# Ted Wragg Trust Curriculum Map: Science

### What do we do?

Human nature is to seek answers to explain the phenomena experienced through their interactions with the World. Through our common curriculum we want every student to build on these observations, discovering how 500 years of scientific endeavor has created theories to rationalize the inexplicable. The skills and attitudes built from our rich and varied Science curriculum, will equip each child for the increasingly scientific and technological age in which we live.

### How does Science equip students with threshold concepts and powerful knowledge?

Through positive collaboration our schools work together to produce a fully resourced and well sequenced curriculum. Our Science curriculum is designed to allow students to develop an appreciation of the threshold concepts in Science Education whilst developing the skills to plan and perform safe experiments and think critically about data and ideas. Considering their own and others research, observations, and explanations regarding each one. It is a 5-year cyclical curriculum, with regular assessment and opportunities for feedback and improvement, resulting in either the Combined Science GCSE qualification or Separate Science GCSEs. The curriculum ensures that threshold concepts are introduced and built on prior to linked topics. This includes, Energy, Forces, Cells, Atoms, Particles. In addition to this substantive knowledge, we concurrently build disciplinary knowledge by including a wide range of practical experiences for students alongside the theories and models of the Science they are learning.

### What skills and cultural capital do students gain in Science?

The curriculum exposes students to differing cultures, busts misconceptions and invites students to think about real world problems. We endeavour to use current examples, for example the Covid-19 pandemic, to ensure that the curriculum is interesting and enriching and that our students are fully prepared to use their scientific knowledge to negotiate the modern world. The curriculum includes learning about historical Scientific figures from a wide range of backgrounds and we explore how these different cultures have benefitted modern society through their contributions.

### How do we support literacy in Science?

The curriculum exposes students to a vast quantity of new tier 3 vocabulary. To support with this, we use Knowledge organisers to introduce tier two and three vocabulary and definitions prior to their first classroom encounter. Where appropriate Frayer models deepen student understanding of key terms. In addition, teachers model how to use subject specific vocabulary in context prior to checking for understanding and we provide opportunities for structured discussion to practice speaking the language of the subject prior to writing it. Students are exposed to scientific language within texts with guidance and support.

### How is the Science curriculum designed?

Students learn the key concepts and processes identified in the national curriculum and then engage with them at a deeper level of understanding at KS4. The curriculum has been carefully sequenced to ensure that the threshold concepts have been delivered before being built on, meaning no teacher should ever have to tell their students that they will learn about that later.

### How do you use spaced practice / retrieval practice?

Retrieval practice is a feature of every lesson. Questions are often selected from the knowledge organiser to strengthen the connection between homework and the Science lessons. KS4 Science students use the Knowledge organiser and Educake for their homework. Teachers use the data to inform the Do Now questions and re-teaching for the subsequent week. Following termly assessments teachers use class and year wide QLA to identify misconceptions, gaps in the students knowledge. They plan lessons to address these and offer further opportunities to students to apply the corrected knowledge.

### What content do you cover and how is this delivered over time?

We have been careful to sequence our teaching to ensure that threshold concepts are taught (and built on from KS2) before introducing further learning that relies on these solid foundations. Topics are split into Biology, Chemistry and Physics, with the interleaving between topics explicitly taught, for example density is taught within both a Physics and Chemistry topic. The National Curriculum disciplinary knowledge is taught alongside the substantive knowledge, allowing students to develop skills in an increasingly sophisticated manner. We have a good understanding of the Science taught at KS2 and assume that at least some of our students will undertake Science to a higher level at KS5 and beyond so will make links to further learning as appropriate.

### What content do you not cover (that others might) and why?

We do not cover some KS3 National Curriculum topics where we are confident that the students are exposed to them thoroughly in their KS2 experience or other through other subjects at KS3. The Earth and Atmosphere is one such topic that is studied in depth through Geography, the Skeletal and muscular system is another covered by PE. In the same way what constitutes a balanced diet is also sufficiently covered through both PSHE and food and nutrition.

### How do you sequence the curriculum so that new knowledge and skills builds on what has been taught before?

Threshold concepts of Energy, Forces, Particles, Atoms, Cells are delivered before being built on. These concepts are then revisited several times throughout KS3 and 4, building on the schema each time.

**Year 11**

**Chemistry**
Rates of reaction
Periodic table and reactivity of groups
Fuels
Changing atmosphere
Revision of key concepts.

**Physics**
Density
Bending and Stretching
Gas pressure
Magnetism
Revision of key concepts

Revision and GCSE exams

**Biology**
Coordination and control
Circulatory system
Respiration
Revision of key concepts

End of year Paper 1 Mock Exams

**Physics**
Forces and momentum
Ionising radiation
Energy
Electricity and circuits

**Chemistry**
Chemical bonding
Chemical calculations
Atomic structure
Acids and Alkalis
Electrolysis
Extracting Metals

**Year 10**

**CYCLE 2**
States of matter
Separating techniques
Chemistry calculations
Atomic structure
Groups of the periodic table
Rates of reaction

**CYCLE 3**
Types of waves
Electromagnetic spectrum
Motion
Forces and momentum

**Biology**
Cells and Control
Genetics and Inheritance
Natural selection and GM
Health and disease

**Year 9**

**CYCLE 1**
Plants and photosynthesis
Cell transport
Enzymes
Ecosystems
Material cycles

**CYCLE 3**
Types of waves
Electromagnetic spectrum
Density
Resistance and electrical safety
Solar System

**CYCLE 2**
**Atomic structure**
**Ions**
**Groups of the periodic table**
**Rates of reaction**
**Fuels**
**Atmosphere and climate change**
**Acids, bases and indicators**

**Year 8**

**CYCLE 2**
**Lab safety**
**States of matter**
**Particle model**
**Separating Mixtures**
**The periodic table**
**Structure of atoms**
**Chemical reactions**
**Chemical equations**

**CYCLE 3**
**Energy stores and transfers**
**Heat transfer**
**Energy resources**
**Speed and acceleration**
**Motion graphs**

**Cycle 1**
Transporting substances
Structure of DNA
Inheritance
Evolution
Natural selection
Health and Disease

**Year 7**

**CYCLE 1**
Life processes
Cell Biology
Organ systems
Digestive system
Enzymes
Reproduction
Puberty

## Future careers in Science

Doctor, Biomedical Scientist, Ecologist, Chemical Engineer, Pharmaceuticals, Forensic Scientist, Renewable Energies, Data Scientist, Environmentalist, Astrophysicist, Microbiologist, Virology, Parasitology, Radiographer, Research Scientist.

## *Enrichment Opportunities*

STEM clubs/Electives
Trust Aspire Conference
Trust Christmas Lectures
Trust Innovation Competition
Girls in STEM trip
Exeter University Collaboration
Exeter College Collaboration
Stimulating Physics Network

## Key Ideas about Science


Energy


Forces


Cells


Atoms


Particles


Working Scientifically


STEM


Critical Thinking

'Science knows no country, because knowledge belongs to humanity, and is the torch which illuminates the World.' Louis Pasteur