Science – biology

INTENT- KS3

We create a positive and safe learning environment, where students feel confident to explore ideas surrounding science. KS3 is about students finding their feet, learning the foundations and skills that are required by excellent scientists. In Year 7 we start learning about cells, atoms and forces, the essential building blocks for building the knowledge in our science curriculum. Science is a hierarchical subject, where success in each of the three specialisms is reliant on mastery of all that sits below. The principal focus of science teaching in KS3 is to develop a deeper understanding of a range of scientific ideas in the subject disciplines of biology, chemistry and physics. Pupils should begin to see the connections between these subject areas and become aware of some of the big ideas underpinning scientific knowledge and understanding.
Our intent is to ensure that students have a developed understanding of the World and Universe they live in, allowing them to be successful in any route they choose; providing opportunity for academic or personal success within the sciences, or wider career network. We are inclusive with all of our students within the KS3 curriculum, learning essential practical and teamwork skills encouraging students to develop scientific enquiry skills to explore the world around them.

SKILLS AND KNOWLEDGE

	Students will develop their KNOWLEDGE of	Students will develop their SKILLS in
7	**Cells and organisation**: Observing, interpreting and recording cell structure; Functions of the cell components; Similarities and differences between plant and animal cells; Role of diffusion in the movement of materials in and between cells; Unicellular organisms; Hierarchical organisation of multicellular organisms **The skeletal and muscular systems**: Structure and functions of the human skeleton; Biomechanics – the interaction between skeleton and muscles; Function of muscles and examples of antagonistic muscles. Nutrition and digestion; Content of a healthy human diet; Calculations of energy requirements in a healthy daily diet; Consequences of imbalances in the diet; Tissues and organs of the human digestive system; Importance of bacteria in the human digestive system; Plants making carbohydrates and gaining mineral nutrients and water **Gas exchange systems**: Structure and functions of the gas exchange system in humans; Mechanism of breathing to move air in and out of the lungs; Explain the movement of gases and measuring lung volume; Impact of exercise, asthma and smoking on the human gas exchange system; Role of leaf stomata in gas exchange in plants. **Reproduction**: Reproduction in humans, structure and function of the male and female reproductive systems, menstrual cycle, gametes, fertilisation, gestation and birth, effect of maternal lifestyle on the foetus through the placenta; Reproduction in plants, flower structure, wind and insect pollination, fertilisation, seed and fruit formation and dispersal, quantitative investigation of some dispersal mechanisms.	**Scientific attitudes**: pay attention to objectivity and concern for accuracy, precision, repeatability and reproducibility; understand that scientific methods and theories develop as earlier explanations are modified to take account of new evidence and ideas, together with the importance of publishing results and peer review; evaluate risks. **Experimental skills and investigations**: ask questions and develop a line of enquiry based on observations of the real world, alongside prior knowledge and experience; make predictions using scientific knowledge and understanding; select, plan and carry out the most appropriate types of scientific enquiries to test predictions, including identifying independent, dependent and control variables, where appropriate; use appropriate techniques, apparatus, and materials during fieldwork and laboratory work, paying attention to health and safety; make and record observations and measurements using a range of methods for different investigations; and evaluate the reliability of methods and suggest possible improvements; apply sampling techniques. **Analysis and evaluation:** apply mathematical concepts and calculate results; present observations and data using appropriate methods, including tables and graphs; interpret observations and data, including identifying patterns and using observations, measurements and data to draw conclusions; present reasoned explanations, including explaining data in relation to predictions and hypotheses ; evaluate data, showing awareness of potential sources of random and systematic error; identify further questions arising from their results. **Measurement:** understand and use SI units and IUPAC (International Union of Pure and Applied Chemistry) chemical nomenclature; use and derive simple equations and carry out appropriate calculations; undertake basic data analysis including simple statistical techniques

	Students will develop their KNOWLEDGE of	Students will develop their SKILLS in
8	**Health**: Effects of recreational drugs and misuse, on behaviour, health and life processes. **Relationships in an ecosystem**: Interdependence of organisms in an ecosystem, including food webs and insect pollinated crops; Importance of plant reproduction through insect pollination in human food security; How organisms affect, and are affected by, their environment, including the accumulation of toxic materials. **Photosynthesis**: The reactants in, and products of, photosynthesis, and a word summary for photosynthesis; Dependence of almost all life on Earth, such as plants and algae, to use sunlight in photosynthesis to build organic molecules that are an essential energy store and to maintain levels of oxygen and carbon dioxide in the atmosphere; Adaptations of leaves for photosynthesis. **Cellular respiration**: Aerobic and anaerobic respiration in living organisms; Word summary for aerobic respiration; Process of anaerobic respiration in humans and micro-organisms, summary for anaerobic respiration; differences between aerobic and anaerobic respiration **Inheritance, chromosomes, DNA and genes**: Heredity as the process by which genetic information is transmitted from one generation to the next; Simple model of chromosomes, genes and DNA in heredity; differences between species; variation between individuals within a species being continuous or discontinuous, to include measurement and graphical representation of variation; variation between species and between individuals of the same species means some organisms compete more successfully, which can drive natural selection; changes in the environment may leave individuals within a species, and some entire species, less well adapted to compete successfully and reproduce, which in turn may lead to extinction; the importance of maintaining biodiversity and the use of gene banks to preserve hereditary material.	**Scientific attitudes**: pay attention to objectivity and concern for accuracy, precision, repeatability and reproducibility; understand that scientific methods and theories develop as earlier explanations are modified to take account of new evidence and ideas, together with the importance of publishing results and peer review; evaluate risks. **Experimental skills and investigations**: ask questions and develop a line of enquiry based on observations of the real world, alongside prior knowledge and experience; make predictions using scientific knowledge and understanding; select, plan and carry out the most appropriate types of scientific enquiries to test predictions, including identifying independent, dependent and control variables, where appropriate; use appropriate techniques, apparatus, and materials during fieldwork and laboratory work, paying attention to health and safety; make and record observations and measurements using a range of methods for different investigations; and evaluate the reliability of methods and suggest possible improvements; apply sampling techniques. **Analysis and evaluation:** apply mathematical concepts and calculate results; present observations and data using appropriate methods, including tables and graphs; interpret observations and data, including identifying patterns and using observations, measurements and data to draw conclusions; present reasoned explanations, including explaining data in relation to predictions and hypotheses ; evaluate data, showing awareness of potential sources of random and systematic error; identify further questions arising from their results. **Measurement:** understand and use SI units and IUPAC (International Union of Pure and Applied Chemistry) chemical nomenclature; use and derive simple equations and carry out appropriate calculations; undertake basic data analysis including simple statistical techniques

SKILLS AND KNOWLEDGE

	Students will develop their KNOWLEDGE of	Students will develop their SKILLS in
9	**Cell biology:** cells as the basic structural unit of all organisms; adaptations of cells related to their functions; the main sub-cellular structures of eukaryotic and prokaryotic cells; stem cells in animals and meristems in plants; enzymes; factors affecting the rate of enzymatic reactions; the importance of cellular respiration; the processes of aerobic and anaerobic respiration; carbohydrates, proteins, nucleic acids and lipids as key biological molecules; need for transport systems in multicellular organisms, including plants; relationship between the structure and functions of the human circulatory system;	**Scientific attitudes**: pay attention to objectivity and concern for accuracy, precision, repeatability and reproducibility; understand that scientific methods and theories develop as earlier explanations are modified to take account of new evidence and ideas, together with the importance of publishing results and peer review; evaluate risks. **Experimental skills and investigations**: ask questions and develop a line of enquiry based on observations of the real world, alongside prior knowledge and experience; make predictions using scientific knowledge and understanding; select, plan and carry out the most appropriate types of scientific enquiries to test predictions, including identifying independent, dependent and control variables, where appropriate; use appropriate techniques, apparatus, and materials during fieldwork and laboratory work, paying attention to health and safety; make and record observations and measurements using a range of methods for different investigations; and evaluate the reliability of methods and suggest possible improvements; apply sampling techniques. **Analysis and evaluation:** apply mathematical concepts and calculate results; present observations and data using appropriate methods, including tables and graphs; interpret observations and data, including identifying patterns and using observations, measurements and data to draw conclusions; present reasoned explanations, including explaining data in relation to predictions and hypotheses ; evaluate data, showing awareness of potential sources of random and systematic error; identify further questions arising from their results. **Measurement:** understand and use SI units and IUPAC (International Union of Pure and Applied Chemistry) chemical nomenclature; use and derive simple equations and carry out appropriate calculations; undertake basic data analysis including simple statistical technique

INTENT- KS4

Our KS4 curriculum builds on the strong foundations that students have set up themselves in KS3. Teaching the sciences in KS4 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, it 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 that 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 science has evolved with time. The sciences taught are linked to different careers in the scientific world. We are inclusive of all students providing triple science for all and differentiating these disciplines to allow all to succeed, this includes the addition of entry level certificate.

SKILLS AND KNOWLEDGE

	Students will develop their KNOWLEDGE of	Students will develop their SKILLS in
10 & 11	**Health, disease and the development of medicines:** relationship between health and disease; communicable diseases including sexually transmitted infections in humans (including HIV/AIDs); Non-communicable diseases; bacteria, viruses and fungi as pathogens in animals and plants; body defences against pathogens and the role of the immune system against disease; reducing and preventing the spread of infectious diseases in animals and plants; process of discovery and development of new medicines; impact of lifestyle factors on the incidence of non-communicable diseases. **Coordination and control:** principles of nervous coordination and control in humans; relationship between the structure and function of the human nervous system; relationship between structure and function in a reflex arc; principles of hormonal coordination and control in humans; hormones in human reproduction, hormonal and non-hormonal methods of contraception; homeostasis. photosynthesis as the key process for food production and therefore biomass for life; process of photosynthesis; Factors affecting the rate of photosynthesis	**The development of scientific thinking:** ways in which scientific methods and theories develop over time; using a variety of concepts and models to develop scientific explanations and understanding; appreciating the power and limitations of science and considering ethical issues which may arise; explaining everyday and technological applications of science; evaluating associated personal, social, economic and environmental implications; and making decisions based on the evaluation of evidence and arguments; evaluating risks both in practical science and the wider societal context, including perception of risk; recognising the importance of peer review of results and of communication of results to a range of audiences. **Experimental skills and strategies:** using scientific theories and explanations to develop hypotheses; planning experiments to make observations, test hypotheses 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 investigations.

SKILLS AND KNOWLEDGE

	Students will develop their KNOWLEDGE of	Students will develop their SKILLS in
10 & 11	**Ecosystems:** levels of organisation within an ecosystem; some abiotic and biotic factors which affect communities; the importance of interactions between organisms in a community; how materials cycle through abiotic and biotic components of ecosystems; role of microorganisms (decomposers) in the cycling of materials through an ecosystem; organisms are interdependent and are adapted to their environment; importance of biodiversity; methods of identifying species and measuring distribution, frequency and abundance of species within a habitat; positive and negative human interactions with ecosystems. **Evolution, inheritance and variation:** genome as the entire genetic material of an organism; How the genome, and its interaction with the environment, influence the development of the phenotype of an organism; potential impact of genomics on medicine; most phenotypic features being the result of multiple, rather than single, genes; single gene inheritance and single gene crosses with dominant and recessive phenotypes; sex determination in humans; genetic variation in populations of a species; process of natural selection leading to evolution; evidence for evolution; developments in biology affecting classification; importance of selective breeding of plants and animals in agriculture; uses of modern biotechnology including gene technology; some of the practical and ethical considerations of modern biotechnology.	**Analysis and evaluation:** 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. **Vocabulary, units, symbols and nomenclature:** 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.

CURRICULUM LESSONS ALLOCATED OVER THE 2 WEEK TIMETABLE

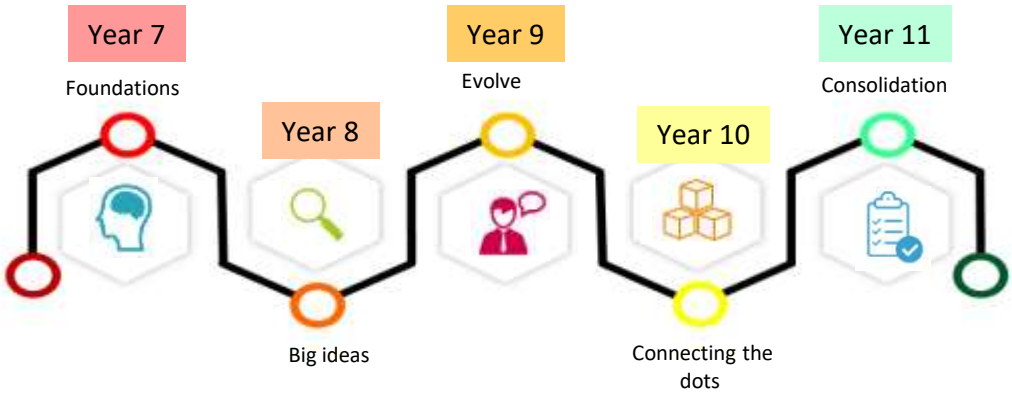
Year 7 – 2 hours	Year 8 – 2 hours	Year 9 – 2 hours	Year 10 – 3 hours	Year 11 – 3 hours
2 hours	2 hours	2 hours	3 hours	3 hours

OVERVIEW

Qualification gained by the end of year 11: GCSE in Biology

Whole school vision links developed in this subject	After school destinations linked to this subject	
• Allowing student to be encouraged in their learning by providing a safe learning environment so they can be ambitious and achieve above and beyond • British values through mutual respect • Inclusive for all- same setting but differentiated work. • Supporting local providers	A Level Biology Academic researcher Medicine Biotechnologist Higher education lecturer Marine biologist Microbiologist Nanotechnologist Nature conservation officer,	Pharmacologist Research scientist Zoologist Ecologist Veterinarian Dentist

Science CURRICULUM THEMES



Cross Curriculum links in Science

- Geography- rock cycle,
- Maths- calculations, graphs
- History- history of periodic table/ atom
- PE- anatomy & lifestyle
- English- literacy
- CA- field science

Year 7- Biology Curriculum

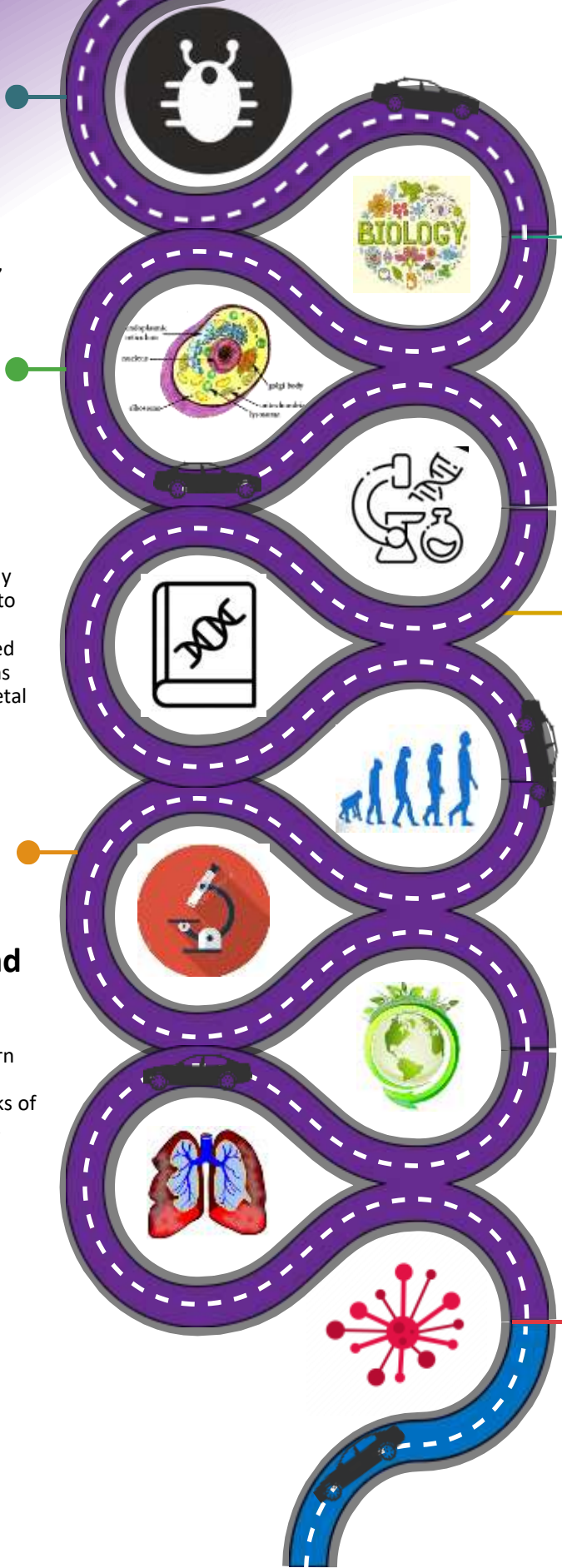
CUMBRIA FUTURES FEDERATION

Curriculum theme: ***Foundations***

In Year 7, students lay the foundations to their knowledge, cementing previous knowledge from KS2 and adding more knowledge and skills to their mind-sets.

KS2 recap

Students are given a baseline test to assess their entry level to KS3. Our first chapter is to introduce science 1 skills, so students learn about variables, predicting, planning obtaining results, analyzing, concluding and evaluating. These are all the fundamental skills needed for experiments.



1. B1.1 Cells

In this module students learn the foundations of biology and are introduced to cells. They will learn the main cell components and the functions and use microscopes to observe cells.

2. B2.2 Body functions

In this module students apply their understanding of cells to the levels of organisation in organisms and are introduced to the different body systems including the digestive, skeletal and respiratory systems.

3. B1.3 Reproduction

In this module students learn the foundations of biology and are introduced to the topic of reproduction. Students learn the process of reproduction in mammals including humans

4. B2.1 Health and lifestyle

In this module students learn about the importance of a healthy lifestyle and the risks of alcohol, drugs and smoking.

Progressing into Year 8

Students will complete an end of year assessment during exam week.

Year 8- Biology Curriculum

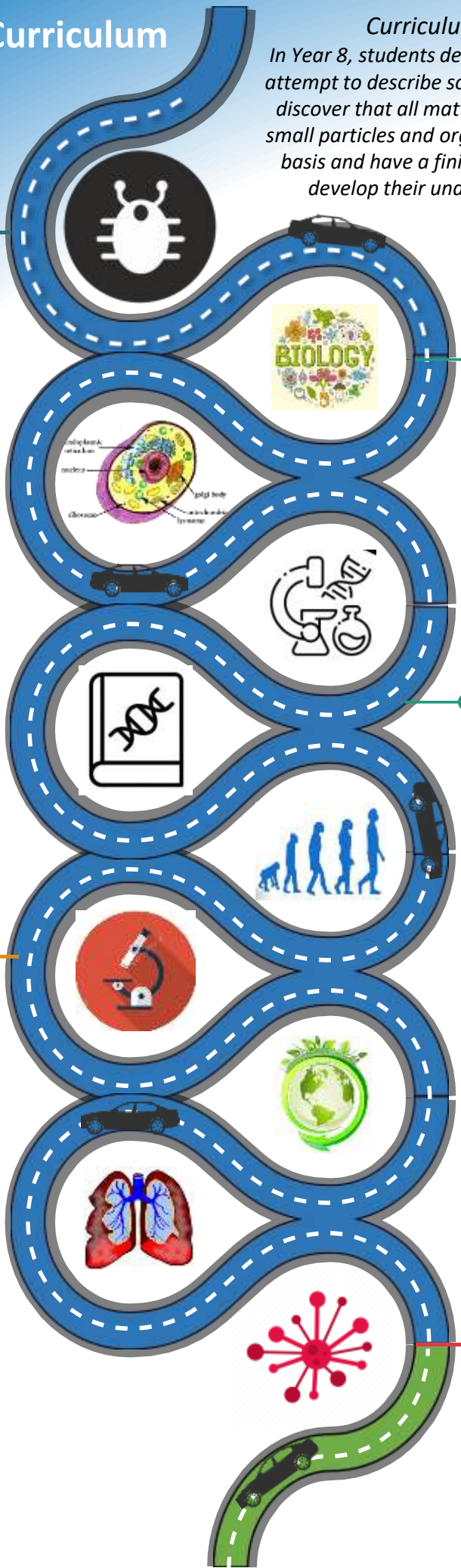
CUMBRIA FUTURES FEDERATION

Curriculum theme: ***Big ideas***

In Year 8, students develop their knowledge further in an attempt to describe some understanding of science. They discover that all matter in the Universe is made of very small particles and organisms are organised on a cellular basis and have a finite life span and students begin to develop their understanding of these big ideas.

Year 7 recap

Students again complete a short chapter about science 1 skills. students recap knowledge about variables, predicting, planning obtaining results, analysing, concluding and evaluating. These are all the fundamental skills needed for experiments



1.B2.1 Health and lifestyle

In this module students review and build on their knowledge from B2.1 Health and Lifestyle, introducing ideas about nutrition, exercise, enzymes and digestion whilst also recapping the risks of alcohol, drugs and smoking.

2. B2.2 Ecosystems

In this module students learn about the different parts of the ecosystem, feeding relationships between species and how plants and animals get their energy through photosynthesis and respiration.

3. B2.3 Adaptations, inheritance and extinction

In this module students learn about the processes of evolution, selective breeding, how animals are adapted to their environment and describe the evidence to support evolution and the way organisms are classified

Progressing into Year 9

Students will complete an end of year assessment during exam week.

Year 9- Biology Curriculum

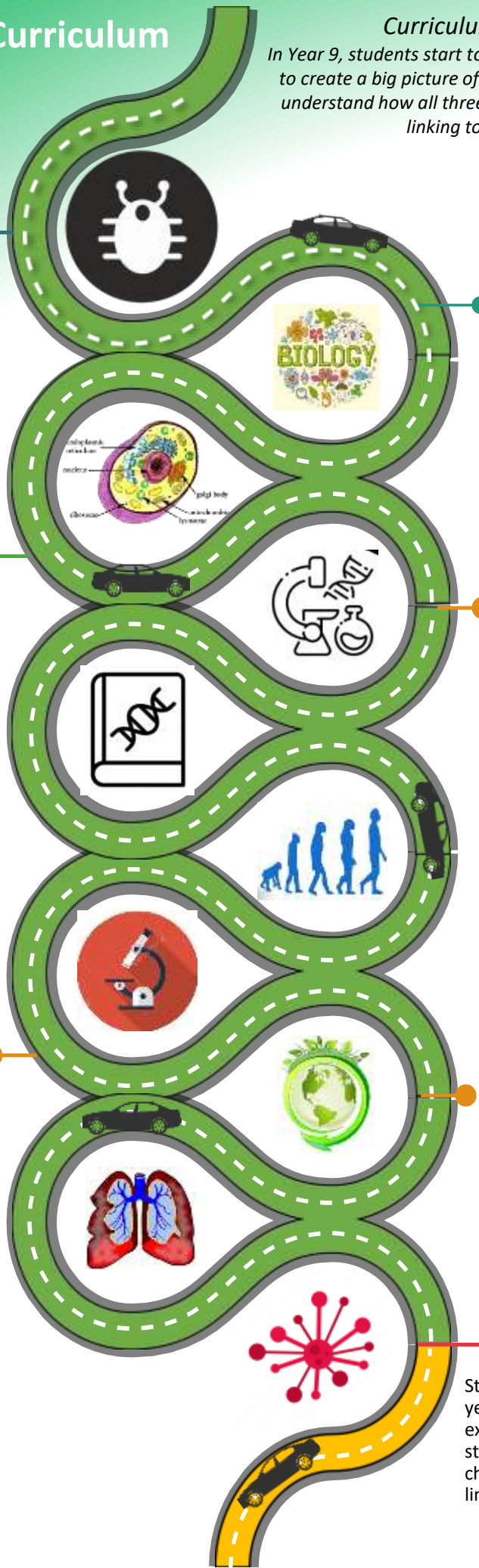
CUMBRIA FUTURES FEDERATION

Curriculum theme: ***Evolve***

In Year 9, students start to bring together knowledge and skills to create a big picture of the world of science. They begin to understand how all three disciplines link together as well as linking to the outside world.

Year 8 recap

Students begin their GCSE course in Year 9. They start by returning to the topic of energy covered in the Year 8 energy chapter. Building on their prior learning and knowledge from Year 8.



1. B1 Cell structure and transport

In this chapter students review and build on their knowledge from the Year 7 cells chapter. They build on their knowledge of plant and animal cells and are introduced to prokaryotic cells, scientific units and calculating magnification. They will also develop their practical skills by using a microscope to observe a range of different cells.

2. B2 Cell division

In this chapter students review and build on their knowledge from the Year 8 adaptions, inheritance and extinction chapter. They build on their knowledge of inheritance to describe cell division, growth and differentiation in animals and plants.

3. B3 Organisation and digestive system

In this chapter students review and build on their knowledge from the Year 8 health and lifestyle chapter. They build on their knowledge of the parts and functions of the digestive system by explaining how different factors affect enzyme activity and the role of bile in digestion

4. B4 Organising animals and plants

In this chapter students review and build on their knowledge from the Year 7 cells chapter. They build on their knowledge of organ systems and diffusion to describe the transport systems and adaptions of organs in mammals and plants.

5. B5 Communicable disease

In this chapter students are introduced to the causes of communicable diseases, how they are spread and describe the body's defences to pathogens. This module then extends to look at the process of growing bacteria in the lab before introducing plant defence responses.

Progressing into Year 10

Students will complete an end of year assessment created by the AQA exam board and aimed at assessing students' knowledge of the Year 9 chapters. Students will be graded in line with GCSE grades 1-9.

Year 10- Biology Curriculum

CUMBRIA FUTURES FEDERATION

Curriculum theme: ***Connecting the dots***

In Year 10, knowledge is linked together in students minds as it is this linking, or construction, that creates understanding. This linking takes time and requires students to engage in practice and a degree of struggle to promote reorganisation of ideas that will ultimately lead to a personal understanding.

Year 9 recap

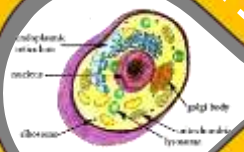
Transition tests

1. B5 Communicable disease

In this chapter students are introduced to the causes of communicable diseases, how they are spread and describe the body's defences to pathogens. This module then extends to look at the process of growing bacteria in the lab before introducing plant defence responses.

2. B6 Preventing and treating diseases

In this chapter students evaluate the use of vaccinations, antibiotics and pain killers before describing how drugs are discovered and developed before use.



3. B7 Non communicable diseases

In this chapter students review and build on their knowledge from the communicable diseases chapter by learning the explaining risk factors associated with different non communicable diseases.

4. B8 Photosynthesis

In this chapter students review and build on their knowledge from Year 9 Organisation in animals and plants unit by describing how plants use glucose and explaining limiting factors for photosynthesis.

5. B9 Respiration

In this chapter students review and build on their knowledge from the organising plants and animal's chapters by comparing aerobic and anaerobic respiration.

6. B10 Human Nervous system

In this chapter students are introduced to the principles of homeostasis and the nervous system. This chapter then extends to study the brain and eye.

7. B11 Hormonal Coordination

In this chapter students build on their knowledge from the nervous system chapter by introducing the principles of hormonal control and its role in maintaining blood glucose levels and reproduction. This module then extends to look at hormonal control in plants.

8. B12 Homeostatsis in action

In this chapter students build on their knowledge from B10 the human nervous system and B11 hormonal co-ordination by describing the processes of temperature control and waste removal in the human body.

Progressing into Year 11

Students will complete an end of year assessment which will be a previous Paper 1 from the AQA exam board and aimed at assessing student's knowledge of the Year 9/10 chapters. Students will be graded in line with GCSE grades 1-9.

Year 11- Biology Curriculum

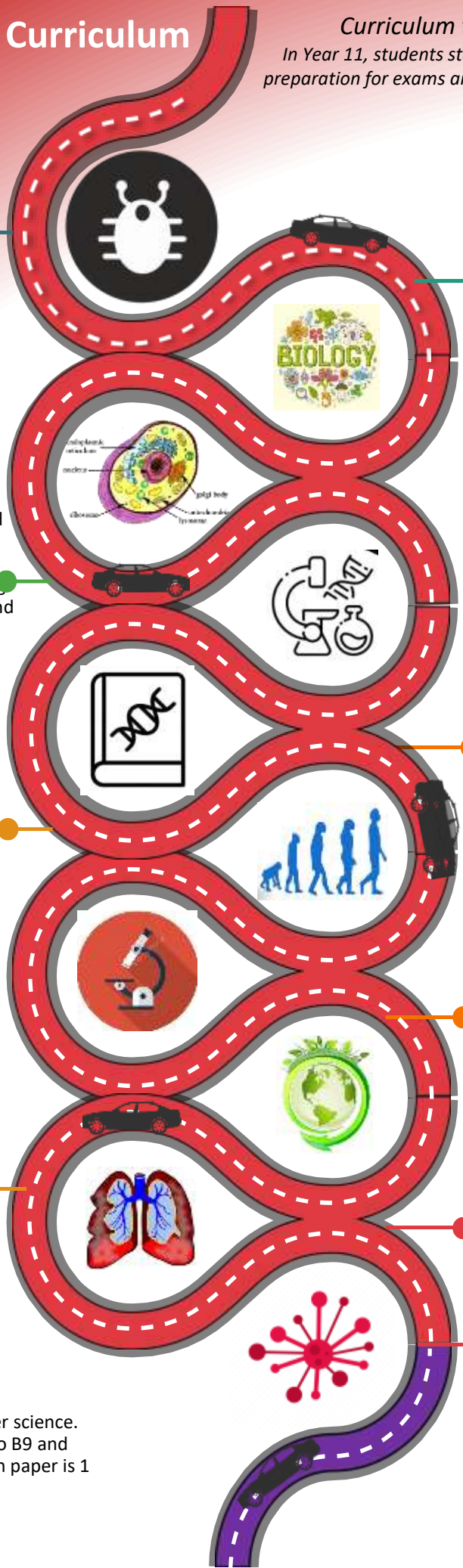
CUMBRIA FUTURES FEDERATION

Curriculum theme: ***Consolidation***

In Year 11, students start to consolidate their knowledge in preparation for exams and putting their knowledge and skills to the test.

Year 10 Recap

Students will move onto the new chapters in the GCSE course. There will be an assessment during assessment week to aid our development and focus for revision sessions.



1. B12 Homeostasis in action

In this chapter students build on their knowledge from B10 the human nervous system and B11 hormonal co-ordination by describing the processes of temperature control and waste removal in the human body.

2. B13 Reproduction

In this chapter students review and build on their knowledge from the Year 7 reproduction chapter by comparing sexual and asexual reproduction and introducing genetics.

3. B14 Variation and evolution

In this module students describe the processes of evolution, selective breeding, cloning and genetic engineering.

4. B15 Genetic and evolution

In this chapter students describe the evidence to support evolution and the process of speciation before moving on to the way organisms are classified.

5. B16 Adaption, inheritance and competition

In this chapter students review and build on their knowledge from the Year 8 ecological relationships chapter by describing the factors that affect survival in a habitat.

6. B17 Organising an ecosystem

In this chapter students review and build on their knowledge from the Year 8 ecological relationships chapter by describing feeding relationships and material cycling in ecosystems

7. B18 biodiversity and ecosystems

In this chapter students analyse the impact of humans on the environment.

Exams

Students will sit two exams per science. Paper 1 in Biology covers B1 to B9 and paper 2 covers P9 to P18. Each paper is 1 hour and 45 minutes.

Potential destinations

A level Biology, Academic researcher, medicine, Biotechnologist, Higher education lecturer, Marine biologist, Microbiologist, Nanotechnologist, Nature conservation officer, Pharmacologist, Research scientist, zoologist, ecologist, veterinarian, dentist.