**KS4 Biology**

**Year Group 9:** Half Term 1

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| Number of Hours | **Topic: 4.1 Cells** |
| 7 | 4.1.1 Cell Structure* Eukaryotes and prokaryotes
* Animal and plant cells
* Cell specialisation and differentiation
* Microscopy and magnification
* Set Practical: Use of a light microscope to view animal and plant cells
 |
| As available | Revision work |
| Reasons behind order of topic in this half term |
| * Understanding of cells as the smallest unit of life underpins the entire topic of Biology
* Knowledge of the structure of cells enables students to understand organisation of living organisms into tissues, organs and systems and links to all subsequent topics.
* The function of organelles is covered in several later topics: mitochondria – respiration, ribosomes – protein synthesis, chloroplasts – photosynthesis, nucleus – cell division, genetics, cell membrane – cell transport.
* 4.1 needed for GCSE Paper 1
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**Year Group 9:** Half Term 2

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| Number of Hours | Topic |
| 8 | 4.1.2 Cell Division* Genes and chromosomes
* Mitosis and the cell cycle
* Stem cells

4.1.3 Cell transport* Diffusion
* Osmosis
* Active transport
* Set Practical: Investigating the effect of a range of salt and sugar solutions on the mass of plant tissue
 |
| As available | Revision work |
| Reasons behind order of topic in this half term |
| * Understanding cell division is the basis of growth and repair in living organisms
* Mitosis is the method that eukaryotic cells use to divide and links to the lifestyle disease cancer which is covered later this year
* Stem cells such are the progenitors of all specialised cells. Bone marrow stem cells produce all types of blood cells as covered in the circulation and infectious diseases topics.
* Substances move in and out of cells in order to allow cells to function and produce and enzymes (digestion topic Y9) and antibodies (communicable diseases topic Y10) and produce and respond to hormones (homeostasis topic Y10)
* The effect of sugar and salt concentrations on cells is important for understanding homeostasis in Y10 and support and water-loss in plants
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**Year Group 9:** Half Term 3

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| Number of Hours | **Topic 4.2 Organisation** |
| 6 | 4.2.1 Organisational Hierarchy4.2.2 Animal tissues, organs and systems* Nutrients and a healthy diet: carbohydrates, fats and proteins
* Set Practical: Food testing
* Human digestive system
* Human digestive enzymes
* Enzymes as biological catalysts
 |
| As available | Revision work |
| Reasons behind order of topic in this half term |
| * Understanding about how cells organise into tissues, organs and systems in living organisms is fundamental to understanding plant and animal life. More importantly it provides a scaffold to embed concepts involved in how living organisms function
* Looking at nutrients in a healthy diet introduces the important biological molecules.
* The ability to test for these biological molecules allows students to study the rate of digestion by enzymes in experimental contexts.
* Understanding the human digestive system introduces the concept of absorption and surface area in the human body and links to topics such as lifestyle diseases (Y9), homeostasis (Y10) and respiration(Y10).
* Enzymes are extremely important biological catalysts that are essential for all reactions in living organisms. Links to topics such as respiration, photosynthesis, homeostasis and genetics.
* 4.2 needed for GCSE Paper 1
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**Year Group 9:** Half Term 4

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| --- | --- |
| Number of Hours | Topic |
| 5 | 4.2.2 Animal tissues, organs and systems* Factors affecting the rate of enzyme reactions
* Set Practical: The effect of pH on the rate of digestion of starch by amylase
* Lung structure and gas exchange
* Heart and blood vessels
 |
| As available | Revision work |
| Reasons behind order of topic in this half term |
| * Factors that affect the rate of enzyme reactions have implications for how chemical reactions are controlled in living organisms and why a constant internal environment is essential in mammals and birds (homeostasis Y10, metabolism Y10)
* Enzyme experiments are very popular exam questions so students need to apply their knowledge of factors affecting enzymes in different practical contexts.
* The structure of the respiratory system is adapted to its function of gas exchange and this links back to adaptations of the gut for absorption.
* Gas exchange directly links to the topic of respiration and the effect of exercise (Y10)
* The structure of the heart and blood vessels explains how the nutrients and oxygen that have been absorbed in the digestive system and the lungs are transported to all of the cells of the body which links to respiration and the effect of exercise (Y10)
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**Year Group 9:** Half Term 5

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| --- | --- |
| Number of Hours | Topic |
| 5 | 4.2.2 Animal tissues, organs and systems* Blood
* Coronary heart disease, a non-communicable disease
* Health Issues: How physical and mental interact and contribute to health
 |
| As available | Revision work |
| Reasons behind order of topic in this half term |
| * The structure and function of the different blood components relates to the topics of gas exchange, digestion and circulatory system and includes two of the specialised cells from Cell structure topic.
* By studying the structure of the heart, students are able to understand what causes CHD and some of the treatments available and how they work
* Non-communicable diseases are the first of three different categories of disease that are studied on the course. Later students look at Communicable diseases (Y10) and then Genetic diseases (Y11)
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**Year Group 9:** Half Term 6

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| --- | --- |
| Number of Hours | Topic |
| 7 | 4.2.2 Animal tissues, organs and systems * Cancer
* The effect of lifestyle on some non-communicable diseases

4.2.3 Plant tissues, organs and systems* Plant tissues
* Plant organs
* Plant transport – xylem, phloem and transpiration in stomata
 |
| As available | Revision Work |
| Reasons behind order of topic in this half term |
| * Cancer is one of the most common of the lifestyle diseases and relates back to the topic of cell division
* Plants are very important living organisms and it is important that students understand that they are organised in very similar ways to animals
* The structure of leaves and roots are important for understanding how plants photosynthesise (Y10) and provide us with food (links to digestion and food chains Y11)
* The importance of water in plants and adaptations to conserve water are covered in evolution and adaptation (Y10 and Y11)
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**Year Group 10:** Half Term 1

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| --- | --- | --- |
| Number of hours (Separate) | Number of hours (Combined) | **Topic 4.3 Communicable Disease** |
| 10 | 9  | 4.3.1 Communicable diseases* Pathogens – bacteria and viruses
* Set Practical: working aseptically, effect of microbial substances on bacterial growth **(Separate biology only)**
* Bacterial, viral, fungal and protist diseases in humans
* Stopping the spread of disease
* Human defence mechanisms
* Vaccinations
* Antibiotics and resistance
 |
| As available | Revision work |
| Reasons behind order of topic in this half term |
| * This is the second type of disease that is covered on the specification and the difference between these and the lifestyle diseases are stressed.
* Looking at bacteria requires an understanding of the differences between prokaryote and eukaryote cells and viruses bring in the concept of microscopic size and magnification and use of the electron microscope
* Examples of different kingdoms of disease links to classification topic (Y11)
* Understanding defence mechanism and hygiene is important for preventing spread of diseases
* Immunity and vaccinations links to blood and specialised cells (Y9)
* Antibiotics and resistance is a first introduction to evolution and natural selection covered in more detail in Y11.
* Needed for GCSE Paper 1
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**Year Group 10:** Half Term 2

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| --- | --- | --- |
| Number of hours (Separate) | Number of hours (Combined | **Topic 4.4 Bioenergetics** |
| 14 | 9 | 4.3.1 Communicable diseases* Discovery and development of drugs

4.3.2 Monoclonal antibodies **(Separate Biology only)*** Production and uses of monoclonal antibodies **(Separate Biology only)**

4.3.3 Plant diseases **(Separate Biology only)*** Infectious and deficiency diseases **(Separate Biology only)**
* Diagnosing disease **(Separate Biology only)**
* Plant defences **(Separate Biology only)**

4.4.1 Photosynthesis* Structure of the leaf
* Photosynthesis reaction
* Factors affecting photosynthesis
* Set Practical: Investigating the effect of a factor on the rate of photosynthesis
 |
| As available | Revision work |
| Reasons behind order of topic in this half term |
| * The topic drug development allows students to examine how to design effective drug trials using unbiased and fair testing. This allows exploration of the scientific method and design of investigations to generate valid results
* Ideas from 4.1 chloroplasts and specialised cells, 4.2 Organisation in plants are used in the photosynthesis topic
* Photosynthesis is one of the two main reactions in biology and has links to the future topic of ecology and the carbon cycle.
* Factors affecting the rate of a reaction which have been discussed in the enzymes topic are further developed and linked to the rate of photosynthesis as an enzyme-controlled reaction
* 4.4 needed for GCSE Paper 1
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**Year Group 10:** Half Term 3

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| --- | --- | --- |
| Number of hours (Separate) | Number of hours (Combined) | Topic |
| 6 | 6 | 4.4.1 Photosynthesis* Uses of glucose by plants

4.4.2 Respiration* Aerobic Respiration
* Anaerobic Respiration
* Effect of exercise
* Metabolism and the liver
 |
| As available | Revision work |
| Reasons behind order of topic in this half term |
| * Uses of glucose by plants links to nutrition and digestion (Y9).
* Respiration is the second important reaction in Biology and links to 4.1 mitochondria and to adrenaline (homeostasis Y10)
* Application of information learned in 4.2 digestion and absorption, lungs and gas exchange, heart and blood vessels are required to look at the effects of exercise
* Respiration links to the carbon cycle (Ecology Y11)
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**Year Group 10:** Half Term 4

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| --- | --- | --- |
| Number of hours (Separate) | Number of hours (Combined) | **Topic 4.5 Homeostasis and response** |
| 9 | 7 | 4.5.1 Homeostasis4.5.2 The Human nervous system* The structure of the nervous system
* Reflex actions
* Set Practical: reaction times
* Brain structure **(Separate Biology only)**
* The Eye **(Separate Biology only)**
* Correcting defects of sight **(Separate biology only)**
* Temperature Control **(Separate biology only)**

4.5.3 Hormonal Coordination in Humans* Human endocrine system
 |
| As available | Revision work |
| Reasons behind order of topic in this half term |
| * 4.5 deals with how conditions in the body are maintained to allow optimal functioning (link back to factors affecting enzymes Y9) this topic cannot be covered until students have a basic understanding of Organisation (Y9) of the body and metabolism (Y9)
* Neurones as part of the nervous system are one of the specialised cells from Y9 and the control of the body in order to coordinate different systems requires a coordination centre such as the CNS or Brain
* The nervous system acts upon information gained from the senses such as sight and from internal sensors and external sensors such as temperature regulation (link to enzymes Y9)
* 4.5 needed for GCSE Paper 2
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**Year Group 10:** Half Term 5

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| --- | --- | --- |
| Number of hours (Separate) | Number of hours (Combined) | Topic |
| 12 | 7 | 4.5.3 Hormonal Coordination in Humans* Control of blood glucose
* Diabetes
* Water and Nitrogen balance **(Separate Biology only)**
* Kidney structure and function **(Separate Biology only)**
* ADH and osmoregulation **(Separate Biology only)**
* Kidney failure and dialysis **(Separate Biology only)**
* Hormones in Human reproduction
* Menstrual cycle
 |
| As available | Revision work |
| Reasons behind order of topic in this half term |
| * The importance of glucose for respiration (Y10) and its source in the diet (Y9) due to plant photosynthesis (Y10) has been covered earlier
* The importance of blood concentration in preventing too much water movement into and out of cells by osmosis was covered in Y9
* Type 2 Diabetes was referred to as one of the lifestyle diseases in Y9 and now students learn about the cause and treatment of type 1 and type 2 diabetes.
* Osmosis and hormones must be understood well before describing the structure of the kidney which links to adaptations of absorption surfaces (Digestion and gas exchange Y9)
* Hormones travel in the blood (Y9) and allow wider communication between cells tissues and organs (Y9)
* The menstrual cycle and reproduction must be understood before the future topic of meiosis and genetics (Y11)
* 4.5 needed for GCSE Paper 2
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**Year Group 10:** Half Term 6

|  |  |  |
| --- | --- | --- |
| Number of hours (Separate) | Number of hours (Combined) | Topic |
| 11 | 8 | 4.5.3 Hormonal Coordination in Humans* Hormones and negative feedback
* Contraception
* Infertility treatment
* Plant hormones and tropisms **(Separate Biology only)**
* Uses of plant hormones **(Separate Biology only)**
* Set practical: effect of light on the growth of seedlings **(Separate Biology only)**
 |
| As available | Revision Work for mock exam |
| Reasons behind order of topic in this half term |
| * Concept of negative feedback can only be explained once students understand how hormones work
* The control of fertility by contraception or fertility treatment and IVF can only be understood once the hormonal control of the menstrual cycle has been taught
* Plant hormones are for comparison to coordination in humans and there is a link to photosynthesis (Y10) but also connection to Adaptations (Y11)
* 4.5 needed for GCSE Paper 2
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**Year Group 11:** Half Term 1

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| --- | --- | --- |
| Number of hours (Separate) | Number of hours (Combined) | Topic **4.6 Inheritance, variation and evolution** |
| 11 | 7 | 4.6.1 Reproduction* Asexual and sexual reproduction
* Meiosis
* Advantages and disadvantages of each type of reproduction - fungi and protists. **(Separate biology only)**
* Sex determination
* DNA and genes
* Structure of DNA **(Separate Biology only)**
* Protein synthesis and epigenetics **(Separate Biology only)**
* Understanding genetics and its history **(Separate Biology only)**
* Genetic Inheritance
* Recessive and dominant genetic disorders
 |
| As available | Revision work |
| Reasons behind order of topic in this half term |
| * These topics need to be taught sequentially as each topic feeds into the next allowing an understanding of reproduction and genetics to form
* There are many links back to cell structure and the nucleus (Y9), cell division (Y9) and hormonal control and reproduction(y10) which are all required to understand this topic
* A third type of disease is added to non-communicable (Y9) and communicable (Y10)
* 4.6 needed for GCSE paper 2
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**Year Group 11:** Half Term 2

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| --- | --- | --- |
| Number of hours (Separate) | Number of hours (Combined) | Topic |
| 12 | 7 | 4.6.2 Variation and Evolution* Variation – continuous or discontinuous
* Inherited or environmental characteristics
* Mutations
* Evolution by natural selection – Darwin
* Selective breeding
* Theories of evolution – Lamarck v Darwin **(Separate biology only)**
* Speciation – Wallace **(Separate Biology only)**
* Genetic engineering
* Cloning **(Separate biology only)**
 |
| As available | Revision work |
| Reasons behind order of topic in this half term |
| * These topics directly link with 4.6.1 Sexual and asexual reproduction in the previous topic.
* Evolution by natural selection links back to antibiotic resistance in bacteria from the communicable diseases topic in Y10
* Mutations relate back to DNA and genes topic and explain a direct effect of environment upon characteristics.
* Selective breeding shows how humans can deliberately select characteristics in domesticated animals and plants important for food (link to photosynthesis Y10 and nutrients Y9)
* Evolution links to the next topic of adaptations in plants and animals and competition in plants and animals
* 4.6 needed for GCSE Paper 2
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**Year Group 11:** Half Term 3

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| --- | --- | --- |
| Number of hours (Separate) | Number of hours (Combined) | **Topic 4.7 Ecology** |
| 12 | 8 | 4.6.3 evidence for evolution* Fossils and the fossil record
* Extinction events

4.6.4 Classification of living organisms* Classification
	+ 1. Adaptations, interdependence and competition
* Communities - Abiotic and biotic factors
* Distribution of organisms (sampling techniques)
* Set Practical**:** Investigating the population size of a common organism in a habitat
* Adaptations

4.7.2 Organisation of an ecosystem* Food chains and feeding relationships
* Trophic levels and pyramids of biomass **(4.7.4 Separate biology only)**
* Decomposers and the carbon cycle
* Rate of decay **(Separate biology only)**
* Set practical: Investigating the effect of a factor on the rate of decay **(Separate biology only)**
 |
| As available | Revision work |
| Reasons behind order of topic in this half term |
| * Evidence for evolution backs up the observations and theories of evolution by natural selection and feeds into the topic of classification which looks at evolutionary relationships between organisms
* The adaptations and interdependence topic looks at the complex interactions between populations and their environment
* Sampling gives an explanation of how we can measure changes in populations over time and look at the effects of environmental factors
* Food chains links to adaptations and feeding relationships and nutrition (Y9)
* The carbon cycle pulls together the effects of photosynthesis, respiration and decomposition in maintaining life on the planet
* The importance of death, decay and decomposition links back to factors affecting enzyme reactions (Y9)
* 4.7 needed for GCSE Paper 2
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**Year Group 11:** Half Term 4

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| --- | --- | --- |
| Number of hours (Separate) | Number of hours Combined | Topic |
| 10 | 5 | 4.7.3 Biodiversity and the effect of human interaction on ecosystems* Biodiversity
* Waste management and pollution of air, land and water
* Land use and deforestation
* Global warming
* Maintaining biodiversity
* Impact of environmental change **(Separate biology only)**

4.7.5 Food production **(Separate biology only)*** Factors affecting food security **(Separate biology only)**
* Farming techniques – intensive v organic **(Separate biology only)**
* Sustainable fisheries **(Separate biology only)**
* Role of biotechnology **(Separate biology only)**
 |
| As available | Revision work |
| Reasons behind order of topic in this half term |
| * The final topics 4.7.3 and 4.7.5 connects key ideas already covered across the course by examining effects on growth, survival, reproduction, evolution, the carbon cycle, photosynthesis and respiration
* Biology builds from cells to tissues to organs to individuals to populations and finally ecosystems, so all of the previous topics are required within 4.7 which is why it is taught last.
* 4.7 needed for GCSE Paper 2
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**Year Group 11:** Half Term 5

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| --- | --- |
| Number of Hours | Topic |
| 7 | Revision work, past papers, material on Frog learning seminars and GCSE examsTo consolidate Y9, Y10, Y11 work, exam practice needed to prepare for GCSE exams |