Hope SENTAMU LEARNING TRUST

Curriculum Progression Pathway for Science

Subject Intent:
Our vision for Science at Hope Sentamu Learning Trust is a curriculum that is inclusive and aspirational for all students, which develops an appreciation of the uses and significance of science to society and their own lives as well as the contribution that science has made in the past.

Our ambitious five year science curriculum is spiral and iterative in nature allowing for students to revisit, reinforce and build upon concepts that run throughout our 'big ideas' (BEST University of York). The most important concepts in the three scientific disciplines, eg. cells, particles and energy run as threads through the whole curriculum. Our curriculum is also underpinned by the substantive and disciplinary knowledge that students are expected to master based on the KS3 National Curriculum and AQA Specifications.

Using the National Curriculum as its key framework, supported by evidence based research from BEST evidence science (University of York) and the wealth of knowledge and experience across the trust we have produced a carefully sequenced learning strategy that builds on prior knowledge allowing for pupils' schema to develop from novice to expert. In each year the three science disciplines are interleaved to provide ample opportunity for retrieval of key concepts and develop strong interdisciplinary links.

Why is the study of Science important?

Studying science allows students to explain the material world and develop a sense of excitement and curiosity about natural phenomena.
By learning about the practices of science students will appreciate the nature and status of scientific knowledge; how it has developed over time and how ideas can be adapted when new evidence is available.

As students learn science, they will also learn about its uses and significance to society and their own lives. It is not just a subject to be covered in school and then forgotten as students move into the next part of their lives. A good understanding of the three scientific disciplines, Biology, Chemistry and Physics, allows all of us to make sense of information that we meet in our everyday lives. From health and medical information so that we can live healthy lives, the materials that we encounter and why, as humans, we are endeavouring to make changes to the way we manufacture and produce energy to reduce our impact on our world, to making sense of information presented to us in the media (social media, newspapers, television or other sources) so that we can

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appreciate when it has been oversimplified or provided by an unreliable or biased source.

By working towards qualifications in science subjects, students gain highly regarded academic qualifications that provide the foundation for a range of diverse and valuable careers. Whether a student achieves GCSE and then moves into other areas or decides to take their science study to a higher level, qualifications in science or science related subjects are the foundation for a very diverse and interesting range of careers that make a significant contribution to our world.

What skills will the study of Science teach you?

- Curiosity about the material world
- Analytical thinking
- Application of mathematical techniques
- Data analysis
- Communication of information for a variety of audiences, including extended writing
- Critical thinking
- Attention to objectivity and concern for accuracy, precision, repeatability and reproducibility
- Understanding that scientific methods and theories develop over time
- Ability to evaluate risk
- Ability to use equipment safety and correctly

What will you know and understand from your study of Science?

Biology

- Structure and function of living organisms
- Materials and cycles of energy
- Interactions and interdependencies
- Genetics and evolution

Chemistry

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- The particulate nature of matter
- Atoms, elements and compounds
- Pure and impure substances
- Chemical reactions
- Energetics
- The Periodic table
- The reactivity series
- Properties of materials
- The Earth and atmosphere

Physics

- Energy and energy changes and transfers
- Motion and forces
- Waves
- Electricity and electromagnetism
- Matter
- Space physics

How does your study of Science support your learning in other subjects?

As a result of studying Science you will develop your skills in communication that are needed for all your subjects. The numeracy skills developed in mathematics are used widely in many subjects and developed and practised in Science. Knowledge and skills developed in Science are transferable to subjects such as PE, Geography, History, Music, Art, Health and Social Care, Hair and Beauty and Technology subjects.

Studying science provides repeated encounters of content covered in other subjects, allowing you to retrieve and develop your wider understanding of these. For example climate change, the causes and impact, are covered in Biology, Chemistry and Physics as well as Geography. The emphasis on writing scientific reports and articulating ideas clearly aids literacy and communication skills, benefiting English and other humanities subjects. This holistic approach strengthens pupils' overall academic development and prepares them for cross-curricular challenges.

How can you deepen your understanding of Science?

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Our Science curriculum helps pupils deepen their understanding of science by building a strong foundation of key scientific concepts, which are progressively developed and interlinked across topics and years. It encourages pupils to think critically, apply their knowledge to solve real-world problems, and understand the nature of scientific enquiry. By focusing on practical investigations, data analysis, and the development of hypotheses, the curriculum fosters curiosity and equips pupils with the skills to explore complex ideas. At KS4, it consolidates prior learning while introducing more advanced concepts, enabling pupils to appreciate the relevance of science in modern society and preparing them for further study or careers in scientific fields.

How can Science support your future?

Science provides the foundation for a range of diverse and valuable careers that are crucial for the economic, environmental and social development of the UK and the world.
There are obvious careers that link directly to the study of GCSE Science, 'A' level Sciences and higher level Science qualifications, e.g medical careers, research scientists, engineering.
However, there are many, less obvious, careers that rely on a good understanding of Science. Games designers must have a detailed understanding of forces to ensure that virtual interactions between objects reflect the reality of how they would in the real world.
The National Careers Service provides careers information, advice and guidance as a starting point to find links to content covered in the Science curriculum.
https://nationalcareers.service.gov.uk/

Exam board used in Y10 & Y11

AQA Combined Science: Trilogy 8464 AQA Biology 8641 AQA Chemistry 8642 AQA Physics 8643

Big ideas (BEST evidence science - University of York):

Biology - B: The cellular basis of life, Heredity and life cycles, Organisms and their environments, Variation, adaptation and evolution, Health and disease

Chemistry - C: Substances and properties, Particles and structure, Chemical reactions, Earth chemistry, Dynamic earth

Physics - P: Matter, Forces and motion, Sound, light and waves, Electricity and magnetism, Earth in space

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	Year 7	Year 8	Year 9	Year 10	Year 11
Autumn 1	**Materials (Substances and properties) - C** Key concepts: ● Differences between materials ● Composite materials ● Ceramics ● Polymers **Particles (Particles and structure) - C** Key concepts: ● States of matter ● Melting and freezing ● Boiling points ● Evaporation ● Diffusion **Cells (The cellular basis of life) - B** Key concepts: ● Microscopy ● Animal and plant cells ● Specialised cells ● Diffusion in cells ● Unicellular organisms	**Health and lifestyle (Health and disease) - B** Key concepts: ● Healthy diet - food groups ● Food tests ● Unhealthy diet ● Digestive system ● Bacteria and enzymes ● Drugs ● Alcohol ● Smoking **The periodic table (Chemical reactions) - C** Key concepts: ● The periodic table ● Metals and non-metals ● Groups in the periodic table ● Displacement reactions **Electricity (Electricity and magnetism) - P** Key concepts:	**Cell Biology (The cellular basis of life) - B** Key concepts: ● Microscopy including calculations ● Eukaryotes and prokaryotes ● Cell specialisation and differentiation ● Diffusion ● Osmosis ● Active transport ● Exchange surfaces ● SA: vol calculations **Mixtures and separation (Substances and properties) - C** Key concepts: ● States of matter ● state symbols + changes of state ● Pure and impure ● Formulations ● Mixtures - Filtration ● Evaporation ● Crystallisation ● Distillation + fractional distillation ● Paper	**Communicable disease (Health and disease) - B** Key concepts: ● Communicable diseases and preventing spread of disease. ● Viral, bacterial, fungal, protist diseases. ● Human defence responses ● Vaccination ● Antibiotics and painkillers ● Discovering drugs **Ions (Particles and structure) - C** Key concepts: ● Atoms into ions ● Ionic bonding ● Giant ionic structures Empirical formula ● Properties of ionic compounds ● Metallic bonding ● Properties of metals	**Inheritance (Heredity and life cycles) - B** Key concepts: ● DNA and the genome ● Sexual and asexual reproduction ● Meiosis ● Inheritance in action: Inheriting sex ● Inheriting other features ● Inherited disorders ● Embryo screening **Forces in motion (Forces and motion) - P** Key concepts: ● Speed ● Velocity ● Distance - time relationship ● Acceleration ● Acceleration ● Newton's first second and third law ● Stopping distance and reaction time ● Factors affecting braking distance ● Momentum

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	• Brownian motion • Gas pressure	• Static electricity • Circuits • Current and series circuits • Current and parallel circuits • Potential difference in series • Potential difference in parallel circuits • Resistance • Measuring resistance	chromatography • Rf values • Identification of common gases	and alloys **Electrical circuits (Electricity and magnetism)- P** Key concepts: • Moving charge and current • Electrical circuits/incl symbols • Potential difference, resistance and the VIR relationship • Investigate current and potential difference graphs for different components. • Energy and power in electrical circuits	• Conservation of momentum **Rates of reaction (Chemical reactions) - C** Key concepts: • Calculating rates of reaction • Catalysts • Reversible reactions • Equilibrium **Year 11 mock - Paper 1**
Autumn 2	**Energy 1 (Matter, forces + motion) - P** Key concepts: • Energy and energy stores • Conservation of energy • Insulators • Convection • Radiation	**Animal and plant processes (The cellular basis of life) - B** Key concepts: • Photosynthesis • Leaf adaptations • Transport in plants • Aerobic respiration • Anaerobic respiration	**Conservation and dissipation of energy (Matter) - P** Key concepts: • Energy stores and systems • Work done and energy transfer • Changes in energy - GPE, KE, elastic potential	**Health and non-communicable disease (Health and disease) - B** Key concepts: • Health and disease • Cancer • Smoking • Diet and exercise • Alcohol and other carcinogens	**Variation and evolution (Variation, adaptation and evolution) - B** Key concepts: • Variation • Evolution and natural selection • Antibiotic resistance • Evidence for evolution • Fossils

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	Body systems (The cellular basis of life) - B Key concepts: ● Levels of organisation ● Gas exchange ● Breathing ● Skelton ● Joints ● Muscles **Separation techniques (Substances and properties) - C** Key concepts: ● Pure substances and mixtures ● Solutions ● Solubility ● Filtration and evaporation ● Distillation ● Chromatography	● Fermentation **Chemical reactions (Chemical reactions) - C** Key concepts: ● What are chemical reactions? ● Chemical formulae and word equations ● Conservation of mass and oxidation ● Catalysts ● Endo and exothermic reactions ● Thermal decomposition	● Energy dissipation ● Energy and efficiency ● Energy consumption in devices ● Power and appliances **Cell division (Heredity and life cycles) - B** Key concepts: ● DNA and the genome ● Chromosomes ● Mitosis and the cell cycle ● Growth and differentiation ● Stem cells ● Stem cells and ethics	**Chemical changes (Chemical reactions) - C** Key concepts: ● Reactions of acids with metals ● Neutralisation of acids ● Salt Production ● Preparation of salts ● pH scale and neutralisation ● Weak and strong acids **Electricity in the home (Electricity and magnetism) - P** Key concepts: ● Alternating current ● Cables and plugs ● Electrical power and PD ● Electrical currents and energy transfers **Plant Biology (The cellular basis of life) - B** Key concepts:	● Extinction ● Selective breeding ● Genetic engineering and ethics ● Classification of living organisms **The Earth's resources (Earth chemistry) - C** Key concepts: ● Finite and renewable resources ● Water safe to drink ● Treating wastewater ● Extracting metals from ores ● Life cycle assessments ● Reduce, reuse and recycle

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				• Plant tissues • Transport • Photosynthesis • Rates of photosynthesis - limiting factors • Rate of photosynthesis - Inverse square law • Uses of glucose from photosynthesis **Chemical calculations (Chemical reactions) - C** Key concepts: • Conservation of mass and balanced chemical equations • Relative formula mass and % by mass in a compound • Mass changes when a reactant or product is a gas • Mass changes when a reactant or product is a gas • Moles and	

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				avogadro's/RFM to moles vice versa ● Amounts of substances in equations/reacting masses ● Using moles to balance equations ● Concentrations ●	
Spring 1	**End point assessment 1** **Forces (Forces and motion) - P** Key concepts: ● Squashing and stretching ● Drag and friction ● Streamlining ● Balanced and unbalanced forces	**End point assessment 1** **Motion and pressure (Matter + forces and motion) - P** Key concepts: ● Speed ● Motion graphs ● Pressure in gases ● Pressure in liquids ● Pressure on solids ● Levers ● Turning forces **Adaptation and inheritance (Heredity and lifecycles and Variation, adaptation**	**End point assessment 1** **Atomic structure (Particles and structure) - C** Key concepts: ● Atoms, elements and compounds ● Chemical equations - and balancing equations ● Structure of the atom ● Atoms - mass and atomic number ● Relative atomic mass and isotopes ● Electronic structure	**Forces in balance (Forces and motion) - P** Key concepts: ● Scalar and vectors ● Vector diagrams ● Contact and non-contact forces ● Gravity ● Resultant forces ● Forces and elasticity **Respiration (The cellular basis of life) - B** Key concepts: ● Aerobic respiration ● Anaerobic	**Electromagnetism (Electricity and magnetism) - P** Key concepts: ● Poles of a magnet ● Magnetic fields ● Strengths of electromagnets ● Flemings left hand rule ● Electric motors **Cycles and Biodiversity (Organisms and their environments) - B** Key concepts: ● How materials are cycled ● Carbon cycle

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		and inheritance) - B Key concepts: ● DNA and chromosomes ● Discovering DNA ● Variation ● Inheritance ● Competition ● Natural selection and evolution	● Development of the model of the atom **Energy by heating (Matter) - P** Key concepts: ● Energy transfers by heating - Conduction ● Insulators ● Heating and insulation homes **Energy resources (Matter) - P** Key concepts: ● Non renewable energy resources ● Renewable energy resources	respiration ● Response to exercise ● Metabolism and the liver **Extraction of metals (Chemical reactions) - C** Key concepts: ● The reactivity series Displacement reactions ● Oxidation and reduction ● Electrolysis	● Biodiversity ● Waste management ● Land use - include peat bogs ● Deforestation ● Global warming ● Maintaining biodiversity **Year 11 mock - Paper 2**
Spring 2	**Atoms, elements and compounds (Particles and structure) - C** Key concepts: ● Atoms ● Elements ● The periodic table ● Metals and	**Metals and acids (Chemical reactions) - C** Key concepts: ● Acids + alkalis ● Indicators - litmus ● Indicators - making red cabbage indicator	**Organisation and the digestive system (The cellular basis of life) - B** Key concepts: ● Principles of organisation ● The digestive system	**Waves (Sound, light, waves) - P** Key concepts: ● Transverse and longitudinal waves ● Properties of waves ● Types of electromagnetic waves	**Revision for GCSE**

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	non-metals ● Compounds ● Chemical formulae **Sound (Sound light and waves) - P** Key concepts: ● Waves ● Sound and energy transfer ● Loudness and pitch ● Detecting sound ● Echoes and ultrasound	● Universal indicator and the pH scale ● Neutralisation ● Neutralisation - making salt ● Acids and metals ● Metals and oxygen ● Metals and water ● Reactivity series ● Displacement reactions ● Extracting metals with carbon	● Enzymes. ● Making digestion efficient **The periodic table (Chemical reactions) - C** Key concepts: ● Development of the periodic table ● Group 1 ● Group 7 ● Displacement reactions ● Group 0 ● Transition metals	● Properties of electromagnetic waves ● Reflection and refraction ● Uses and applications of electromagnetic waves **The nervous system and hormonal control (The cellular basis of life) - B** Key concepts: ● Hormones in human reproduction ● Hormones in human reproduction - interactions of hormones ● Contraception ● The use of hormones to control fertility ●	
Summer 1	**Reproduction (Heredity and life**	**Light (Sound, light, waves) - P**	**Transport in animals (The cellular basis of**	**Covalent molecules (Particles and**	

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	cycles) - B Key concepts: ● Puberty and adolescence ● Human reproductive systems ● Fertilisation ● Development of a foetus ● Menstrual cycle ● Flowers and pollination ● Fertilsation and germination ● Seed dispersal **Energy 2 (Matter) - P** Key concepts: ● Power and energy ● Energy in the home ● Energy in food ● Non renewable energy ● Renewable energy	Key concepts: ● Light ● Reflection ● Refraction ● The eye and pinhole cameras ● Colour **Ecosystems (Organisms and their environments) - B** Key concepts: ● Food chains and webs ● Disruption to food chains and webs ● Ecosystems	**life) - B** Key concepts: ● Blood ● Blood vessels ● The heart ● Helping the heart ● Coronary heart disease ● Breathing and gas exchange **The Earth's atmosphere (Earth chemistry) - C** Key concepts: ● History of the atmosphere ● The evolving atmosphere ● Greenhouse gases ● Global climate change ● Carbon footprint ● Atmospheric pollutants **Particle model and matter (Matter) - P** Key concepts: ● Density	**structure) - C** Key concepts: ● Properties of small molecules ● Covalent bonding ● Giant covalent structures - diamond, graphite, silica ● Fullerenes and graphene ● Polymers **Hydrocarbons (Substances and particles) - C** Key concepts: ● Crude oil, hydrocarbons and alkanes ● Fractional distillation ● Cracking and alkenes ● Complete and incomplete combustion **Energy changes (Chemical reactions) - C**	

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			• Internal energy • Specific heat capacity • Changes of state and specific latent heat • Particle motion in gases	Key concepts: • Exothermic and endothermic reactions • Reaction profiles • Bond energy calculations **Radioactivity (Matter) - P** Key concepts: • Structure of an atom + isotopes • The development of the model of the atom • Radioactive decay and nuclear radiation • Nuclear equations • Half life • Radioactive contamination	
Summer 2	**End point assessment 2** **Space (Earth in space) - P** Key concepts: • The spinning	**End point assessment 2** **Magnetism (Electricity and magnetism) - P** Key concepts:	**End point assessment 2** **Organisms and their environments (Organisms and their environments) - B**	**Revision and Year 10 mocks**	

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	Earth ● Our solar system ● Gravity ● Stars, galaxies and the universe ● Heating by the sun ● The Earth's tilt ● Seasons on Earth	● Magnetic forces ● Magnetic fields ● Electromagnets ● Electromagnet investigation ● Uses of Electromagnets ● Electric motors **The Earth (Dynamic Earth) - C** Key concepts: ● The earth ● The atmosphere ● Sedimentary rocks ● Igneous rocks ● Metamorphic rocks ● The rock cycle ● The carbon cycle ● Human impact and recycling ● Climate change	Key concepts: ● Food chains and webs ● Populations, communities, ecosystems ● Interdependence ● Biotic and abiotic factors ● Competition ● Adaptations ● Sampling techniques		