# Science - Curriculum Intent

## Curriculum Priorities

In a diverse community where science might be not always be seen as relevant or as a viable career choice, and a world where women are under-represented in STEM, a high-quality science education provides the foundations for understanding the world and increasing opportunities in these areas. Through the disciplines of biology, chemistry and physics, science has changed our lives and is vital to the world's future survival and prosperity, and all pupils should be taught essential aspects of the knowledge, the scientific method, processes and uses of science. By building up a body of key foundational knowledge and concepts, pupils should develop a sense of awe in the beauty of our universe and curiosity about natural phenomena and be encouraged to recognise the power of rational explanation. They should be encouraged to understand how science can be used to explain what is occurring, predict how things will behave, and analyse causes.

### Knowledge

In KS3 content is taught using the Best Evidence Science Teaching (BEST), and the University of York.

The best teaching draws on the best evidence emerging from education research. The resources have been developed from the best research evidence available on common misunderstandings in science, effective diagnostic questioning and formative assessment, constructivist approaches to building understanding, and effective sequencing of key concepts.

At KS3 pupils cover the national curriculum using a sequence based on BEST, the following big ideas are covered and revisited:

Biology – The Cellular Basis of Life, Heredity and Life Cycles, Organisms and Their Environment, Variation Adaptation and Evolution, Health and Disease.

Chemistry – Substances and Properties, Particles and Structure, Chemical Reaction, Earth Chemistry, Dynamic Earth

Physics – Matter, Forces and Motion, Sound, light and waves, Electricity and Magnetism, Earth in Space

Each idea is made up of smaller topics: the building blocks for the big ideas.

At KS4 pupils start on a pathway to accessing separate science, and a decision will be made whether pupils will continue that pathway or move to the combined science pathway at the end of year 10.

As a school we currently teach pupils AQA science, the pupils development knowledge in the following areas,

Biology – Cell Biology, Organisation, Health and Disease, Bioenergetics, Homeostasis, Variation, Adaptation and Evolution, and Ecology.

Chemistry – Atomic Structure and the Periodic table, Bonding and Structure, Quantitative Chemistry, Chemical Changes, Energy Changes, Rates of Reaction, Organic Chemistry, Chemical Analysis, Environmental Chemistry and Using Resources.

Physics – Energy, Electricity, Particle Model, Atomic Structure, Forces, Waves, Electromagnetism and Space (Physics Only).

At KS5 we offer the following subjects, Biology, Chemistry, Physics and Applied Human Biology.

Biology – Practical Skills, Foundations in Biology, Exchange and Transport, Evolution and Disease, Communication Homeostasis and Energy, Genetics, Evolution and Ecosystem.

Chemistry – Practical Skills, Foundations in Chemistry, Periodic Table and Energy, Core Organic Chemistry, Physical Chemistry and Organic Analysis.

Physics – Practical Skills, Foundations in Physics, Forces and Motion, Electrons Waves and Photons, Newtownian world and Astrophysics, Fields and Frontiers.

Applied Human Biology – Principles of Applied Human Biology, Practical Microbiology, Human Biology and Health

## Skills

The skills we aim to develop are:


Literacy & Numeracy


Communication


Problem Solving


Metacognition


Leadership


Collaboration


Physical, Practical & Technical


Digital Literacy

For example:

- <u>Scientific Thinking:</u>
  - Understand how scientific theories develop over time.
  - Use a variety models (spatial, mathematical etc) to solve problems, make predictions and to develop scientific explanations and understanding of familiar and unfamiliar facts.
  - Appreciate the power and limitations of science and consider any ethical issues which may arise.
  - Explain every day and technological applications of science, evaluate associated personal, social, economic and environmental implications; and make decisions based on the evaluation of evidence and arguments.
  - Evaluate risks in both practical sciences and the wider societal context, including perception of risk in relation to data and consequences.
  - Recognise the importance of peer review and of communicating results to a range of audiences.
- <u>Experimental skills and strategies</u>
  - Use scientific theories and explanations to develop hypotheses.
  - Plan experiments or devise procedures to make observations, produce or characterise a substance, test hypotheses, check data or explore phenomena.
  - applying a knowledge of a range of techniques, apparatus, and materials to select those appropriate both for fieldwork and for experiments.
  - carrying out experiments appropriately, having due regard to the correct manipulation of apparatus, the accuracy of measurements and health and safety considerations
  - recognising when to apply a knowledge of sampling techniques to ensure any samples collected are representative.
  - making and recording observations and measurements using a range of apparatus and methods
  - evaluating methods and suggesting possible improvements and further investigation
- <u>Analysis and evaluation</u>
  - applying the cycle of collecting, presenting and analysing data, including:
    - presenting observations and other data using appropriate methods
    - translating data from one form to another
    - carrying out and representing mathematical and statistical analysis

        - representing distributions of results and making estimations of uncertainty
        - interpreting observations and other data, including identifying patterns and trends, making inferences and drawing conclusions
        - presenting reasoned explanations, including relating data to hypotheses
        - being objective, evaluating data in terms of accuracy, precision, repeatability and reproducibility, and identifying potential sources of random and systematic error
    - communicating the scientific rationale for investigations, including the methods used, the findings and reasoned conclusions, using paper-based and electronic reports and presentations.
- <u>Vocabulary, units, symbols and nomenclature</u>
    - developing their use of scientific vocabulary and nomenclature
    - recognising the importance of scientific quantities and understanding how they are determined.
    - using SI units and IUPAC chemical nomenclature unless inappropriate
    - using prefixes and powers of ten for orders of magnitude (e.g. tera, giga, mega, kilo, centi, milli, micro and nano)
    - interconverting units
    - using an appropriate number of significant figures in calculations

### Qualities

The qualities we aim to develop are:


For example:

- Kindness, respect and tolerance are all developed in practical lessons, discussions and debates throughout KS3 and KS4 science.
- Creativity is encouraged when making physical models of (often abstract) phenomena (e.g., model cells, models of atoms, space, wind turbines)
- Empathy is fostered when discussing challenging subjects (e.g., cloning, IVF, genetics, impact of using resources)
- Aspiration is embedded when discussing famous scientists, careers, university links & visits.

## Curriculum Principles

### Sequencing, Learning and Assessment

Our curriculum has been structured to take into account the cognitive science of how we learn. Key knowledge is covered sequentially and deliberately revisited and built upon. Spaced practice and retrieval are a feature of the curriculum structure.

This is further reinforced by:

- Learning Challenge: a purely formative assessment to help evaluate, and then reshape learning and address misconceptions at the end of each unit.
- Learning Consolidation: a summative assessment, taken at a planned interval from the end of the unit, to help evaluate retention of learning in the long-term memory.

### Cultural Capital

Cultural capital is developed throughout the curriculum with deliberate opportunities for all pupils to experience aspects of the taught curriculum through trips, events and activities and broaden their horizons.

For example:

- International Women in Engineering week encourages participation in engineering-based activities to remove barriers to these career areas.
- British Science Week – every year a week of themed activities and events are developed and run by students from across the school.
- Ignite, in partnership with the Royal Society of Chemistry, work with local scientists and artists to deliver projects with the aim of students developing a product and presenting scientific information to other students.

## Equality

We want our curriculum to reflect what it means to be a young, British woman today; for our pupils to know about the struggle and sacrifice that has led to the freedom and opportunity they have. We want them to know about their heritage and culture, and that of others in our community, enabling them to celebrate it and contribute to the progress of democracy as global citizens. We therefore regularly review and consult on the equality of our curriculum.

For example:

- Science and STEM themed events are organised for Women in Engineering day, and International Women's day, celebrating the role that women have played.
- In KS3 lessons, contributions from a diverse range of female and male scientists are shared and discussed
- Purposefully links examples of scientists from diverse backgrounds linked into the curriculum

## Careers and Employability

To support our pupils growing understanding of how our subject might support them with employment, we plan in explicit links between their subject area and possible career pathways. Examples of the careers and sectors we highlight are:

- We have strong links with outreach departments at both Nottingham Trent University and the University of Nottingham – visits are organised to Christmas lectures and STEM activity days to all students to experience different courses and a day in the life of an undergraduate.
- I'm a medic/engineer events allow……
- STEM careers are discussed during topics
- Yearly Ada Lovelace trip to Biocity where companies such as Boots, Rolls Royce and Elasmogen offer interactive activities allowing exploration of different aspects of STEM. Students partake in a challenge.