

## Upper Key Stage 2

Science teaching in upper KS2 should enable students to develop a deeper understanding of a wider range of scientific ideas compared to lower KS2 and KS1.

They should do this by exploring and talking about their ideas; asking their own questions about scientific phenomena and selecting the best methods to answer these questions. At this point of study the students should encounter more abstract ideas and begin to recognise how this helps them understand and make predictions about the world around them. Students should draw conclusions based on data and observations and use evidence and knowledge to explain their findings.

Students should read, spell and pronounce science vocabulary correctly.

Please see Mid/Long term plans for more detail.

### Overall Rationale:

The curriculum in science has been designed around the best evidence of what works best to deliver the best learning experience for our students. The curriculum is sequenced such that it builds on knowledge and skills throughout KS3 and KS4 and has 5 key concepts that are the core of the learning of each discipline.

In Biology these Key Concepts are:



Working Scientifically (WS) Skills build up within this structure and in Year 7 include 2 WS units at the start and end of the year to help build and embed the procedural knowledge needed to access subsequent WS Skills.

For greater detail please see Science Curriculum Maps and Mid/Long Term Plans.

Term 1

Term 2

Term 3

## Year 7

### Cells

#### Key Concept: How Organisms Work

#### Core Concepts:

- How to use microscopes to observe cells
- Structure and function of plant and animal cells
- Structural adaptations of specialised cells and unicellular organisms
- Role and process of diffusion

**Rationale:** In this topic students learn about cells as the building blocks of life. The topic centres around the understanding the different types of cells, the function of different parts of a cell and the movement of substances in and out of cells by diffusion. This ensures that students have the knowledge necessary to understand the hierarchy within an organism which is covered in more detail in later units at KS3 and KS4.

### Structure & Function of Body Systems:

#### Key Concept: How Organisms Work

#### Core Concepts:

- Organisation in plants and animals (cells to systems)
- Structural adaptations of gas exchange surfaces (alveoli)
- Structure and function of the skeletal system, including joints and muscles

**Rationale:** This topic builds on the topic of cells, and looks at how cells work together to form tissues, organs and organ systems. The topic then goes on to look in more detail at some different organ systems and their adaptations including the respiratory system and the skeletal system. Students will later revisit some of these concepts at KS4 when covering B3: Moving and Changing Materials.

### Reproduction

#### Key Concept: Growth, Development & Reproduction

#### Core Concepts:

- Human fertilisation and implantation
- Structure and function of the male and female reproductive systems
- Plant pollination and fertilisation

**Rationale:** In this unit students will learn about the processes that lead to new life. They will look at the changes that happen to the body in puberty and adolescence before looking at the male and female reproductive systems and develop an understanding of how fertilisation of gametes leads to the production of new life in both plants and animals.

**Rationale:** In this unit students will consider the different factors that lead to our differences whether those be genes inherited from parents or the influence of our environment. The students will look at how different living things evolved features due to the process of natural selection.

## Year 8

### Health & Lifestyle

#### Key Concept: Health & Disease

#### Core Concepts:

- Food groups and food tests
- Structure & function of the digestive system
- The role of enzymes in digestion
- The effect of drugs on the body

**Rationale:** The unit will look at the different food groups and the reagents that can be used to test for them, this will be revisited by students in KS4 when they do the required practical using different reagents to test foods. Students will also build on their knowledge from year 7 to develop their understanding of the structure and function of the digestive system. Then they will look at enzymes and their role in digestion. The final thing students will look at is the effect of drugs on the body which will be revisited at KSS when studying the unit B4: Health Matters.

### Biological Processes

#### Key Concept: How Organisms Work

#### Core Concepts:

- The process and importance of photosynthesis
- The adaptation of leaves for photosynthesis
- The process of aerobic respiration in living organisms
- The process of anaerobic respiration in humans and microbes.

**Rationale:** This unit starts off looking at plants and the process that they use to make glucose and the ways that they are adapted to do so. This feeds into unit B2: Photosynthesis covered in KS4. In addition, this unit then leads on to looking at how plants, animals such as humans and microbes use this glucose to release energy in the processes of aerobic and anaerobic respiration.

### Ecosystems & Adaptations

#### Key Concept: Growth, Ecosystems & Environment

#### Core Concepts:

- Interdependence
- Plant and animal adaptations

**Rationale:** In this unit students will learn how animals, such as a predator and its prey, can be interdependent and their population sizes depend on one another. Then students will look at the special features, or adaptations, that different living things have that make them suited to their environment or role in the ecosystem.

### Inheritance

#### Key Concept: Genetics & Inheritance

#### Core Concepts:

- Variation (genetic and environmental)
- Natural Selection

**Rationale:** In this unit students will consider the different factors that lead to our differences whether those be genes inherited from parents or the influence of our environment. The students will look at how different living things evolved features due to the process of natural selection.

## Year 9

### Cells

#### Key Concept: How Organisms Work

#### Core Concepts:

- Plant and animal cells
- Specialised cells
- Aerobic respiration
- Diffusion and osmosis

**Rationale:** In this topic students build on their knowledge from the year 7 topic cells and revisit the different parts of plant and animal cells and different types of specialised cells there are. They will then look at the importances of aerobic respiration to provide energy in the cells of living things and look at how the processes of diffusion and osmosis allow molecules including water to move into and out of things like cells.

### Cell Systems

#### Key Concept: How Organisms Work

#### Core Concepts:

- Cells to systems
- Photosynthesis

**Rationale:** In this unit students will revisit the idea that cells work together to form tissues, organs and organ systems which in turn build a whole living thing. They will also look at the process of photosynthesis and its importance in plants.

### Fertilisation and Implantation

#### Key Concept: Growth, Development & Reproduction

#### Core Concepts:

- Fertilisation and Implantation

**Rationale:** This unit students will build on their knowledge of reproduction from year 7 to revisit how sperm and egg or pollen and ovule join at fertilisation to create new life. Then they will consider how a fertilised egg, or zygote, must implant into the lining of the uterus and grow by cell division to form an embryo, foetus and finally a baby.

### Variation and Natural Selection

#### Key Concept: Genetics & Inheritance

#### Core Concepts:

- Variation and natural selection

**Rationale:** This unit students will build on knowledge from the inheritance unit studied in year 8 to develop and understanding of how different variations can be selected for by environmental pressures and lead to the evolution of new species by the process known as natural selection and consider its importance in explaining the variety of different life forms on the planet today.

### B1 Cell Biology

#### Key Concept: How Organisms Work

#### Core Concepts:

- How have scientists developed their understanding of cell structure & function?
- How do we develop into a complex organism from a fertilised egg?
- Do all substances move into living things by diffusion?

**Rationale:** In unit 1 students will build on their knowledge of cells from KS3 and consider how different types of microscopes enabled scientist to gain an understanding of the subcellular structure of cells. Students will also look at how the process of the cell cycle and mitosis enables organisms to grow and repair, and how cell differentiation means that un-specialised stem cells can turn into the different types of cells that work together to form a whole organism. In addition, technologies that use stem cells will be discussed and their merits and drawbacks evaluated. Students will also look at the movement of substances in and out of cells by the processes of diffusion, osmosis and active transport and use experimental methods to demonstrate factors that can some affect these.

## Year 10

### B2 Photosynthesis

#### Key Concept: Ecosystems & Environment

#### Core Concepts:

- How do plants' special adaptations help them survive?
- What factors affect photosynthesis?
- How is the supply of water to a plant affected by the environment?
- Which substance diffuse in and out of plants?

**Rationale:** In unit 2 students look at plants in detail. They will look at different ways to find out whether plants have been photosynthesising and consider different ways to investigate factors affecting photosynthesis before carrying out a required practical into the effect of light intensity on photosynthesis. They will also look at cells, tissues and organs in leaves and how they are adapted for photosynthesis and gas exchange as well as looking at how cells in the roots are specialised for absorbing water and minerals. Students will also look at the transport systems in a plant, the xylem and phloem and the adaptations that make them suited to carrying water and sugar through a plant.

### B3 Moving & Changing Materials

#### Key Concept: How Organisms Work

#### Core Concepts:

- Why do some organism need organ systems?
- Do all organisms move materials in the same way?
- How do enzymes work?
- How do living things obtain energy from food?

**Rationale:** In unit 3 students will build on previous topics to look at the role of enzymes in more detail and investigate the effect of different factors in enzyme action. They will look at the enzymes in the digestive system, the digestive organs and their adaptations that allow us to obtain nutrients from food. Students will consider how nutrients and important gases move between the blood and cells and link this to their knowledge of respiration. Students will apply knowledge of diffusion to explain the different gas exchange surfaces of living things looking in detail at the lungs. Students will also consider the role of transport systems in different complexities of living things and look in detail at the mammalian heart and circulatory system.

### B4 Health Matters

#### Key Concept: Health & Disease

#### Core Concepts:

- Factors that affect our chances of catching a non-communicable disease.
- How are communicable diseases spread?
- How do we control the spread of diseases?
- Why is it import and to study microbes?
- How do we grow microbes in the laboratory and commercially?
- How are plants affected by disease and protected from attack?

**Rationale:** In unit 4 students will study the difference between communicable and non-communicable diseases and look at several examples of each in detail, considering their transmission, risk factors that increase their likelihood, and different treatments including painkillers and antibiotics. Students will also look at the immune response to different types of illness and how artificial immunity can be created using vaccines. Finally, students will look at how plants are able to protect themselves from disease without the help of an immune system.

## Year 11

### B5 Coordination & Control

#### Key Concept: How Organisms Work

- Conditions in the body, processes and systems are coordinated and controlled.
- Control of metabolism and levels of chemicals in the body.
- Control of sexual development and human reproduction.
- Plants respond to stimuli to control important processes.

**Rationale:** In unit 5 students will look in detail at the role of the nervous and endocrine system in controlling homeostatic processes such as temperature, water and sugar balance in the body. Students will also look at the role of hormones on the development of secondary sexual characteristics, the menstrual cycle and reproductive technologies to build on the basic knowledge students obtained when studying reproduction at KS3.

### B6 Genetics

#### Key Concept: Variation & Evolution Genetics & Inheritance

#### Core Concepts:

- Our understanding of DNA and the way genes work.
- Production of sex cells for reproduction
- Characteristics are inherited from one generation to the next.

**Rationale:** In Unit 6 we will build on the concepts covered in KS3 looking at variation and look in detail at the structure of DNA and how a section of DNA, known as a gene can code for a protein. Students will also look at how the process of meiosis differs from that of mitosis and enables the production of gametes and how these allow genetic information to be passed on from parents to offspring in sexual reproduction.

### B7 Variation & Evolution

#### Key Concept: Variation & Evolution

#### Core Concepts:

- What causes variation and what are it's effects on an individual?
- How do variation, a struggle for existence and natural selection lead to the evolution of new species?
- What are the causes of extinctions?

**Rationale:** In unit 7 students will build on their knowledge of genes and inheritance to explain in detail how new species came to be due to environmental pressures that lead to the processes of natural selection. They will also consider what these different environmental pressures may have been historically and today and consider possible factors that could lead to extinction in the past and present.

### B8 Ecology

#### Key Concept: Ecosystems & Ecology

#### Core Concepts:

- What factors affect living organisms in a habitat?
- How do plants and animals within a community interact?
- How do human activities affect biodiversity?
- How are materials in a community cycled?

**Rationale:** In unit 8 students will look at different biotic and abiotic factors that can have an effect on the living things in a habitat. Students will learn how water and carbon are cycled in the environment and how manmade processes can have an effect on these natural processes. They will consider how human activity is having an impact on global biodiversity and consider the importance of having a variety of different species for food chains and human food security.





<p><b>Enrichment, Personal Development &amp; Extracurricular</b></p>	<p>The curriculum is designed along side the best evidence to ensure the best learning experience for our students and is based on 6 key pillars;</p> <ul style="list-style-type: none"> <li>• Coherence</li> <li>• High Expectations</li> <li>• Metacognitive learning</li> <li>• Learner Identity</li> <li>• Responsive Teaching &amp; Learning</li> <li>• Awe and Wonder</li> </ul> <p>The department run numerous trips and visits to local universities and colleges and promote science in science week via the sharing of peer science projects or via community events such as primary science clubs. The school also has a weekly STEM club.</p>	<p><b>Careers Education &amp; Cultural Capital</b></p>	<p>Relevance of Science to learners is integrated throughout the curriculum components and resources, including student-facing content on accessible Science and diverse scientists in society.</p> <p>Support for teachers promoting learner identity and identification with Science is provided through CPD and resources available on the kerboodle platform. These explore the impact and relevance to learners' lives and society, and pathways in Science, for each of the six key concepts for each discipline. (see MT/LT plans)</p>
<p><b>Numeracy</b></p>	<p>Mathematical skills are fundamental to success within scientific disciplines and, as such, learners' development of these crucial skills is emphasised within all curriculum materials. In particular, application of skills and knowledge learnt within the Maths curriculum to scientific contexts can be a sticking point for learners, and the curriculum is designed to support learners with this throughout KS3 and KS4 and within all resources. Maths skills are incorporated into all relevant lessons and further supported by targeted resources.</p> <p>See MT/LT Plans for more information.</p>	<p><b>Metacognition</b></p>	<p>Understanding of how an individual learns and self-regulation of that learning are key to develop effective Science learners. The EEF notes that incorporating metacognition and self-regulation approaches in teaching and learning leads to great positive impact on learner progress. This ownership of learning is developed in a number of ways including for example;</p> <ul style="list-style-type: none"> <li>• Incorporation of the plan-monitor-evaluate cycle within relevant activities and resources, so that learners become familiar with planning the steps they will take within an activity or to solve a problem, monitoring their progress, and evaluating what they have learned.</li> <li>• Direct teaching and practice of a range of metacognitive strategies throughout the lesson content and student resources, as appropriate for the scientific topic at hand, followed by use of metacognitive strategies outside of class to review and reflect.</li> <li>• Consistent teacher-led modelling of thinking and problem-solving skills, to demonstrate how an expert employs strategies like the plan-monitor-evaluate cycle.</li> <li>• Fostering metacognitive talk in the classroom at appropriate opportunities.</li> <li>• Dedicated support within teaching materials and targeted PD resources for teachers.</li> </ul>
<p><b>Literacy</b></p>	<p>Effective use of vocabulary, reading and writing skills, and scientific communication are all integral to long-term success in Science. Practice of literacy skills is therefore embedded throughout the Science curriculum, following a progression designed around the EEF's Improving Secondary Science recommendations.</p> <p>Literacy skills are developed through the use of literacy trackers to highlight key vocabulary and definitions, lesson activities, targeted guidance and activities. Literacy is also emphasised throughout the new activate KS3 scheme specifically to target recommendations within the Oxford University Press Bridging the Word Gap report, which highlighted literacy as a major target area for improvement in the transition to Secondary school.</p>	<p><b>Catholic Ethos</b></p>	<p>Science is delivered with the CTK virtues at it's core. The core pillars of the curriculum include 'awe and wonder' not only to instil a fascination with the world in which we live but equally importantly to deepen our students faith and spiritual journey by relating the wonders of our world to our Catholic faith. The curriculum also links closely to the Ctk way and the department actively promote the awarding of merits for particular aspects of learning and the curriculum.</p>