

TCEAT Curriculum & Assessment Overview: Science

Course description and overarching aims (Intent)

Scientific understanding is vital for students to understand the world around them and to drive change in the world. We have designed a curriculum that ensures students foster a sense of curiosity and creativity, whilst learning the essential aspects of scientific knowledge. Working backwards from where we wanted the students to be when they left our Trust, we have used GCSE (and, for our higher and advanced tiers, A level) criteria, as well as our understanding of what it means to be (and think like) a real world scientist to design a curriculum which builds upon prior learning, including KS1 and KS2 expected knowledge (for Year 7 and 8).

Curriculum model overview (Implementation)

How is our curriculum planned and why:

Content knowledge is built upon using a spiral approach, with fundamentals of scientific understanding learnt first. Concepts are then revisited and built on with greater detail. New concepts which require foundational understanding are introduced later, and finally concepts requiring linking multiple scientific ideas are introduced. We have designed our curriculum so that both science-specific and general skills are developed through repeated experience. Each repeated encounter increases the complexity (also a spiral approach) and, where appropriate, puts the content into new contexts, to support students' cognitive load.

Three tiers and three outcomes

Our curriculum is structured so that all students can access the appropriate level of support and challenge. There are three tiers (Core, Higher, Advanced) which cover the same key material at increasing levels of challenge. All lessons have three differentiated outcomes (labelled Gold/Silver/Bronze) at KS3 and KS4. At KS5, each lesson is differentiated into three outcomes. These allow the students to have a high ownership of their learning and a sense of purposeful progression. This means not only is it possible for all students to learn the same key content at a level appropriate to their current understanding, but it also allows students to move between tiers at any point with ease. The spiral nature of the curriculum results in students having the opportunity to develop further in each topic the next time the topic is revisited.

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Example:

LESSON OUTCOMES	CORE TIER	HIGHER TIER	ADVANCED TIER
Describe what a microscope does	Bronze		
Define magnification and resolution	Silver	Bronze	
Compare light and electron microscopes	Gold	Silver	Bronze
Explain how electron microscopy has increased understanding of cell parts		Gold	Silver
Calculate magnification			Gold

Assessment Objectives

We have overarching objectives which summarise the skills covered, or the handling of content involved. The internal school assessment system has integrated assessment objectives so that students can be aware of and consciously work on the different strands of content and skills within the subject /course. The internal school system uses the same objectives from Year 7 to Year 13 so that students can build the habit of subject specific self-review as a continuous process from KS3 to KS5

A01 Demonstrate knowledge and understanding

This requires students to remember and understand key scientific ideas, as well as scientific techniques and procedures. This fundamental skill is the foundation to using and developing scientific knowledge both theoretical and practical. It is essential enough time is spent to ensure this knowledge is secure in students' long term memory.

A02 Apply knowledge and understanding

This requires students to apply their knowledge and understanding of scientific ideas, as well as scientific techniques and procedures. By ensuring A01 is secure, students are able to apply their knowledge to known and unknown contexts, which will set them up for future learning, employment and understand the world around them.

A03 Analyse information and ideas

This requires students to interpret and evaluate scientific knowledge, such as experimental data, to make judgements and conclusions by drawing on their knowledge and understanding (A01). This also requires students to develop and improve experimental procedures such as method writing.

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		Year 7		Year 8			
		Q1-Q3	Q4	Q1	Q2	Q3	Q4
Advanced-Higher	A01	70	60	70	60	70	60
	A02/3	30	40	30	40	30	40
Higher-Advanced	A01	70	60	70	70	70	60
	A02/3	30	40	30	40	30	40
Core-Higher	A01	70	60	70	50	70	60
	A02/3	30	40	30	50	30	40

		Year 9	Year 10	Year 11	
		Q1-Q4	Q1-Q4	Q1	Q2-Q3
Advanced	A01		50	60	40
	A02/3		50	40	60
Advanced-Higher	A01	80	50	60	40
	A02/3	20	50	40	60
Core-Higher	A01	80	50	60	40
	A02/3	20	50	40	60

		Year 12	Year 13	
		Q1-4	Q1-2	Q3
Biology	A01	60	40	33
	A02/3	40	60	67
Chemistry	A01	40	40	40
	A02/3	60	60	60
Physics	A01	35	35	35
	A02/3	65	65	65

		Year 12
		Q1-3
Laboratory Science	A01	29
	A02	40
	A03	31

		Year 13
		Q1-Q3
PO1		102
PO2		70
PO3		41

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Knowledge:

- Substantive knowledge - all concepts, models, laws and theories of science
 - Atoms and Chemical Reactions
 - Forces and fields
 - Forces and their effects
 - Energy stores and energy transfers
 - Earth and the atmosphere
 - Space
 - Cells
 - Competition and ecosystems
 - Genetics
 - Evolution
- Disciplinary knowledge - How substantive knowledge is established through scientific enquiry:
 - Predicting cause and effect
 - Experiment design and risk assessment
 - How and why we use scientific equipment
 - Presenting, using and manipulating data
 - Drawing conclusions
 - Changing theories
 - Real world use of Science
 - Ethics and implications
- Disciplinary Literacy

Communication of ideas is central to becoming confident with scientific knowledge. Our curriculum is designed to develop student's communication and confidence through explicit teaching of literacy and oracy; in particular tier 3 vocabulary (including root words, prefixes and suffixes), and regular use of connective, discussion, experimental write up and exam command words.

 - Increase understanding and use of subject specific vocabulary (substantive and disciplinary) including root word, prefixes and suffixes
 - Develop how to communicate their subject knowledge in written and verbal responses
 - Understand the common exam command words and how to structure their answers accordingly

Curriculum seven-year plan:

The science curriculum is designed to converge at key points throughout the academic year. Each term includes one of the three scientific disciplines, allowing students to revisit biology, chemistry and physics concepts frequently. Science students will follow *the TCEAT curriculum as mapped below:*

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	Big ideas of Science ⁽¹⁾	Simplified idea	Key stage 2	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Scientific Knowledge	All material in the Universe is made of very small particles.	Atoms and Chemical Reactions	States of matter (Y4) Properties and changes of materials (Y5)	C1b – Matter C3 - Acids and Bases	C4 – Periodic Table and reactions C5 – Chemical reactions C6 – Energy resources	C1 – Atomic structure and periodic table C2 – States of matter and mixtures C3 – Fuels and atmosphere B1 – Key concepts in Biology P3 – Particle model	C4 – Bonding and calculating mass C5 – Acids C5b - Qualitative Analysis (triple only) P5 – Electricity C6 – Metals and rates B6b – Key concepts 2 (triple only not WP)	C7 – Physical Chemistry C7b - Organic Chemistry (Triple) P7 – Radioactivity B9, C8 and P8 - Revision	M4 – Electrons, waves and photons M2 – Foundations in chemistry M3 – Periodic table and energy M4 – Core organic chemistry T4 – Materials and Chemical properties T5 – Acids/bases and chemical change T9 – Particles and radiation	M5 – Newtonian world and astrophysics M6 – Particles and medical physics M5 – Physical chemistry and transition elements M6 – Organic chemistry and analysis LSC2/LSC5 The atom/Bonding LSC3 Amount of substance LSC4 Acids
	Objects can affect other objects at a distance.	Forces and fields	Forces (Y3&5)	P1b - Forces P2 – Space P3 - Light and Sound	P5 – Electricity and magnetism	P2 - Waves	P4 – Forces P6 – Magnetism and Electromagnetism P4b – Astronomy (triple only) P5 – Electricity	B9 and P8 - Revision	M3 – Forces and motion M4 – Electrons, waves and photons T6 – Electricity	M5 – Newtonian world and astrophysics M6 – Particles and medical physics LSP5 Magnetism and electromagnetism
	Changing the movement of an object requires a net force to be acting on it.	Forces and their effects	Forces (Y3&5)	P1b - Forces	P6 - Motion	P1 – Energy	P4 – Forces P6 – Magnetism and Electromagnetism	B9 and P8 - Revision	M3 – Forces and motion T7 – Magnetism and electromagnetism	M5 – Newtonian world and astrophysics M6 – Particles and medical physics
	The total amount of energy in the Universe is always the same but energy can be transformed when things change or are made to happen.	Energy stores and energy transfers	Light (Y3&6) Sound (Y4) Electricity (Y4&6)	C2 – Fuels (TWY only) P3 - Light and Sound	P5 – Electricity and magnetism P4 – Heating and cooling	P1 – Energy P2 – Waves C3 – Fuels and atmosphere P3 – Particle model	C4 – Bonding and calculating mass P4 – Forces P5 – Electricity B6a – Plant structures and their functions P6 – Magnetism and Electromagnetism	C7 – Physical Chemistry P7b – Waves (triple only not WP) P7 - Radioactivity B9, C8 and P8 - Revision	M3 – Forces and motion M4 – Electrons, waves and photons M3 – Periodic table and energy T8 – Waves	M5 – Newtonian world and astrophysics M6 – Particles and medical physics LSP3 Electricity LP6 Nuclear Physics
	The composition of the Earth and its atmosphere and the processes occurring within them shape the Earth's surface and its climate.	Earth and the atmosphere	Rocks (Y3) Earth and Space (Y5)	C2 – Geology (WP)/ Earth and atmosphere (ADA)/ Earth and Space (EF)	C6 – Energy resources P4 – Heating and cooling	C3 – Fuels and atmosphere	P4 – Forces (triple content) B6a – Plant structures and their functions C6 – Metals and rates	P7 – Radioactivity B9, C8 and P8 – Revision	M2 – Foundations in chemistry M3 – Periodic table and energy M4 – Core organic chemistry	M6 – Particles and medical physics M5 – Physical chemistry and transition elements M6 – Organic chemistry and analysis LSC6/7 Physical chemistry LSC8 Organic Chemistry and analysis
	The solar system is a very small part of one of millions of galaxies in the Universe.	Space	Earth and Space (Y5)	P2 - Space		P2 - Waves	P4b – Astronomy (triple only)	P8 – Revision		M5 – Newtonian world and astrophysics
	Organisms are organised on a cellular basis.	Cells	Plants (Y3) Living things and their habitats (Y4)	B1b - Organs and health B2 – Reproduction	B4 – Microbiology	B1 – Key concepts in Biology B2 – Cells and control B3 – Exchange and transport in animals	B4a – Genetics B5 – Animal co-ordination, control and homeostasis B6 – Plant structures and their functions B6b – Key concepts 2 (triple only not WP)	B7 – Health and Disease B9 – Revision	M2 – Foundations in biology M3 – Exchange and transport M4 – Biodiversity, evolution and disease T1 – Cells and tissues T3 – Microbiology and immunology	M5 – Communication, homeostasis and energy Module 6 Genetics, evolution and ecosystems LSB2 Cell Structure LSB3 Respiration LSB4 Metabolic pathways
	Organisms require a supply of energy and materials for which they are often dependent on or in competition with other organisms.	Competition and ecosystems	Plants (Y3) Living things and their habitats (Y5), Animals, including humans (Y3-6)	B3 - Ecology B1b - Organs and health	B6 – Organic energy	B3 – Exchange and transport in animals	B4b – Natural selection and GMO B6 – Plant structures and their functions	B8 Ecosystems and material cycles B9 – Revision	M3 – Exchange and transport M4 – Biodiversity, evolution and disease	M5 – Communication, homeostasis and energy M6 Genetics, evolution and ecosystems LSB7 Ecosystems
	Genetic information is passed down from one generation of organisms to another.	Genetics	Plants (y3) Evolution and inheritance (Y6)	B2 - Reproduction	B5 - Genetics	B2 – Cells and control	B4a – Genetics B4b – Natural selection and GMO	B9 – Revision	M2 – Foundations in biology T2 – Genetics	M6 Genetics, evolution and ecosystems LSB5 Genetics
	The diversity of organisms, living and extinct, is the result of evolution.	Evolution	Evolution and inheritance (Y6)	B2 - Reproduction B3 - Ecology	B5 - Genetics		B4b – Natural selection and GMO	B8 Ecosystems and material cycles B9 – Revision	M4 – Biodiversity, evolution and disease	M6 Genetics, evolution and ecosystems
Scientific Skills	Science assumes that for every effect there is one or more causes, and that scientific explanations, theories and models are those that best fit the facts known at a particular time.	Predicting cause and effect Experiment design and risk assessment How and why we use scientific equipment Presenting, using and manipulating data Drawing conclusions Changing theories	Working scientifically (Y5&6)	Intro to Science (B1a, C1a, P1) All topics present opportunities for explicit teaching of skills	All topics present opportunities for explicit teaching of skills	All topics present opportunities for explicit teaching of skills	All topics present opportunities for explicit teaching of skills	All topics present opportunities for explicit teaching of skills	All modules present opportunities for explicit teaching of skills	All modules present opportunities for explicit teaching of skills LSB1 Health and safety in the lab LSB6 Data collection and processing
	The knowledge produced by science is used in some technologies to create products to serve human ends.	Real world use of Science		All topics present opportunities for explicit teaching of skills	All topics present opportunities for explicit teaching of skills	All topics present opportunities for explicit teaching of skills	All topics present opportunities for explicit teaching of skills	All topics present opportunities for explicit teaching of skills	All modules present opportunities for explicit teaching of skills	All modules present opportunities for explicit teaching of skills LSB1 Health and safety in the lab
	Applications of science often have ethical, social, economic and political implications.	Ethics and implications		All topics present opportunities for explicit teaching of skills	All topics present opportunities for explicit teaching of skills	All topics present opportunities for explicit teaching of skills	All topics present opportunities for explicit teaching of skills	All topics present opportunities for explicit teaching of skills	All modules present opportunities for explicit teaching of skills	All modules present opportunities for explicit teaching of skills LSB1 Health and safety in the lab

1 – Harlen, W. (2010). Principles and big ideas of science education. Association for Science Education. (<https://www.ase.org.uk/bigideas>)

Denotes revisiting topics through review, application and extension

Scientific knowledge colours, link to the most represented specialism i.e. the first big idea has content from all specialisms, with chemistry being most represented. Therefore, this 'big idea' has been linked primarily to chemistry for the purpose of this document, but all units should be reviewed.

Year 7

Year 8

Year 10

Year 11

B1a/C1a/P1 Introduction to Science
Lab safety Hazard symbols Science equipment Scientific investigation: prediction Variables results tables methods conclusion graphing
Building on: w1 - Scientific enquiry (KS2)
Leading to: All science topics

B1b Organs and health
Cell structure Microscopes Organs Healthy living Nutrients Testing for biomolecules
Building on: b1 - Living things and their habitats (KS2) b3 - Animals, including humans (KS2)
Leading to: Y8 B1b - Microbiology Y9 B1 - Key concepts Y10 B6b - Key concepts 2* Y11 B7 - Health and disease

B2 Reproduction
Gametes Mammalian reproductive systems Sexual intercourse Foetal development Puberty and the menstrual cycle Plant reproduction
Building on: b1 - Living things and their habitats (KS2) b2 - Plants (KS2)
Leading to: Y8 B5 - Genetics Y9 B2 - Cells and control Y10 B4a - Genetics Y10 B5 - Animal coordination and homeostasis Y11 B7 - Health and disease

B3 Ecology
Classification Sampling techniques Predator and prey Food chains and webs Evolution by natural selection
Building on: b1 - Living things and their habitats (KS2) b4 - Evolution and inheritance (KS2)
Leading to: Y10 B4a - Genetics Y10 B4b - Natural selection and genetic modification Y11 B8 - Ecosystems and cycles

B4 Microbiology
Cell structure Microscopes Specialised cells Microorganisms Disease Immunity Vaccination
Building on: Y7 B1b - Organs and health Y7 B2 - Reproduction
Leading to: Y9 B1 - Key concepts Y9 B2 - Cells and control Y10 B6a - Plant structures and their functions Y10 B6b - Key concepts 2* Y11 B7 - Health and disease

B5 Genetics
Variation DNA and chromosomes Genetic crosses Sexual and asexual reproduction Cloning Selective breeding Genetic engineering
Building on: b4 - Evolution and inheritance (KS2)
Leading to: Y7 B2 - Reproduction Y9 B2 - Cells and control Y10 B4a - Genetics Y10 B4b - Natural selection and GMO

B6 Organic energy
Plant structure Photosynthesis Limiting factors Respiration Digestion Breathing Circulatory system Healthy living
Building on: b2 - Plants (KS2) b3 - Animals, including humans (KS2)
Leading to: Y7 B1b - Organs and health Y7 B2 - Reproduction Y9 B3 - Exchange and transport in animals Y10 B6a - Plant structures and their functions Y10 B5 - Animal coordination and homeostasis Y11 B8 - Ecosystems and material cycles

B1 Key concepts
Cell structure Specialised cells Microscopes Enzymes Diffusion Active transport Osmosis
Building on: Y7 B1b - Organs and health Y8 B4 - Microbiology Y8 B6 - Organic energy
Leading to: All future biology content

B2 Cells and control
Cell division Stem cells Nervous system Specialised cells Differentiation
Building on: Y7 B2 - Reproduction Y8 B4 - Microbiology Y9 B1 - Key concepts
Leading to: Y10 B4a - Genetics Y11 B7 - Health and disease

B3 Exchange and transport in animals
SA:V Circulatory system Breathing Respiration
Building on: Y7 B1b - Organs and health Y8 B6 - Organic energy
Leading to: Y10 B6 - Plants structure and their function Y10 B5 - Animal coordination and homeostasis Y11 B7 - Health and disease

B4a Genetics
DNA structure Cell division Key genetics terms Explaining inheritance variation mutations HGP Protein synthesis* Sexual and asexual reproduction*
Building on: Y7 B2 - Reproduction Y8 B5 - Genetics Y9 B1 - Key concepts
Leading to: Y10 B4b - Natural selection and genetic modification Y11 B7 - Health and disease

B4b Natural selection and GMO
Evolution by natural selection Human evolution Classification Selective breeding Genetic engineering Tissue culture*
Building on: Y7 B3 - Ecology Y8 B5 - Genetics Y10 B4a - Genetics
Leading to: Y11 B7 - Health and disease

B5 Animal coordination and homeostasis
Hormones Menstrual cycle Contraception ART Homeostasis: blood glucose concentration, thermoregulation*, osmoregulation* Diabetes Healthy living Urinary system*
Building on: Y7 B1b - Organs and health Y7 B2 - Reproduction Y8 B6 - Organic energy Y9 B1 - Key concepts Y9 B3 - Exchange and transport in animals
Leading to: Y10 B6a - Plant structures and their functions Y11 B7 - Health and disease

B6 Plant structure and their function
Photosynthesis Limiting factors Plant transport Specialised cells/tissues Transpiration Translocation Leaf structure* Plant hormones* Plant adaptations*
Building on: Y7 B2 - Reproduction Y8 B1b - Microbiology Y8 B6 - Organic energy Y9 B1 - Key concepts Y9 B2 - Cells and control Y10 B5 - Animal coordination and homeostasis
Leading to: Y11 B7 - Health and disease Y11 B8 - Ecosystems and cycles

B6b Key concepts 2*
Brain Eye Testing for biomolecules Calorimetry
Building on: Y7 B1b - Organs and health Y9 B1 - Key concepts
Leading to: Y10 B5 - Animal coordination and homeostasis Y11 B8 - Ecosystems and cycles

B7 Health and disease
Healthy living Non-communicable diseases Communication diseases Virus lifecycle* STIs Immune system Immunisation Plant defence: pests and pathogens* Antibiotics Aseptic technique* Monoclonal antibodies*
Building on: Y7 B1b - Organs and health Y7 B2 - Reproduction All Y8 biology Y9 B1 - Key concepts Y10 B4a - Genetics Y10 B4b - Natural selection and GMO Y10 B6a - Plant structures and their functions
Leading to: Y11 B9 - Revision

B8 Ecosystems and material cycles
Ecosystems: biotic and abiotic Sampling techniques Energy transfer between trophic levels* Biodiversity Food security* Material cycles: water, carbon, nitrogen Indicator species* Decomposition
Building on: Y7 B3 - Ecology Y8 B6 - Organic energy
Leading to: Y11 B9 - Revision

Year 9

Year 7

C1b Matter
Matter Change of State Atom, element, compound, mixture, solution Chromatography
Building on: c2 - States of matter (KS2) c3 - Properties and changes of materials (KS2)
Leading to: All chemistry topics

C2 Fuels
Scientific investigation Energy content
Building on: Y7 C1a - Introduction to science Y7 C1b - Matter
Leading to: Y8 P4 - Heating and cooling Y8 C6 - Energy resources Y9 C3 - Fuels and atmosphere Y9 P1 - Energy Y11 C7 - Physical chemistry

C2 Geology/Earth and Atmosphere/Earth (and Space)
Earth's structure Types of rocks (igneous, sedimentary, metamorphic) Rock Cycle Weathering (physical and chemical)
Building on: c1 - Rocks
Leading to: Y8 C4 Periodic table Y8 C5 Chemical reactions Y9 C1 Atomic structure and periodic table Y9 C3 Fuels and Atmosphere Y10 C5 Acids

C3 Acids and bases
Hazard symbols Acids and bases pH scales Neutralisation
Building on: c3 - Properties and changing materials (KS2) Y7 C1b - Matter
Leading to: Y8 C4 - Periodic table Y9 C3 - Fuels and atmosphere Y10 C5 - Acids

Year 8

C4 Periodic table
Atom, element, compound, mixture, solution Periodic table Metals and non-metals Chemical equations Reactions with metals (oxygen, water, acid) Reactivity
Building on: c2 - States of matter (KS2) c3 - Properties and changing materials (KS2) Y7 C1b - Matter Y7 C3 - Acids and bases
Leading to: All chemistry topics

C5 Chemical reactions
Chemical and physical changes Using reactivity series Speeding up chemical reactions Electrolysis
Building on: c2 - States of matter (KS2) c3 - Properties and changing materials (KS2) Y7 C1b - Matter Y8 C4 - Periodic table
Leading to: All chemistry topics

C6 Energy resources
Gas tests: oxygen and carbon dioxide Fire safety Combustion Fossil fuels Pollution Greenhouse effect Energy sources
Building on: c1 - Rocks (KS2) c3 - Properties and changing materials (KS2) b1 - Living things and their habitats Y7 C2 - Fuels Y8 C5 - Chemical reactions
Leading to: Y9 C3 - Fuels and atmosphere Y11 C7 - Physical chemistry

Year 9

C1 Atomic structure and periodic table
Atomic structure Periodic table Isotopes Electronic configuration Group 0, 1, and 7 Displacement reactions Balancing equations
Building on: Y7 C1b - Matter Y8 C4 - Periodic table Y8 C5 - Chemical reactions
Leading to: All chemistry topics

C2 Separating techniques
States of matter Separation techniques: filtration crystallisation chromatography distillation Purifying water
Building on: Y7 C1b - Matter Y8 C4 - Periodic table Y8 C5 - Chemical reactions Y9 C1 - Atomic structure and periodic table
Leading to: Y9 C3 - Fuels and atmosphere Y10 C5 - Acids Y10 C5b - Qualitative chemistry* Y10 C6 - Metals and rates Y11 C7 - Physical chemistry

C3 Fuels and atmosphere
Oil Fractional distillation Combustion Fuels Changing atmosphere Greenhouse effect Testing gases
Building on: All chemistry topics Y8 P5 Heating and cooling Y9 P1 - Energy
Leading to: Y11 C7 - Physical chemistry Y11 C7b - Organic chemistry*

Year 10

C4 Bonding and calculating masses
Atomic structure Ions Ionic bonding: compounds and formulae Covalent bonding Metallic bonding Dot and cross diagrams RFM and RAM Empirical formula Calculations involving masses (moles) Calculations involving gases (moles)* Yields* Atom economy* Chemical equations Balancing equations
Building on: Y7 C1b - Matter Y8 C4 - Periodic table Y8 C5 - Chemical reactions Y9 C1 - Atomic structure and periodic table
Leading to: All chemistry topics

C5 Acids
Acids and bases pH scale Neutralisation Titration* Synthesis of pure, dry salts Solubility Precipitation reaction
Building on: Y7 C1b - Matter Y7 C3 - Acids and bases Y8 C4 - Periodic table Y8 C5 - Chemical reactions Y9 C1 - Atomic structure and periodic table Y10 C4 - Bonding and calculating masses
Leading to: Y10 C6 - Metals and rates Y11 C7 - Physical chemistry Y11 C7b - Organic chemistry*

C5b Qualitative chemistry*
Testing cations and anions Physical properties of materials Nanoparticles
Building on: Y7 C1b - Matter Y8 C4 - Periodic table Y8 C5 - Chemical reactions Y9 C1 - Atomic structure and periodic table Y10 C4 - Bonding and calculating masses
Leading to: Y11 C7 - Physical chemistry

C6 Metals and rates
Reactivity of metals Metals reactions (water, salt solutions and acids) Ionic equations (REDOX) Oxidation and reduction Displacement reactions Metal extraction Metal recycling Transition metals* Metal corrosion* Alloys*
Building on: Y7 C1b - Matter Y8 C4 - Periodic table Y8 C5 - Chemical reactions Y9 C1 - Atomic structure and periodic table Y10 C4 - Bonding and calculating masses Y10 C5 - Acids
Leading to: Y11 C7 - Physical chemistry Y11 C7b - Organic energy*

Year 11

C7 Physical chemistry
Endothermic and exothermic reactions Energy profiles Equilibrium and reversible reactions Haber process Half equations Ionic compound properties (structure and bonding) Electrolysis REDOX Fertilisers* Fuel cells*
Building on: All chemistry topics
Leading to: Y11 C8 - Revision

C7b Organic chemistry*
Hydrocarbons Polymers Alcohols Carboxylic acids
Building on: Y7 C2 - Fuels Y9 C3 - Fuels and atmosphere Y10 C4 - bonding and calculating masses
Leading to: Y11 C8 - Revision

Year 7

P2 Force and space
Days, months, seasons, and years Gravity Mass and weight Balanced and unbalanced forces
Building on: p1 - Earth and space (KS2) p2 - Forces and magnets (KS2)
Leading to: Y8 P6 - Motion Y9 P1 - Energy Y10 P4 - Forces Y10 P4b - Astronomy*

P3 Light and Sound
Properties of light Reflection Refraction Colour Wave properties: frequency and amplitude Properties of sound
Building on: p3 - Light (KS2) p4 - Sound (KS2)
Leading to: Y9 P2 - Waves Y11 P7 - Radioactivity Y11 P7b - Waves 2*

Year 8

P4 Heating and cooling
Temperature Heat Energy transfer: Conduction Convection Radiation Heat's effect on particles
Building on: c3 - Properties and changes of materials (KS2)
Leading to: All Y9 physics topics Y10 P4b - Astronomy* Y11 P7 - Radioactivity

P5 Electricity and magnetism
Circuits: parallel and series Current Voltage/potential difference Conductors and insulators Magnets Magnetic fields Electromagnets
Building on: p2 - Forces and magnets (KS2) p5 - Electricity (KS2)
Leading to: Y10 P5 - Electricity Y10 P6 - Magnetism and electromagnetism

P6 Motion
Graphing and SI units Speed calculations Distance/time graphs Acceleration Air resistance
Building on: p2 - Forces and magnets (KS2)
Y7 P2 - Forces and space
Leading to: Y10 P4 - Forces

Year 9

P1 Energy
Energy types and waste Efficiency Work Power GPE/KE Energy resources
Building on: Y7 P2 - Forces and space Y8 P4 - Heating and cooling
Leading to: Y9 P3 - Particle model Y10 P5 - Electricity Y11 P7 - Radioactivity

P2 Waves
Wave properties Wave speed Refraction EM spectrum: properties, uses, dangers
Building on: Y7 P3 - Light and sound
Leading to: Y11 P7 - Radioactivity Y11 P7b - Waves 2*

P3 Particle model
States of matter Density Specific latent heat Specific heat capacity Gases: temperature and pressure
Building on: Y7 C1b - States of matter Y8 P4 - Heating and cooling Y8 C5 - Chemical reactions Y9 P1 - Energy Y8 C5 - Chemical reactions
Leading to: Y10 P4 - Forces

Year 10

P4 Forces
Balanced and unbalanced forces Vectors diagrams Distance/time graphs Acceleration Velocity/time graphs Newton's Laws (1-3) Momentum Car safety: momentum, braking, energy Elastic and inelastic distortions Hooke's Law Turning forces* Pressure* Upthrust*
Building on: Y7 P2 - Forces and space Y8 P4 - Heating and cooling Y8 P6 - Motion Y9 P3 - Particle model
Leading to: Y10 P4b - Astronomy* Y10 P6 - Magnetism and electromagnetism

P4b Astronomy*
Gravity Solar system Orbits Theories of the universe Doppler effect Life cycle of stars
Building on: Y7 P2 - Forces and space Y9 P1 - Energy Y10 P4 - Forces
Leading to: Y11 P7 - Radioactivity Y11 P7b - Waves 2*

P5 Electricity
Atomic structure Circuits Current Potential difference Resistance Electrical components Electrical energy Power AC/DC Electrical safety at home Electric fields* Static electricity*
Building on: Y8 P5 - Electricity and magnetism Y9 P1 - Energy
Leading to: Y10 P6 - Magnetism and electromagnetism

P6 Magnetism and electromagnetism
Magnetism Magnetic fields Electromagnets Magnetic forces Transformers Induction*
Building on: Y8 P5 - Electricity and magnetism Y10 P4 - Forces Y10 P5 - Electricity
Leading to: Y11 P8 - Revision

Year 11

P7 Radioactivity
Atomic structure Electrons and orbits gamma, background, dangers, users* Radioactive decay Half life Nuclear energy* Fission and fusion*
Building on: Y7 P3 - Light and sound Y8 P4 - Heating and cooling Y9 P1 - Energy Y9 P2 - Waves Y10 P4b - Astronomy*
Leading to: Y11 P8 - Revision

P7b Waves 2*
Wave properties and TIR Lenses Blackbody radiation Sound properties Ear
Building on: Y7 P3 - Light and sound Y9 P2 - Waves Y10 P4b - Astronomy*
Leading to: Y11 P8 - Revision

TCEAT Curriculum & Assessment Overview: Science

Approaches to learning

Every unit focusses on substantive and disciplinary knowledge, including tier 2 and 3 vocabulary, to inspire passionate scientists who can communicate with confidence and spontaneity. The three assessment objectives (AO1-3) are practised regularly over the course of each unit of each specialism (biology, chemistry and physics). Literacy is developed through the systematic and explicit introduction and repetition of subject specific vocabulary, the use of sentence starters, writing frames, and decoding exam command words. Every topic, from Y7-13, has a Knowledge Organiser which supports our curriculum. These outline the key science knowledge for each topic, including tier 3 vocabulary. Students are provided with these at the start of every topic and are expected to review these on a regular basis. They are used to support learning both in and out of timetabled lessons, with clear signposting within the curriculum.

Assessment

The Trust assessment policy is central to support the 10:10 ethic which informs the ethos of all of the Trust's schools. Effective assessment allows students to know when and how they have done well, it identifies areas of weakness and supports students to know where they have got to improve. The school assessment system is entirely formative as all assessments are designed to be diagnostic for both the students and the teacher, designed to provide information on progress and provide feedback on areas for improvement as part of a feedback loop. The delivery of the curriculum in all subjects allows for a range of assessment activities including:

AfL – Assessment for Learning

AfL is critical to learning. Throughout each lesson students will be given opportunities test their understanding and give their teacher opportunities to identify issues and correct misunderstandings on the spot. All teachers utilise strategies to ensure they can assess whole class progress rapidly & target support within lessons. These strategies include the use of mini whiteboards, green pens (used to distinguish student self-marking /correction from that of the teacher), self-assessment, peer-assessment, circulation, live marking using a visualiser and various types of questioning. All KS3 and KS4 units contain a starter activity in the format of 'fish, dog, elephant' which supports recall and retention of content from recent lesson to previous units/academic years. At KS5, students complete recall tasks that enable practise of key content in a low-stakes setting. The regular use of past exam questions, both within and outside of lessons, supports students develop writing scientifically, and is an effective technique to check memory and/or understanding. This helps identify strengths and weaknesses, enabling adaptive teaching and learning, and development of exam technique.

TCEAT Curriculum & Assessment Overview: Science

Prep

Prep is designed to support learners to retain and retrieve information therefore strengthening long-term memory. Preps are short tasks, no longer than 15 minutes in length, set each lesson with a due date of the next timetabled lesson. This work is to be completed outside of the classroom (at home or in study club) and is designed to consolidate learning and prepare students for their next lesson. Within science, prep can take a range of forms: further practise of key content through worksheets, exam questions, or an online platform (Seneca); research to support their learning in a subsequent lesson or extend learning from a previous lesson.

Standardised assessments

These are longer tasks designed to provide students with a chance to applying work from several lessons. These may be done as homeworks or in class. These tasks will have an extended deadline as they will take students longer to complete. The majority of standardised assessments are teacher marked.

Standardised assessments may include an element of synopticity to support students' long term memory and ability to link content from different units. These assessments are marked and feedback is provided enabling the identification of strengths and weakness; it also informs future planning by the teacher and guidance for the student on immediate areas of focus. Standardised assessments feed into our larger formative Quarterly Assessments, and therefore the completion of these and the feedback loop is essential for students to make the most progress.

Quarterly assessments

At fixed points throughout the year students sit exams in a formal setting.

Four times per academic year (quarterly assessment weeks) students will sit assessments that take the form of formal exams and examine cumulative skills and content acquisition. These milestones are opportunities for students, staff, parents & carers to take stock of progress and performance at this point. We then have the information and feedback needed to take the next steps in their learning. Key details of each quarterly assessment can be found on each QA 'What's on Qx' document, which is available on Copia and shared with students at the beginning of each period preceding the QA. All QA take the form of exam questions.

TCEAT Curriculum & Assessment Overview: Science

	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Quarter 1	<p>Formal assessment for Q1 focussing on specific units as defined on 'What's on Q1 document' e.g. Microbiology and Heating and cooling topics only in Year 8</p> <p>Marks and grades recorded on Go4Schools.</p> <p>Learning habit grades, current grades, on track shown on Go4Schools and grade sheets.</p>						
Quarter 2	<p>Formal assessment for Q2 focussing on specific units as defined on 'What's on Q2 document' e.g. B1 Key Concepts; B4a – Genetics, B4b – Natural Selection & Genetic Modification on the Year 10 biology combined science paper.</p> <p>Marks and grades recorded on Go4Schools.</p> <p>Learning habit grades, current grades, on track shown on Go4Schools and grade sheets.</p>						
Quarter 3	<p>Formal assessment for Q3 focussing on specific units as defined on 'What's on Q3 document'</p> <p>Y11, Y12 (T Level only) and Y13 complete full mock papers</p> <p>Marks and grades recorded on Go4Schools.</p> <p>Learning habit grades, current grades, on track shown on Go4Schools and grade sheets.</p>						
Quarter 4	<p>Formal assessment for Q4 focussing on the whole year or course to date as defined on 'What's on Q4 document'</p> <p>Marks and grades recorded on Go4Schools.</p> <p>Learning habit grades, current grades, on track shown on Go4Schools and grade sheets.</p> <p>For Year 11 and 13, final GCSE, T Level and A Level exams.</p>						

TCEAT Curriculum & Assessment Overview: Science

Feedback routines.

Students are given feedback throughout the school year so they can improve.

In lessons students will regularly use their mini whiteboards to show their answers and give teachers the opportunity to correct misconceptions. Teachers use a variety of questioning techniques such as no hands-up questions, the use of thinking time (e.g. Pose-Pause-Pounce-Bounce), pair talk (e.g. Think-Pair-Share), no opt-out (e.g. reframing the question to the same pupil) and follow up questions (e.g. asking pupil to elaborate, or avoiding paraphrasing pupils- instead pushing for the 'best version' answer). This allows teachers to adapt teaching as necessary.

Formal assessments and Quarterly assessments will be followed by feedback and opportunities to re-check understanding. This will include time for the student to respond to their feedback, time for the teacher to immediately address any significant misconceptions/errors in student understanding, a follow up task or prep that allows students to build on the feedback given and time for students to update their progress tracker in their exercise books/ planners.

In science students will be taken through the main errors and misconceptions raised in their assessments during their feedback lesson(s) using references to mark scheme criteria, assessment language and examiner report feedback where applicable. Teachers provide guidance and opportunities to improve before students are given feedback tasks (coloured sheets) to complete once teachers have re-taught any identified content. This provides students with a second opportunity to check that they have improved their understanding in that area by completing this linked follow up task before progressing to the next stage in the curriculum.

External examinations.

KS4 exam board: Edexcel – Combined Science (1SC0), Biology (1BI0), Chemistry (1CH0), Physics (1PH0)

KS5 exam board: A level: OCR – Biology A (H420), Chemistry A (H432), Physics A (H556)

T level: NCFE – Laboratory Science (6034/6989/9)