SCIENCE DEPARTMENT KEY STAGE 4 BIOLOGY CURRICULUM OVERVIEW

The Science department key stage 4 curriculum is designed to implement the Academy's vision of "Deepening Learning, Raising Aspiration", in line with the OAT curriculum strategy of "Teach, Develop, Change". Our curriculum is carefully designed to build resilience, aspiration and independence in our learners. We carefully design the KS4 curriculum to further develop and build upon prior learning at KS3.

Science in key stage 4 continues with the process of building upon and deepening scientific knowledge and the understanding of ideas developed in earlier key stages in the subject disciplines of biology, chemistry and physics.

For some students, studying the sciences in key stage 4 provides the platform for more advanced studies, establishing the basis for a wide range of careers. For others, i will be their last formal study of subjects that provide the foundations for understanding the natural world and will enhance their lives in an increasingly technological society.

Science is changing our lives and is vital to the world's future prosperity, and all students should be taught essential aspects of the knowledge, methods, processes and uses of science. They should be helped to appreciate the achievements of science in showing how the complex and diverse phenomena of the natural world can be described in terms of a number of key ideas relating to the sciences which are inter-linked, and which are of universal application.

Diversity

Our Science curriculum covers many of the world's greatest Scientists including Darwin and Dalton (England), Einstein (Germany), Boyle (Ireland). We introduce a wide range of Scientists during the learning of the three different disciplines in Science, for example in Physics, radioactivity, we learn about Marie Curie (Poland) who discovered radium, Katherine Johnson (African American) whose calculations enabled the USA moon landing. In Biology, we learn about the work of Rosalind E Franklin (England) who, through x-ray crystallography was central to the understanding of the molecular structure of DNA. In Chemistry, we teach about Percy Julian (African American) a renowned research chemist who was a pioneer in the chemical synthesis of medicinal drugs from plants. We discuss innovations with related subjects and this includes Mary Jackson, NASA's first black female engineer and Ada Lovelace a mathematician and pioneer of computing.

We introduce the students to new and emerging technologies from around the world in the context of their wider learning and celebrate events such as Earth Day and National Technology Day. We encourage our students to discuss and debate views on Science from other religions such as Hinduism and Creationists.

ORMISTON RIVERS ACADEMY– KEY STAGE 4 BIOLOGY OVERVIEW

Year 10

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
Autumn	**Cell Biology** Diversity						**Organisation** Diversity					
	Cell structure Culturing microorganisms			Cell division Transport in cells			Animal and plant tissues Organs and organ systems			Non-communicable diseases		
Spring	**Infection and Response** Diversity						**Bioenergetics**					
	Communicable diseases Human defence systems Vaccination, antibiotics and painkillers			Monoclonal antibodies Plant diseases and responses			Photosynthesis reaction and rate			Aerobic and anaerobic respiration Metabolism		
Summer	**Homeostasis and Response**						**Homeostasis and Response**					
	Human nervous system Brain, eye and thermoregulation			Hormonal coordination in humans Control of blood glucose, water and nitrogen			Hormones in reproduction			Plant hormones		

ORMISTON RIVERS ACADEMY– KEY STAGE 4 BIOLOGY OVERVIEW

Autumn Half Term 1

Block 1 – Weeks 1 to 3

Cell Biology

- Explore how structural differences between types of cells enable them to perform specific functions
- Describe and compare and uncontaminated culture using aseptic techniques
- Carry out calculations involving magnification

Notes/Links/Interleaving

- **Refers back to and builds on Cells (Year 7), Human Body (Year 8) Biology Fundamentals 1 (Year 9) and links to A Level Biology topics**

Block 2 – Weeks 4 to 6

Cell Biology

- Understand the three overall stages of the cell cycle
- Recognise, draw and interpret diagrams that model transport in cells (diffusion, osmosis and active transport)
- Plot draw and interpret appropriate graphs

Additional Higher Content

- Calculating magnification using equations
- Evaluating ethical issues in the use of stem cells
- Using models and analogies to develop explanations of how cells divide
- Express answers in standard form

Autumn Half Term 2

Block 3 – Weeks 7 to 9

Organisation

- Study the digestive, respiratory and circulatory systems
- Evaluate the advantages and disadvantages of coronary heart disease treatments
- Study how plant tissues are related to their function
- Describe the process of transpiration and translocation

Notes/Links/Interleaving

- **Refers back to and builds on Cells (Year 7), Human Body (Year 8) Biology Fundamentals 1 (Year 9) and links to A Level Biology topics**

Block 4 – Weeks 10 to 12

Organisation

- Learn about damage to these systems, effects on the body and treatments or prevention
- Understand the principles of sampling as applied to scientific data
- Describe cancer as a result in changes in cells that leads to uncontrolled growth

Additional Higher Content

- Extract and interpret information from graphs, charts and tables

Spring Half Term 1

Block 1 – Weeks 1 to 3	Block 2 – Weeks 4 to 6
Infection and Response • Study prevention of diseases, how the body defends and responds to pathogens • Explain how vaccination prevents illness • Explain the use of antibiotics and other medicines in treating diseases	**Infection and Response** • Describe how monoclonal antibodies are produced and used • Describe physical and chemical plant disease and defence responses
Notes/Links/Interleaving • **Refers back to and builds on Cells and Infectious Diseases (Year 7), Human Body (Year 8) Biology Fundamentals 1 (Year 9) and links to A Level Biology topics**	**Additional Higher Content** • Evaluate the advantages and disadvantages of monoclonal antibodies • Application of scientific knowledge to detect and identify plant disease

Block 3 – Weeks 7 to 9	Block 4 – Weeks 10 to 12
Bioenergetics • Explore how plants harness the suns energy to make food through photosynthesis • Identifying the uses of glucose by a plant	**Bioenergetics** • Describe cellular respiration both aerobic and anaerobic to transfer energy • Explain the importance of sugars, amino acids, fatty acids and glycerol in the synthesis and breakdown of nutrients
Notes/Links/Interleaving • **Refers back to Cells (Year 7), Genes and Reproduction and Ecology and Plants (Year 8), Biology Fundamentals 1 (Year 9) and links to A Level Biology**	**Additional Higher Content** • Explain graphs of photosynthesis rate involving two or three factors • Limiting factors are important in economics of conditions in a greenhouse • Describe oxygen debt as the amount of extra oxygen needed after exercise to react and remove lactic acid

ORMISTON RIVERS ACADEMY– KEY STAGE 4 BIOLOGY OVERVIEW

Summer Half Term 1

Block 1 – Weeks 1 to 3

Homeostasis and Response

- Explore the structure and function of the nervous system
- Identify parts of the brain and describe their functions
- Identify structures of the eye and relate to their function
- Interpret ray diagrams showing myopia and hyperopia

Notes/Links/Interleaving

- **Refers back to Genes and Reproduction (Year 7), Human Body (Year 8), Biology Fundamentals 1 (Year 9) and links to A Level Biology**

Block 2 – Weeks 4 to 6

Homeostasis and Response

- Understanding the role of hormones and their slower changes in the body
- Explain how insulin controls blood glucose
- Describe the function of the kidneys in maintaining water balance in the body

Additional Higher Content

- Explain difficulties of investigating brain function
- Evaluate risks and benefits of procedures on the brain
- Describe the effect of ADH on the kidneys
- Explain negative feedback with thyroxine and adrenalin

Summer Half Term 2

Block 3 – Weeks 7 to 9

Homeostasis and Response

- Explaining how reproductive hormones have allowed scientists to develop contraception and fertility drugs
- Evaluate different hormonal and non-hormonal methods of contraception

Notes/Links/Interleaving

- **Refers back to Genes and Reproduction and Ecology and Plants (Year 8) Biology Fundamentals 1 (Year 9) and links to A Level Biology**

Block 4 – Weeks 10 to 12

Homeostasis and Response

- Describe the role of hormones in plants
- Understand how the use of hormones as weed killers effects biodiversity

Additional Higher Content

- Explain the role of hormones in technologies to treat infertility
- Describe the effect of FSH, oestrogen, LH and progesterone on the menstrual cycle
- The role of gibberellins and ethane in plants

Year 11	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
Autumn	**Inheritance, Variation and Evolution** Diversity						**Ecology**					
	Reproduction Variation and evolution			Development of understanding genetics and evolution Classification of living organisms			Adaptations, interdependence and competition			Organisation of an ecosystem		
Spring	**Ecology**						**Revision**					
	Biodiversity Effect of human interactions on ecosystems			Trophic levels in an ecosystem Food production			All topics Exam skills and practice					
Summer	**Revision and Exams**						**Revision and Exams**					
	All topics Exam skills and practice						Biology paper 1 and paper 2					

ORMISTON RIVERS ACADEMY– KEY STAGE 4 BIOLOGY OVERVIEW

Autumn Half Term 1

Block 1 – Weeks 1 to 3

Inheritance, Variation and Evolution

- Identify the differences between sexual and asexual reproduction, meiosis and mitosis
- Describe the structure of DNA and predicting the results of a gene cross
- Describe variation in a population

Notes/Links/Interleaving

- **Refers back to Genes and Reproduction (Year 7) and Biology Fundamentals 1 (Year 9) and links to A Level Biology**

Block 2 – Weeks 4 to 6

Inheritance, Variation and Evolution

- Explain the theory of evolution by natural selection and the work of Darwin and Wallace
- Describe the development of genetics through the work of Mendel
- Studying selective breeding and genetic engineering of food crops and animals
- Understand the Linnaean system of classification

Additional Higher Content

- Describe protein synthesis and how DNA affects the proteins made
- Construct a genetic cross by punnet square to make predictions using the theory of probability
- Describe the main steps in the process of genetic engineering and cloning

Autumn Half Term 2

Block 3 – Weeks 7 to 9

Ecology

- Describe different levels of organisation in an ecosystem
- Describe how changes in abiotic and biotic factors can affect a community
- Explain how organisms are adapted to live in their natural environment

Notes/Links/Interleaving

- **Refers to Ecology and Plants (Year 8) and links to A Level Biology**

Block 4 – Weeks 10 to 12

Ecology

- Understand the abundance of organisms, feeding relationships, mean, mode and median
- Explain the role of microorganisms in cycling materials through an ecosystem
- Explain how temperature, water and available oxygen affect the rate of decay of biological material

Additional Higher Content

- Evaluate the impact of environmental changes on the distribution of a species in an ecosystem

ORMISTON RIVERS ACADEMY– KEY STAGE 4 BIOLOGY OVERVIEW

Spring Half Term 1

Block 1 – Weeks 1 to 3

Ecology

- Explain how waste, deforestation and global warming impact biodiversity
- Understand the need for cheap available compost to increase food production and the need to conserve peat bogs
- Evaluate the environmental implications of deforestation
- Describe biological consequences of global warming
- Describe positive and negative human interactions in an ecosystem and explain the impact on biodiversity

Notes/Links/Interleaving

- **Refers to Ecology and Plants (Year 8) and links to A Level Biology**

Block 2 – Weeks 4 to 6

Ecology

- Describe the differences between trophic levels of organisation in an ecosystem
- Calculate efficiencies of biomass transfer between levels
- Describe some of the biological factors affecting levels of food security
- Evaluate the advantages and disadvantages of modern farming techniques and fishing techniques
- Describe and explain some possible biotechnical and agricultural solutions including genetic modification to meet the demands of a growing population

Additional Higher Content

- Evaluate modern farming methods

Spring Half Term 2

Block 3 – Weeks 7 to 9

Paper 1 Revision

- All topics

Notes/Links/Interleaving

- **Revision of the whole course**

Block 4 – Weeks 10 to 12

Paper 1 and Paper 2 Revision

- All topics

Additional Higher Content

- Higher level content as taught throughout the course

ORMISTON RIVERS ACADEMY– KEY STAGE 4 BIOLOGY OVERVIEW

Summer Half Term 1	
Block 1 – Weeks 1 to 3	**Block 2 – Weeks 4 to 6**
Paper 2 Revision • All topics	**Revision and Exams** • Biology paper 1 and paper 2
Notes/Links/Interleaving • **Revision of the whole course**	**Additional Higher Content** • Higher level content as taught throughout the course

Summer Half Term 2	
Block 3 – Weeks 7 to 9	**Block 4 – Weeks 10 to 12**
Revision and Exams • Biology paper 1 and paper 2	**Revision and Exams** • Biology paper 1 and paper 2
Notes/Links/Interleaving • **Revision of the whole course**	**Additional Higher Content** • Higher level content as taught throughout the course