

## KS4 Curriculum Overview: Biology

### Rationale:

In Key Stage 4 we continue to teach Biology separately to Physics and Chemistry. These divisions are mirrored further in the Sixth Form at Level 3, in the structure of both A level courses and units of the Vocational BTEC Level 3 National Extended Certificate in Applied Science.

In Years 10 and 11, we continue the work started in Year 9 as we build on the knowledge and understanding of Biology gained during Key Stage 3. This follows the philosophy of a '5 Year Key Stage 4' inherent in the current Programme of Study and National Curriculum for KS3 and 4 Science. (In other words, both the knowledge and skills directly gained at KS3 and those developed further during KS4 are tested during the GCSE exams taken at the end of Year 11).

At Key Stage 4 we follow the AQA Scheme of Learning, in common with Physics and Chemistry. All students in Years 10 and 11 follow the Combined Science Trilogy course, with 11A1, 11A2 and 11A3 being taught the Separate Science content in addition. Final decisions about the specific exam route taken are made in Year 11 on an individual basis.

In Year 10, students study Infections and Response, Bioenergetics and Homeostasis and Response, and then begin Ecology, as this coincides with the summer term and being able to study ecosystems in the field. This continues into Year 11 followed by the final module of Inheritance, Variation and Evolution. As far as is possible with separate topics, this sequence means that earlier material is revisited to support later material. Throughout the course, the scientific process is taught, with many opportunities to safely plan, risk assess, investigate, record, conclude and evaluate practical investigations, together with the relevant maths skills, and key subject-specific vocabulary that will enable students to be scientifically literate.

- 1. In the following Overview, the lesson numbers are approximate and will vary depending on the number of weeks in each term.*
- 2. All in italic are for separate sciences only*
- 3. All in bold are for higher tier only**

**Reading in the curriculum:** The Sciences offer many opportunities to develop and extend students' literacy skills. There is a large amount of new, subject-specific vocabulary, and so each unit includes a glossary which students will complete and learn during the unit. Students will use texts to find out information for themselves, using the functional layout of such texts, including index, contents and glossary sections of text books used in class, and also at home in an online format. Students will also review and connect information within topics, so knowledge organisers are provided for each topic.

**Connected knowledge:** Topics in the Sciences do not stand alone. Each topic connects to prior knowledge from primary school, other topics learnt or still to be learnt at this school both in the Sciences and in other subjects and also in the outside world. Connected knowledge is discussed in class, starting with the Context Summary which is shared with students at the start of each topic.

**Diversity:** Science belongs to everyone, regardless of background, and people from all walks of life contribute to its development and reap its benefits. This is reflected in the examples used in lessons and the Scientists whose work we consider.

Term / Length of Unit	Outline	Assessment	Home Learning	Resources	Knowledge/Skills End Points	Reading in the Curriculum
Year 10 Autumn term 1 Topic 3 Infection and Response 6 lessons (8 including assessment and responding to feedback lessons)	<u>Topic 3 Infection and Response Term 1</u>  An introduction to communicable diseases, in contrast to the non-communicable diseases associated with lifestyle studies in Topic 2. Bacterial, viral, fungal and protist pathogens are studied along with examples of diseases they cause, mode of transmission and treatments. This links to cell structure and reproduction studied in Topic 1, and to the organ systems studied in Topic 2.  Opportunities for practical work are limited due to the nature of the topic, however ease of transmission can be modelled in class, and there is plenty of real-life application available.	Mid and End of Topic test	Homework question booklets	SoL on science shared area, including powerpoints, details of practical investigations and associated risk assessments, worksheets, revision resources, homework booklet and test. Biology Student Book	<u>Knowledge</u> <ul style="list-style-type: none"> <li>Definition of 'pathogen' and 4 classifications (viral, bacterial, fungal and protist)</li> <li>Explain how the different pathogens harm the body</li> <li>Specific examples of diseases caused by each type of pathogen, symptoms, transmission and treatments available (measles, HIV, TMV, salmonella, gonorrhoea, rose black spot and malaria)</li> </ul> <u>Skills</u> <ul style="list-style-type: none"> <li>Relate the theoretical knowledge gained in class to real-life – recent pandemics and how communicable diseases can rapidly spread through populations, affecting human health and the economy, and the response of governments and world bodies such as the WHO</li> </ul>	Glossary, context summary, knowledge organiser and guided reading opportunities
Year 10 Autumn Term 2 Topic 3 Infection and Response 6 lessons Combined H and F (8 including assessment and responding to feedback lessons) <i>8 lessons for Biology F</i> <b>10 lessons for Biology H (12)</b>	<u>Topic 3 Infection &amp; Response Term 2</u>  Students continue this topic begun in Year 9 by learning about another organ system – the immune system. They study how the body defends itself against entry to pathogens, phagocytes and lymphocytes, and how vaccination and medicines support health. They also learn about the stages of developing new drugs.	Mid-point and end of topic test	Homework question booklets	SoL on science shared area, including powerpoints, details of practical investigations and associated risk assessments, worksheets, revision resources, homework booklet and test. Biology Student Book	<u>Knowledge</u> <ul style="list-style-type: none"> <li>Non-specific defences of the human body against pathogens</li> <li>The actions of white blood cells should pathogens enter the body</li> <li>How vaccination prevents the spread of disease, and how vaccination works</li> <li>Explain the use (and limitations) of painkillers and antibiotics</li> <li>The discovery and development of potential new medicines, including preclinical and clinical testing.</li> <li><i>Non-specific defences in plants</i></li> <li><b>Production and use of monoclonal antibodies</b></li> </ul>	Glossary, context summary, knowledge organiser and guided reading opportunities

<p><b>including assessment and responding to feedback lessons)</b></p>	<p><i>Biology students extend their knowledge by looking at plant defences.</i></p> <p><b>Biology H students also look at the production and use of monoclonal antibodies.</b></p> <p>There are further opportunities to view white blood cells using a microscope, but a lack of hands-on experience can be made up by the numerous opportunities to look at real-life application of vaccination, discovery and development of drugs, the relevant history (Jenner and Fleming) and current affairs (new vaccinations for evolving viruses / the anti-vax movement)</p>				<p><u>Skills</u></p> <ul style="list-style-type: none"> <li>Evaluate the global use of vaccination in the prevention of disease.</li> <li>Understand that the results of testing and trials are published only after scrutiny by peer review.</li> <li>Viewing and drawing white blood cells using a microscope</li> <li><b>Evaluation of therapeutic use of monoclonal antibodies</b></li> </ul>	
<p>Year 10 Autumn Term 2 Topic 4 Bioenergetics 11 lessons (15 lessons including 2 x assessment and responding to feedback lessons)</p>	<p><u>Topic 4 Bioenergetics Term 2</u></p> <p>This is a short unit of work which covers two interdependent processes; photosynthesis and respiration. This combines the work covered so far looking at internal cellular organelles such as chloroplasts and mitochondria, adaptations of cells and organs, and the organ systems required to supply the cells with the chemicals needed to respire to release energy, and photosynthesise to produce glucose.</p> <p>There are many opportunities for practical work in this topic, including looking for</p>	<p>Mid-point and end of topic test</p>	<p>Homework question booklets</p>	<p>SoL on science shared area, including powerpoints, details of practical investigations and associated risk assessments, worksheets, revision resources, homework booklet and test. Biology Student Book</p>	<p><u>Knowledge</u></p> <ul style="list-style-type: none"> <li>The photosynthetic reaction and equation</li> <li>Rate of photosynthesis and limiting factors</li> <li>Uses of glucose</li> <li><b>inverse square law and light intensity in the context of photosynthesis</b></li> <li>Aerobic and anaerobic respiration</li> <li>Response of the body to exercise</li> <li>Metabolism definition and examples</li> </ul> <p><u>Skills</u></p> <ul style="list-style-type: none"> <li>RP – investigate the effect of light intensity on the rate of photosynthesis using an aquatic organism such as pondweed.</li> <li>measure and calculate rates of photosynthesis</li> </ul>	<p>Glossary, context summary, knowledge organiser and guided reading opportunities</p>

	evidence that photosynthesis has taken place, investigating the factors that affect photosynthesis and effect of exercise on breathing and heart rate. Further applications to real life include anaerobic respiration of yeast in brewing and bread-making.				<ul style="list-style-type: none"> <li>extract and interpret graphs of photosynthesis rate involving one limiting factor</li> <li>plot and draw appropriate graphs selecting appropriate scale for axes</li> <li>translate information between graphical and numeric form</li> <li>Tests to identify starch, glucose and proteins using simple qualitative reagents.</li> <li>Investigations into the effect of exercise on the body</li> <li><b>Use data to relate limiting factors to the cost effectiveness of adding heat, light or carbon dioxide to greenhouses</b></li> </ul>	
<p>Year 10 Spring Term 1 Topic 5 Homeostasis Combined Foundation – 12 lessons (16 including assessment and responding to feedback lessons) <b>Combined Higher – 16 lessons (22 in total)</b> <i>Biology Foundation – 20 lessons (26 lessons in total)</i> <b>Biology Higher – 25 lessons (31 in total)</b></p>	<p><u>Topic 5 Homeostasis Term 3</u></p> <p>The first section of this large unit begins with an introduction to the concept of homeostasis and control systems, with examples, followed by learning about one of the organ systems in control of some of our body responses, the nervous system.</p> <p>Practical work includes a required practical investigating the effect of a stimulant on reaction times.</p>	Mid-point and end of topic test	Homework question booklets	<p>SoL on science shared area, including powerpoints, details of practical investigations and associated risk assessments, worksheets, revision resources, homework booklet and test. Biology Student Book</p>	<p><u>Knowledge</u></p> <ul style="list-style-type: none"> <li>Definition and examples of homeostasis</li> <li>Stimulus – receptor – co-ordinator – effector - response</li> <li>Structure and function of sensory, relay and motor neurones</li> <li>Role of brain and spinal cord as coordinators</li> <li>Identifying stimuli, receptors, effectors and responses</li> <li>Role and pathway of the reflex arc</li> </ul> <p><u>Skills</u></p> <ul style="list-style-type: none"> <li>RP - plan and carry out an investigation into the effect of a factor on human reaction time</li> <li>Extract and interpret data from graphs, charts and tables, about the functioning of the nervous system</li> <li>Translate information about reaction times between numerical and graphical forms</li> </ul>	Glossary, context summary, knowledge organiser and guided reading opportunities

<p>Year 10 Spring Term 2 Topic 5 Homeostasis (as above)</p>	<p><u>Topic 5 Homeostasis Term 4</u></p> <p>The second part of the topic involves learning about the other organ system involved in coordinated homeostasis – the endocrine system. Students learn about endocrine glands and hormones, in particular about the hormones involved in the regulation of blood sugar levels (and diabetes), and hormones that control the human menstrual cycle.</p> <p>Students are able to see a range of examples of contraception, and there are many real-life applications of diabetes and contraception.</p>	<p>Mid and End of topic test</p>	<p>Homework question booklets</p>	<p>SoL on science shared area, including powerpoints, details of practical investigations and associated risk assessments, worksheets, revision resources, homework booklet and test. Biology Student Book</p>	<p><u>Knowledge</u></p> <ul style="list-style-type: none"> <li>Identifying endocrine glands in the human body</li> <li>How hormones are released from glands, travel around the body in the blood stream and effect target cells</li> <li>The pituitary gland as the 'master' gland</li> <li>How insulin <b>and glucagon</b> control blood sugar levels</li> <li>Compare and contrast the causes, symptoms and treatments of Type I and Type II diabetes</li> <li>The name and role of the main male and female sex hormones <b>and the interactions of FSH, LH, oestrogen and progesterone</b></li> <li>How sex hormones can be used to control fertility, along with non-hormonal methods</li> </ul> <p><u>Skills</u></p> <ul style="list-style-type: none"> <li>Evaluate information around the relationship between obesity and diabetes, and make recommendations taking into account social and ethical issues</li> <li>extract information and interpret data from graphs that show the effect of insulin in blood glucose levels in both people with diabetes and people without diabetes</li> <li><b>extract and interpret data from graphs showing hormone levels during the menstrual cycle</b></li> <li>Show why issues around contraception cannot be answered by science alone</li> <li>Explain everyday and technological applications of science; evaluate associated personal, social, economic and</li> </ul>	<p>Glossary, context summary, knowledge organiser and guided reading opportunities</p>
---	---	----------------------------------	-----------------------------------	--	---	--

					environmental implications; and make decisions based on the evaluation of evidence and arguments.	
<p>Year 10 Summer Term 1 Topic 5 Homeostasis (as above) Combined Foundation and Higher students are likely to begin Topic 7 Ecosystems in this term (see below)</p>	<p><u>Topic 5 Homeostasis Term 5</u></p> <p>Combined Foundation students will finish the Homeostasis topic and move on to Topic 7. Combined Higher students and Biology Higher students learn about the role of hormones in IVF, and learn about negative feedback using thyroxine and adrenaline as examples. Combined Higher students then move on to Topic 7. Biology Higher and Foundation students move on to the significant amount of content that is in the Biology course only – the brain, the eye, the kidneys, control of body temperature and plant hormones.</p> <p><i>There are opportunities for dissection for the Biology students, using the eye and the kidney. There is also a biology only required practical investigating the effect of plant hormones.</i></p>	Mid and End of topic test	Homework question booklets	<p>SoL on science shared area, including powerpoints, details of practical investigations and associated risk assessments, worksheets, revision resources, homework booklet and test. Biology Student Book.</p>	<p><u>Knowledge</u></p> <ul style="list-style-type: none"> <li>• <b>Reproductive hormones increasing fertility (IVF)</b></li> <li>• <b>Negative feedback loops involving thyroxine and adrenaline</b></li> <li>• <i>Identify parts of the brain <b>and brain mapping</b></i></li> <li>• <i>relate the structures of the eye to their functions, including accommodation to focus on near or distant objects and adaptation to dim light.</i></li> <li>• <i>Eye defects</i></li> <li>• <i>Control of body temperature</i></li> <li>• <i>The role of the kidney in maintaining water and nitrogen balance <b>including the role of ADH</b></i></li> <li>• <i>Treatments of kidney failure</i></li> <li>• <i>Plants produce hormones to coordinate and control growth and responses to light and gravity</i></li> <li>• <i>Role of auxin (<b>and ethene and giberellins</b>)</i></li> <li>• <b>Uses of plant hormones</b></li> </ul> <p><u>Skills</u></p> <ul style="list-style-type: none"> <li>• <b>Developments of microscopy techniques have enabled IVF treatments to develop.</b></li> <li>• <b>Understand social and ethical issues associated with IVF treatments.</b></li> <li>• <b>Evaluate from the perspective of patients and doctors the methods of treating infertility</b></li> </ul>	Glossary, context summary, knowledge organiser and guided reading opportunities

					<ul style="list-style-type: none"> <li>• <b>Interpret and explain simple diagrams of negative feedback control</b></li> <li>• <i>Evaluate the benefits and risks of procedures carried out on the brain and nervous system</i></li> <li>• <i>Translate tables and bar charts of glucose, ions and urea before and after filtration</i></li> <li>• <i>Describe how kidney dialysis works</i></li> <li>• <i>Evaluate the advantages and disadvantages of treating organ failure by mechanical device or transplant</i></li> <li>• <i>RP - investigate the effect of light or gravity on the growth of newly germinated seedlings</i></li> <li>• <b>Understand how the everyday use of hormones as weed killers has an effect on biodiversity</b></li> </ul>	
<p>Year 10 Summer Term 2 Topic 7 Ecosystems 7 lessons (9 lessons including assessment and responding to feedback lessons)</p>	<p><u>Topic 7 Ecosystems Term 6</u></p> <p>This is the only topic not taught in sequence, as practical skills taught within this topic require access to the school's external environment and hopefully good weather (school field, pond etc). Students begin by learning that all species live in ecosystems composed of complex communities of animals and plants dependent on each other and that are adapted to particular conditions, both abiotic and biotic. They learn about competition for resources and predator-prey relationships. <i>Biology students also learn about the transfer of energy through</i></p>	<p>Mid and End of topic test Year 10 PPE</p>	<p>Homework question booklets</p>	<p>SoL on science shared area, including powerpoints, details of practical investigations and associated risk assessments, worksheets, revision resources, homework booklet and test. Biology Student Book</p>	<p><u>Knowledge</u></p> <ul style="list-style-type: none"> <li>• Definitions of key words</li> <li>• Examples of biotic and abiotic factors</li> <li>• Predator-prey relationships</li> <li>• Competition</li> <li>• Adaptation of animals and plants</li> <li>• <i>Food chains, tropic levels and pyramids of biomass</i></li> </ul> <p><u>Skills</u></p> <ul style="list-style-type: none"> <li>• Recording first-hand observations of organisms</li> <li>• Extract and interpret information from charts, graphs and tables</li> <li>• understand the terms mean, mode and median</li> <li>• calculate arithmetic means</li> <li>• plot and draw appropriate graphs selecting appropriate scales for the axes</li> <li>• Interpret graphs used to model predator-prey cycles</li> </ul>	<p>Glossary, context summary, knowledge organiser and guided reading opportunities</p>

	<p><i>food chains, trophic levels and pyramids of biomass.</i></p> <p>Students will be able to view organisms in their own environment by carrying out a practical into the distribution of plants on the school field, and creating a self-sustaining ecosystem using samples from the pond.</p>				<ul style="list-style-type: none"> <li>• RP - measure the population size of a common species in a habitat. Use sampling techniques to investigate the effect of a factor on the distribution of this species</li> <li>• <i>Construct accurate pyramids of biomass from appropriate data</i></li> <li>• <i>Calculate the efficiency of biomass transfer between trophic levels</i></li> </ul>	
<p>Year 11 Autumn Term 1 Topic 7 Ecosystems Combined Science - 8 lessons (10 lessons including assessment and responding to feedback lessons) <i>Biology - 15 lessons (19 in total)</i></p>	<p><u>Topic 7 Ecosystems Term 1</u></p> <p>Students continue the second part of the Ecosystems topic, learning about cycling materials, the impact of humans on the environment and the possible long-term consequences.</p> <p><i>Biology students also learn about factors affecting decomposition in a required practical, in addition to food security, modern farming methods and biotechnological solutions.</i></p>	<p>Mid-point and end of topic test</p>	<p>Homework question booklets</p>	<p>SoL on science shared area, including powerpoints, details of practical investigations and associated risk assessments, worksheets, revision resources, homework booklet and test. Biology Student Book</p>	<p><u>Knowledge</u></p> <ul style="list-style-type: none"> <li>• Recycling materials e.g. water and carbon and the role of microorganisms</li> <li>• <i>Factors affecting the rate of decomposition</i></li> <li>• <b>Evaluate the impact of environmental change</b></li> <li>• Explain how waste, deforestation and global warming have an impact on biodiversity</li> <li>• Waste management and pollution</li> <li>• Land use, including destruction of peat bogs and deforestation</li> <li>• Biological consequences of global warming</li> <li>• Methods of maintaining biodiversity</li> <li>• <i>Factors affecting food security, and sustainable fisheries</i></li> <li>• <i>Modern farming techniques, including a discussion of the ethical considerations</i></li> <li>• <i>possible biotechnical and agricultural solutions, including genetic modification, to the demands of the growing human population</i></li> </ul> <p><u>Skills</u></p> <ul style="list-style-type: none"> <li>• Interpret and explain the processes in diagrams of the carbon cycle, the water cycle</li> </ul>	<p>Glossary, context summary, knowledge organiser and guided reading opportunities</p>

					<ul style="list-style-type: none"> <li>• Understand that the scientific consensus about global warming and climate change is based on systematic reviews of thousands of peer reviewed publications</li> <li>• Explain and evaluate the conflicting pressures on maintaining biodiversity given appropriate information</li> <li>• <i>calculate rate changes in the decay of biological material</i></li> <li>• <i>translate information between numerical and graphical form</i></li> <li>• <i>plot and draw appropriate graphs selecting appropriate scales for the axes</i></li> <li>• <i>RP - investigate the effect of temperature on the rate of decay of fresh milk by measuring pH change</i></li> <li>• <i>Interpret population and food production statistics to evaluate food security</i></li> <li>• <i>Evaluate the advantages and disadvantages of modern farming techniques</i></li> </ul>	
<p>Year 11 Autumn Term 2 Topic 6 Inheritance, Variation and Evolution 7 lessons (9 lessons including assessment and responding to feedback lessons)</p>	<p><u>Topic 6 Inheritance, Variation and Evolution Term 2</u></p> <p>In the final topic studied, students begin by studying inheritance, so revisit the work learned in B1 Cells and look at the role of chromosomes in the nucleus, and information that can be gained from the human genome. They also learn about meiosis and compare it to mitosis (also covered in B1). This topic also links with inheritance of useful characteristics (adaptation and evolution) covered in Topic 7.</p>	<p>Mid and End of topic test</p> <p>Year 11 PPE 1</p>	<p>Homework question booklets</p>	<p>SoL on science shared area, including powerpoints, details of practical investigations and associated risk assessments, worksheets, revision resources, homework booklet and test. Biology Student Book</p>	<p><u>Knowledge</u></p> <ul style="list-style-type: none"> <li>• DNA, chromosomes, genes and the genome</li> <li>• Asexual and sexual reproduction (<i>advantages and disadvantages</i>)</li> <li>• Inheritance of X and Y chromosomes</li> <li>• Inheritance of genes and genetic diseases (<i>and genetic screening</i>)</li> </ul> <p><u>Skills</u></p> <ul style="list-style-type: none"> <li>• <i>Historical developments of our understanding of the causes and prevention of malaria</i></li> <li>• discuss the importance of understanding the human genome</li> </ul>	<p>Glossary, context summary, knowledge organiser and guided reading opportunities</p>

					<ul style="list-style-type: none"> <li>• Complete (<b>and construct</b>) a genetic cross to show sex inheritance</li> <li>• Understand and use direct proportion and simple ratios in genetic crosses</li> </ul>
<p>Year 11 Spring Term 1 Topic 6 Inheritance, Variation and Evolution Combined Science - 7 lessons (9 lessons including assessment and responding to feedback lessons) <i>Biology Foundation - 11 lessons (15 in total)</i> <b>Biology Higher – 13 lessons (17 in total)</b></p>	<p><u>Topic 6 Inheritance, Variation and Evolution Term 3</u></p> <p>Students finish this topic by moving on to learn about variation and evolution, and the effects that genetics have on the ability of species to adapt to their surroundings. It links to many of the concepts learned in Topic B7, and to the work covered in Topic B3 regarding antibiotics.</p>	<p>Mid-point and end of topic test</p>	<p>Homework question booklets</p>	<p>SoL on science shared area, including powerpoints, details of practical investigations and associated risk assessments, worksheets, revision resources, homework booklet and test. Biology Student Book</p>	<p><u>Knowledge</u></p> <ul style="list-style-type: none"> <li>• Genetic and environmental causes of variation</li> <li>• The theory of evolution by natural selection and evidence for evolution</li> <li>• <i>Lamarck's theory of evolution</i></li> <li>• Selective breeding</li> <li>• Genetic engineering (<b>and vectors</b>)</li> <li>• Causes of extinction</li> <li>• Antibiotic-resistant bacteria</li> <li>• Classification of organisms</li> <li>• <b>Mutation</b></li> <li>• <b>Protein synthesis</b></li> <li>• <i>Speciation</i></li> <li>• <i>Cloning</i></li> <li>• <i>Understanding of genetics</i></li> </ul> <p><u>Skills</u></p> <ul style="list-style-type: none"> <li>• Explain the benefits and risks of selective breeding given appropriate information and consider related ethical issues</li> <li>• <b>Interpret information about genetic engineering techniques and to make informed judgements about issues concerning cloning and genetic engineering, including GM crops</b></li> <li>• <i>benefits and risks of cloning in agriculture and in medicine</i></li> <li>• <i>An appreciation that the theory of evolution by natural selection, speciation and understanding of genetics developed over time and from information gathered by many scientists</i></li> </ul>

					<ul style="list-style-type: none"> <li>• Extract and interpret information from charts, graphs and tables</li> <li>• Understand how scientific methods and theories develop over time</li> <li>• Interpret evolutionary trees</li> </ul>	
<p>Year 11 Spring Term 2 and Summer Term 1</p> <p>Revision</p>	REVISION	Year 11 PPE 2	Homework question booklets	<p>Homework booklets Past exam questions SENECA Tassomai BBC Bitesize SMH quiz's</p>		<p>Glossary, context summary, knowledge organiser and guided reading opportunities</p>