cacti having spines].

Foundation Stage 1

- Students **describe** some processes and phenomena related to organisms, their behaviour and the environment, drawing on scientific knowledge and understanding and using appropriate terminology, for example using food chains to describe feeding relationships in terms of transfer of energy between plants and animals in a habitat. Plants requiring sunlight as a producer in order to be the source of chemical energy for other organisms for respiration.
- They recognise that evidence can support or refute scientific ideas, such as in the identification and grouping of living things.
- They recognise some applications and implications of science, such as the use of predators to control pest populations. The use of pesticides on crops leading to bioaccumulation. Identify a way to treat bacterial infections through antibiotics.

Foundation Stage 2

- Students **describe** processes and phenomena related to organisms, their behaviour and the environment, drawing on abstract ideas and using appropriate terminology, for example the main functions of plant and animal organs and how these functions are essential and give examples of organ systems which could include; the circulatory, respiratory and digestive system for animals and the main organs of a flowering plant related to reproduction.
- They **explain** processes and phenomena, in more than one step or using a model, such as the main stages of the life cycles of humans and flowering plants, describe the route that food takes through the digestive system.
- They **apply** and use knowledge and understanding in familiar contexts, such as different organisms being found in different habitats because of differences in environmental factors, for example give a range of reasons why a camel can live in a hot environment and a polar bear to live in a cold environment.
- They **recognise** that both evidence and creative thinking contribute to the development of scientific ideas, for example the work of Carl Linnaeus on developing a system for classifying living organisms.
- They **describe** applications and implications of science, such as solving some of the health problems that arise when organ damage occurs.

Foundation Stage 3

- Students **describe** processes and phenomena related to organisms, their behaviour and the environment, using abstract ideas and appropriate terminology, for example simple cell structure and function. Students can use the word equation for photosynthesis and respiration.
- They take account of a number of factors or use **abstract** ideas or models in their explanations of processes and phenomena, such as environmental factors affecting the distribution of organisms in habitats. Describe how a model lung can explain the mechanism of breathing and its importance for providing a reactant needed for respiration.
- They **apply** and use knowledge and understanding in unfamiliar contexts, such as a food web in a habitat. Identify the different organs within an organism and use them to explain the different organ systems and their importance.
- They **describe** some evidence for some accepted scientific ideas, such as the causes of variation between living things for example; the research done by Watson and Crick. A comparison can be made between creationism and evolution and the evidence for each described.
- They **explain** the importance of some applications and implications of science, such as the use of selective breeding, an explanation for bioaccumulation, Eutrophication and their impact on the environment and the organisms living there.

Foundation Stage 4

- Students **describe** a wide range of processes and phenomena related to organisms, their behaviour and the environment, using abstract ideas and appropriate terminology and sequencing a number of points, for example recalling the balanced symbol equation for respiration and photosynthesis and drawing a pyramid of numbers and biomass using data provided.
- They make links between different areas of science in their explanations. They apply and use more abstract knowledge and understanding, in a range of contexts, such as inherited and environmental variation. **Explain** the use of enzymes in digestion and give an example of an enzyme in the human body. **Describe** how carbon can move between living organisms and the atmosphere.
- They **explain** how evidence supports some accepted scientific ideas, such as the structure and function of cells. They **explain**, using abstract ideas where appropriate, the importance of some applications and implications of science for example the implication of antibiotic resistance on health care. **Explore** the ethical issues surrounding subjects such as; cloning, genetic engineering.

Foundation Stage 5

- Students demonstrate **extensive** knowledge and understanding related to organisms, their behaviour and the environment. They use and apply this effectively in their descriptions and explanations, identifying links between topics, for example relating cellular structure of organs to their associated life processes. How organ systems work together for the functioning of the human body for example; the circulatory and respiratory systems.
- They **interpret**, **evaluate** and **synthesise** data from a range of sources and in a range of contexts, for example environmental data from fieldwork, using quadrats to estimate populations and biodiversity. Interpreting and synthesising data for predator-prey relationships, the effect of temperature and pH on enzymes.
- They show they understand the relationship between evidence and scientific ideas, and why scientific ideas may need to be changed, for example the short-term and long-term effects of pollution and the links to global warming. Explain how scientific ideas have changed, based on experimental evidence, for example Van Helmont.
- They **describe** and **explain** the importance of a wide range of applications and implications of science, such as relating photosynthesis and respiration to the cycling of carbon from living to non-living things including how carbon can be locked up, e.g: Fossil Fuels and carbon sinks. Explain the impact of deforestation, increased population, and combustion on levels of carbon in the atmosphere.

Beyond Foundation Stage

- Students demonstrate both breadth and depth of knowledge and understanding of organisms, their behaviour and the environment. They apply this effectively in their descriptions and explanations, for example; explaining the advantage of different forms of chlorophyll for photosynthesis. The ability to explain

why different types of cells contain different organelles. For example, the need for muscle cells to contain many mitochondria.
- They interpret, evaluate and synthesise data, from a range of sources in a range of contexts, and apply their understanding to a wide range of biological systems.
- They demonstrate an understanding of how scientific knowledge and understanding changes, building on processes such as questioning, investigating and evidence-gathering, for example in the study of global climate change through manipulating data to identify trends and suggest correlation between data.
- They describe and explain the importance of a wide range of applications and implications of science in familiar and unfamiliar contexts, such as addressing problems arising from global climate change, explaining in detail the impact on environment, economic and social issues arising. Suggest and explain how problems can be combatted by science. For example, cloning pigs for human transplants, genetically engineering crops to help third world problems, producing biofuels for a sustainable resource

Exceptional Performance

- Students must be working consistently above and beyond all the descriptors listed above.

SCIENCE – CHEMISTRY

Pre-Foundation Stage

Students identify a range of common materials and know about some of their properties. They describe similarities and differences between materials. They sort materials into groups and describe the basis for their groupings in everyday terms [for example, shininess, hardness, smoothness].

They describe ways in which some materials are changed by heating or cooling or by processes such as bending or stretching.

Students use their knowledge and understanding of materials when they describe a variety of ways of sorting them into groups according to their properties.

Examples include: elements, rocks, metals etc.

They explain simply why some materials are particularly suitable for specific purposes [for example, glass for windows, copper for electrical cables].

They recognise that some changes [for example, the freezing of water] can be reversed and some [for example, the baking of clay] cannot, and they classify changes in this way.

Foundation Stage 1

Students recall keywords when supplied with a definition

Students describe some processes and phenomena related to materials, their properties and the Earth, drawing on scientific knowledge and understanding. For example;

- Describing changing state by using scientific terminology such as freezing, melting etc.

- Describing how a sedimentary rock is formed,
- Describing observations of a chemical reaction,
- Describing properties e.g. malleable, brittle, high melting point etc.

Students recognise that evidence can support or refute scientific ideas, such as;

- The classification of reactions as reversible and irreversible.
- Brownian motion supports the theory of atoms.
- Chemical tests (e.g. limewater) can be used to identify products made in a chemical reaction.
- An increase in temperature supports the idea that chemical reactions release energy.
- A change in indicator colour identifies acids, alkalis and neutral solutions

Students recognise some applications and implications of science, such as;

- The safe use of acids and alkalis (implications are skin burns and harmful to eyes)
- Plants can be used as medicines
- Limestone is used to make building materials, statues and other useful products (e.g. cement, toothpaste etc.)

Foundation Stage 2

Students describe processes and phenomena related to materials, their properties and the Earth, drawing on abstract ideas and using appropriate terminology, for example;

- Describe different types of weathering of rocks.
- Describing changing state in terms of particles.
- Describing observations of a chemical reaction and state what causes these observations.
- Describing combustion of fuels, using ideas about reacting with oxygen and energy being released.
- Describe a pattern in reactivity by drawing on the outcomes of displacement reactions.
- Describing elements, compounds and mixtures using particle diagrams
- Identifying an acid or alkali using indicators

They explain processes and phenomena, in more than one step or using a model, such as;

- Using a diagram to explain how sedimentary rocks are formed.
- Drawing a shell diagram to represent an atom.
- When provided with the names of reactants and products, construct a word equation to show what happens in a chemical reaction.
- Explaining melting, evaporating etc. using the particle model.

They recognise that both evidence and creative thinking contribute to the development of scientific ideas, such as;

- Basing separation methods for mixtures on physical and chemical properties.
- Dancing pollen grains and creative thinking helped develop the theory of atoms.
- Patterns helped Mendeleev develop the periodic table.
- The appearance of rocks is used to develop ideas about how they’re made.

They describe applications and implications of science, such as;

- The uses of metals based on their specific properties
- The benefits and drawbacks of the use of fossil fuels.
- The advantages and disadvantages of limestone quarrying.

Foundation Stage 3

Students describe processes and phenomena related to materials, their properties and the Earth, using abstract ideas and appropriate terminology, for example;

- Describe different types of weathering of rocks.
- Describe how different types of rocks are formed.
- Describing changing state in terms of particles.
- Describing observations of a chemical reaction and state what causes these observations.
- Describing combustion of fuels, using ideas about reacting with oxygen and energy being released.
- Describe a pattern in reactivity by drawing on the outcomes of displacement reactions.
- Describe elements as solid, liquid or gases based on melting and boiling points.

They take account of a number of factors or use abstract ideas or models in their explanations of processes and phenomena, for example;

- The deposition of sediments and their formation into rocks.
- Drawing a shell diagram to represent an atom.
- Using observations or use reactants **or** products **provided** to construct a word equation in order to model a chemical reaction.
- Explaining melting, evaporating etc. using the particle model.
- Use chemical formula to deduce the elements present and the number of atoms.

They explain the importance of some applications and implications of science, for example;

- The production of new materials with specific desirable properties
- The separating of crude oil to obtain useful fuels and other products
- Uses of carbonates to reduce indigestion
- Evaluate the advantages and disadvantages of Quarrying of limestone

Foundation Stage 4

Students describe a wide range of processes and phenomena related to materials, their properties and the Earth, using abstract ideas and appropriate terminology and sequencing a number of points, for example

- Describing the rock cycle.
- Describing the evolution of the earth's atmosphere.
- Describing how global warming or acid rain is caused.
- Describing how salt can be extracted from rock salt.
- Describe and explain the process of chromatography

They make links between different areas of science in their explanations, such as

- Between the nature and behaviour of materials and their particles.
- Explaining melting, evaporating etc. using the particle model and ideas about energy breaking forces between particles.
- Using ideas about changing states and the particle model to explain how distillation works

They apply and use more abstract knowledge and understanding, in a range of contexts, such as;

- The particle model of matter.
- Symbols and formulae for elements and compounds.
- Naming compounds from chemical formula.
- Using balanced symbol equations to represent chemical reactions.

They explain how evidence supports some accepted scientific ideas, such as

- Reactions of metals with acid or water support the reactivity series of metals.
- Reflection of alpha particles supports the idea of an atom having a nucleus.

They explain, using abstract ideas where appropriate, the importance of some applications and implications of science, such as the need to consider the availability of resources, and environmental effects, in the production of energy and materials.

Foundation Stage 5

Students demonstrate extensive knowledge and understanding related to materials, their properties and the Earth. They use and apply this effectively in their descriptions and explanations, identifying links between topics, for example

- Relating mode of formation of rocks to their texture and mineral content.
- Relating increasing carbon dioxide levels to diminishing ice in the North Pole and increasing temperature of the Earth.
- Students link understanding of atoms and bonds with energy and temperature changes to describe reactions as exothermic or endothermic.
- Students use ideas about particles and energy to explain why increasing temperature speeds up the rate of a chemical reaction.
- Describe and explain the process of continental drift.

They represent common compounds by chemical formulae and use these formulae to form balanced symbol equations for reactions.

They show they understand the relationship between evidence and scientific ideas, and why scientific ideas may need to be changed. For example;

- Newlands periodic table was changed due to Mendeleev's version including gaps for undiscovered elements.
- Rutherford's gold leaf experiment disproved the plum pudding model.

They describe and explain the importance of a wide range of applications and implications of science. (Consistent level 6's for this thread would suggest that students and explain a **wide range** of applications and implications)

Beyond Foundation Stage

Students demonstrate both breadth and depth of knowledge and understanding of materials, their properties and the Earth, for example the different timescales over which rock formation and deformation take place.

They apply this effectively in their descriptions and explanations, identifying links and patterns within and between topics, for example relating the properties of materials to the nature of their constituent particles.

They interpret, evaluate and synthesise data from a range of sources in a range of contexts, and apply their understanding to a wide range of chemical systems, such as explaining chemical behaviours that do not fit expected patterns.

They demonstrate an understanding of how scientific knowledge and understanding changes, building on processes such as questioning, investigating and evidence-gathering.

They describe and explain the importance of a wide range of applications and implications of science in familiar and unfamiliar contexts.

Exceptional Performance

Students must be working consistently above and beyond all the descriptors listed above.

SCIENCE – PHYSICS

Pre-Foundation Stage

Students communicate observations of changes in light, sound or movement that result from actions for example,

- switching on a simple electrical circuit,
- pushing and pulling objects

They recognise that sound and light come from a variety of sources and name some of these.

- TV/ radio
- Torch
- Sun
- People

Students know about a range of physical phenomena and recognise and describe similarities and differences associated with them for example

- sound, light and water waves

They compare the way in which devices for example,

- bulbs
- motors
- resistors

work in different electrical circuits.

They compare the

- brightness or colour of lights
- the loudness or pitch of sounds from looking at a waveform.
- the current or voltage from looking at ammeters or voltmeters

They compare the movement of different objects in terms of speed or direction.

Students use their knowledge and understanding of physical phenomena to link cause and effect in simple explanations for example,

- a bulb failing to light because of a break in an electrical circuit,
- the direction or speed of movement of an object changing because of a push or a pull,
- an object being weightless because of distance from a gravitational field due to a massive object such as a planet.

They begin to make simple generalisations about physical phenomena for example,

- explaining that sounds they hear become fainter the further they are from the source
- or gravitational fields become fainter the further they are from the source

- or EM radiation become fainter the further they are from the source

Foundation Stage 1

Students describe some processes and phenomena related to energy, forces and space, drawing on scientific knowledge and understanding and using appropriate terminology, for example:

- The observed position of the sun in the sky over the course of a day.
- Describe what is emitted from the nucleus in radioactive decay.

They recognise that evidence can support or refute scientific ideas,

- such as sounds being heard through a variety of materials.
- recognise CMBR and Redshift support big bang theory.
- moons of Jupiter and phases/ size of Venus supports heliocentric theory and disproves geostationary.

They recognise some applications and implications of science, such as

- the use of electrical components to make electrical devices.
- magnetic fields and moving wires generates electricity in power stations.
- link density to materials needed to make boats.
- link sound topic to how ear defenders work

Foundation Stage 2

Students describe processes and phenomena related to energy, forces and space, drawing on abstract ideas (an idea given in the question or reading off a graph) and using appropriate terminology, for example

- 'balanced forces' or 'unbalanced forces'. Linked to gradient of a graph

They explain processes and phenomena, in more than one step such as

- the operation of an electric bell,
- convection currents,
- the weight of an object on a see-saw (moments),
- life cycle of a star.

They explain processes and phenomena, using a model, such as

- the length of a day or a year.
- Current and voltage in circuits.

They apply and use knowledge and understanding in familiar contexts. E.g.

- moments on a see saw,
- convection in a room or oven,
- wavelength of a water wave
- conduction in a metal rod.
- reflection in a mirror

They recognise that both evidence and creative thinking contribute to the development of scientific ideas, such as

- objects being seen when light from them enters the eye.
- big bang theory

- heliocentric vs geocentric.

They describe applications and implications of science, such as

- the ways sound can be produced and controlled, for example in musical instruments.
- uses of alpha, beta and gamma radiation.
- uses of EM radiation

Read data from graphs

Use formula as given in data sheet e.g. force from f=ma not m from f=ma

Foundation Stage 3

Students describe processes and phenomena related to energy, forces and space, using abstract ideas (they give the idea not given in question or shown on graph) and appropriate terminology, for example:

- Electric current as a way of transferring energy.
- Ionization of atoms by rubbing or ionizing radiation.
- Balanced or unbalanced forces linked to acceleration or constant speed with no hint given

They take account of a number of factors in their explanations of processes and phenomena, for example

- in the relative brightness of stars and planets (due to size and distance).
- increased strength electromagnet because of number or turns or current or iron core.

They also use abstract ideas or models, for example

- sustainable energy sources
- the refraction of light (model as one side of car slows down in mud or line of soldiers marching).

They apply and use knowledge and understanding in unfamiliar contexts.

- conduction in penguins feet,
- EM radiation wavelength, amplitude etc.,
- reflection linked to phases of the moon
- convection at the see side.
- moments balancing a crane.

They describe some evidence for some accepted scientific ideas,

- (conservation of energy) such as the transfer of energy by light, sound or electricity, a
- (wave model of light) the refraction and dispersion of light.

They explain the importance of some applications and implications of science, such as

- the responsible use of unsustainable sources of energy.
- safety when using Ionising radiation
- safety with loud noise

Manipulate formulas to change the subject and get correct numerical answer.

Get correct unit (just one term m, s, kg, N etc. not m/s or Nm)

Foundation Stage 4

Students describe a wide range of processes and phenomena related to energy, forces and space, using abstract ideas and appropriate terminology and **sequencing** a number of points, for example

- how energy is transferred by radiation or by conduction.
- electric bell workings
- life of different stars

They make links between different areas of science in their explanations, such as

- between electricity and magnetism.
- static electricity and ionising radiation
- pressure (hydraulics) and moments

They apply and use more abstract knowledge and understanding in a range of contexts, such as

- the appearance of objects in different colours of light.
- resistance in parallel circuits

They explain how evidence supports some accepted scientific ideas, such as

- the role of gravitational attraction in determining the motion of bodies in the solar system.

They explain, using abstract ideas where appropriate, the importance of some applications and implications of science, such as

- the uses of electromagnets
- uses of transformers.

Use compound measures appropriately. Such as

- m/s for speed,
- Nm for moment
- N/m^2 for pressure

Foundation Stage 5

Students demonstrate extensive knowledge and understanding related to energy, forces and space, for example

- the passage of sound waves through a medium.
- flow of current in a parallel circuit

They use and apply this effectively in their descriptions and explanations, identifying links between topics.

They interpret, evaluate and synthesise data from a range of sources and in a range of contexts. They show they understand the relationship between evidence and scientific ideas, and why scientific ideas may need to be changed, such as

- the developing understanding of the structure of the solar system. [Heliocentric or geocentric]

They describe and explain the importance of a wide range of applications and implications of science, such as

- relating the dissipation of energy during energy transfer to the need to conserve limited energy resources.

They carry out multi-step calculations

- force at different side of a moment system.
- force at different side of hydraulic system
- initial or final speed rather than change in speed.
- more than 3 term questions

Beyond Foundation Stage

Students demonstrate both breadth and depth of knowledge and understanding of energy, forces and space. They apply this effectively in their descriptions and explanations, identifying links and patterns within and between topics, for example

- understanding how models like the particle model are useful in explaining physical phenomena,
    - such as how sweating causes cooling.
    - density
    - speeds of sound

They interpret, evaluate and synthesise data from a range of sources in a range of contexts and apply their understanding to a wide range of data on energy efficient physical systems.

They demonstrate an understanding of how scientific knowledge and understanding changes, building on processes such as questioning, investigating and evidence gathering, for example through the role of artificial satellites and probes in communications and space exploration and theories about the start of the universe, big bang or steady state theory.

They describe and explain the importance of a wide range of applications and implications of science in familiar and unfamiliar contexts, such as alternative methods of electricity generation.

Exceptional Performance

Students must be working consistently above and beyond all the descriptors listed above.

Attitudes and Habits

At Laurus Cheadle Hulme we expect all of our students to display the following **Attitudes and Habits in all of their subjects**.

Development in each area will be judged by the subject teacher as either, **emerging, establishing, secure, enhancing or excelling** dependant on the progress being made.

ATTITUDES

- Ready to learn and quick to settle
- Takes responsibility for learning
- Has a thirst for learning
- Willing to work independently with focus/without teacher input
- Willing to actively participate in a variety of situations
- Seeks to develop learning by questioning
- Takes risks to further learning
- Maintains a positive relationship with others
- Shows respect at all times
- Always puts effort into learning/classwork/P & P
- Understands the importance of working to deadlines
- Takes responsibility for their own and others safety in school/classroom/learning environment
- Meets school expectations of behaviour/learning/attendance

HABITS

- Prepared to learn
- Fully equipped for lessons
- Prepared for assessment
- Actively engages with learning
- Always responds to targets/feedback
- Seeks to demonstrate knowledge through answering questions
- Seeks opportunities to be challenged
- Able to work independently with focus
- Willing to ask for help if needed and knows where to find help
- Follows all instructions
- Work is well organised
- P & P is always completed
- Regularly meets deadlines
- Seeks opportunities to participate in extra-curricular activities and/or roles of responsibility
- Attendance follows school's expectations