



Course Outline

Science Year 9

Inspiring excellence, empowering global minds

Overview

The Science Syllabus at GEMS Wesgreen International Secondary School aims to support students to develop their ability to explore the world, to reason and solve problems through application of knowledge and transferable skills. Throughout the year we cover and extend objectives as the focus is on providing a foundation for understanding the world, the ability to reason scientifically, an appreciation of the beauty and power of science, and a sense of enjoyment and curiosity about the subject.

Learning Outcomes

The sciences at Wesgreen are taught in ways that ensure that the students have the knowledge to enable them to develop curiosity about the natural world, insight into working scientifically, and appreciation of the relevance of science to their everyday lives, so that they develop:

- scientific knowledge and conceptual understanding in the areas of biology, chemistry, and physics
- understanding of the nature, processes, and methods of science through scientific enquiry, which helps them to answer scientific questions on the world around them
- learning of how to apply observational, practical, and enquiry-based skills to the world around them
- their ability to evaluate claims based on science through critical analysis of methods, evidence and conclusions, both qualitative and quantitative.

Scientific enquiry is set out separately but must always be taught through, and be clearly related to, the Pearson Edexcel International Award in Lower Secondary Science learning objectives.

Chapter Overviews

Term 1

Chapter 1 – 9A – Genetics and Evolution

Approximate length: 8 lessons

In this chapter the students look at different types of variations, factors that lead to variation, mathematical calculations to relate variations to probability, link DNA and genes to extinction of species and the phenomenon of natural selection.

Specific Objectives Covered:

- Describe the basic structure of DNA
- Describe the relationship between chromosomes, DNA, genes, genetic information, and nuclei.
- Outline how structure of DNA was discovered.
- Explain how environmental variations can cause problems with classification.
- Explain how sexual reproduction leads to inherited variation.
- Explain what probability is.
- Calculate probability and display them in different forms.
- Recall the difference between continuous and discontinuous variation (including in graphical representation) and identify a normal distribution
- Describe heredity as the process by which genetic information is transmitted from one generation to the next
- Explain how organisms become endangered or extinct.
- Explain how animals get adapted to the environment.
- Explain ways of preserving biodiversity.
- Recall that individuals in a population vary genetically.
- Explain how variation between species and individuals of the same species means individuals who are better adapted compete more successfully, driving natural selection
- Define the term 'evolution' and how natural selection leads to evolution

Chapter 4 – 9E – Making materials

Approximate length: 7 lessons

In this chapter the students will learn about materials like ceramics, polymers and composite materials and their uses. They will understand the chemistry behind these materials and link it to reactions and recycling.

Specific National Curriculum Objectives Covered:

- Name some ceramics and their uses.
- Explain why certain ceramics have particular uses.
- Explain how the properties of ceramics depend on their structure.
- Explain composite materials, giving examples.

- Name some examples and uses of polymers.
- Explain some properties of ceramics.
- Describe how polymers are made.
- Draw the structure of monomers and the repeating unit of the polymer
- Describe how the properties of a polymer change depending on the monomers used and how the chains are arranged (e.g. HD and LD)
- Investigate the tensile strength of different types of plastic bags using a newton meter and weights
- Explain how making and using materials can cause problems.
- Suggest methods of reducing problems associated with making and using materials

Chapter 3 – 9I – Forces and Motion

Approximate length: 11 lessons

In this chapter the students will recall what is force and motion. Use formulae to calculate speed, distance, and time. They will also analyse and plot graphs for different kinds of motion.

Specific National Curriculum Objectives Covered:

- Recall names of different forces.
- Explain effects of balanced and unbalanced forces.
- Explain why moving objects have a top speed.
- Describe the meaning of speed and mean speed.
- Use the formula relating to speed, distance and time.
- Represent simple journeys on a distance-time graph.
- Draw and interpret distance-time graph.
- Calculate the gradient of a line graph.
- Draw and interpret speed-time graph.
- Describe and calculate acceleration
- Recall ways in which energy can be stored and transferred.
- Recall laws of energy conservation.
- Understand how brakes work in terms of energy transfer
- Define 'stopping distance'
- Define braking and thinking distance and explain factors that affect them
- Describe how forces change
- Explain why moving objects reach terminal velocity
- Describe how a simple lever can multiply forces or distances.
- Identify load, effort, and pivot on a diagram of a lever.
- Describe the factors that affect the size of a moment.
- Describe how simple machines can magnify forces.
- Describe factors that can affect work done

Chapter 5 – 9B – Plant growth**Approximate length: 9 lessons**

In this chapter the students will learn about plants, the need of photosynthesis, different adaptations in plants, factors that affect photosynthesis, effects of pests and pesticides on plant growth.

Specific National Curriculum Objectives Covered:

- Explain what happens when plants photosynthesize and respire.
- Describe how plants use the glucose produced during photosynthesis
- Label the structure of a leaf and describe the basic structural difference between cells in the palisade and spongy mesophyll
- Explain how a leaf is adapted for photosynthesis
- Explain how the rate of photosynthesis can be affected.
- Describe how the concentration of oxygen and carbon dioxide changes through a 24 hour period
- Explain why the concentration of carbon dioxide and oxygen changes
- Describe how the roots are adapted for their function
- Explain the role of key minerals in a plant (magnesium and nitrates)
- Describe how pests and human population alter the food supply.
- Explain ways in which farmers boost food production.
- Use models, for example food webs and carbon cycle to explain changes in an ecosystem.
- Identify bias.
- Recognise advantages and disadvantages of different farming methods
- Explain whether something is valid.

Term 2**Chapter 6 – 9F – Reactivity****Approximate length: 8 lessons**

In this chapter the students will define a reaction, a reactant, and a product. They will also compare physical and chemical reactions. They will investigate the production of oxygen gas during a chemical reaction. They will analyze and give examples of displacement reactions.

Specific National Curriculum Objectives Covered:

- State hazards
- Define the terms 'endothermic' and 'exothermic'
- Investigate a series of chemical reactions and from temperature change observations, determine whether they are exothermic or endothermic reactions
- Recall the reactions of metals with acid, oxygen and water and be able to write chemical and balanced symbol equations
- From observational data from the above reactions be able to put metals into a reactivity series
- Explain what happens in a displacement reaction
- Write word and symbol equations for displacement reactions

- Describe the extraction method for a metal using its position in the reactivity series in relation to carbon
- Explain why electrolysis is not used to extract all metals
- Explain why no extraction is required for metals like gold
- Describe the general process of extracting iron using a blast furnace
- Write a word equation for the process, explain why it is an example of a redox reaction
- Describe the general process of extracting aluminium using electrolysis
- Explain why cryolite is used in the process

Chapter 8 – 9G – Transition to further study – Chemistry

Approximate length: 12 lessons

In this chapter the students will learn the diversity of topics which will help them link their learning easily to year 10. They will understand compounds, mixtures and elements, ionic bond formation in compounds, properties of ionic compounds, topics related to weather and rate of reaction.

Specific National Curriculum Objectives Covered:

- Draw the electron configuration of atoms (only hydrogen to calcium required)
- Identify the elements in a chemical formula of a compound.
- Explain how two ions are formed.
- Describe and explain how ionic bonds form
- Describe and explain the general properties of ionic compounds
- Describe metallic bonding
- Describe and explain the properties of metallic bondings
- Explain how metals and ionic compounds can conduct electricity.
- Interpret and sketch energy profiles.
- Explain why changes are described as being exothermic or endothermic.
- Describe how rates of reactions change.
- Write balanced symbol equations with state symbols.
- Recognise and use numbers and units with indices.
- Convert numbers to and from standard form.
- Represent reversible reactions using balanced symbol equations.
- Explain how a dynamic equilibrium is formed in reversible reactions.

Chapter 12 – 9J – Force Fields and Electromagnets

Approximate length: 10 lessons

In this chapter the students will learn the basic concepts of electricity and carry out investigations to understand the relation between current, magnetic field and resistance. They will also use mathematical skills to calculate voltage, current and resistance. They will learn to convert their numerical answers to scientific notation or to standard form.

Specific National Curriculum Objectives Covered:

- Recall the basic principles of electricity.

- State what is meant by a force field.
- Describe the shape of a magnetic field.
- Recall the factors that affect the strength of gravity.
- Calculate weight of a mass.
- Explain why an insulating material can be given a charge by rubbing.
- Describe how electrically charged objects affect each other.
- Describe an electric field.
- Explain how switches can be used to control different parts of a circuit.
- Recall how current behaves in series and parallel circuits.
- Describe how voltage behaves in series and parallel circuits.
- Describe some factors that affect resistance.
- Use the formula relating voltage, current and resistance.
- Round off numbers to a given number of decimal places.
- Round off numbers to a given number of significant figures.
- Describe an electromagnet and its magnetic field.
- Describe how the strength of an electromagnet can be changed.
- Describe the motor effect
- Explain how an electric motor works

Chapter 10 – 9C – Transition to further study – Biology

Approximate length: 14 lessons

In this chapter the students will learn the diversity of topics which will help them link their learning easily to year 10. The students will learn about life cycle, life expectancy, microorganisms affecting immunity, working of nervous system, coordination by the hormones, using statistical skills to estimate population size of a species in an area, topics related to osmosis.

Specific National Curriculum Objectives Covered:

- Explain the factors that have led to a change in life expectancy.
- Give examples of different kinds of diseases and describe how they are caused.
- Explain how infectious diseases affect organisms.
- Describe the difference between a benign and malignant tumour and describe the stages of tumour growth
- Explain the risk factors of cancer: genetic, environmental and lifestyle related
- Describe how chemical and physical barriers prevent infection
- Explain how white blood cells (lymphocytes and phagocytes) protect against pathogens
- Explain how a vaccination works to establish immunity, reviewing graphical evidence
- Explain the function of memory cells
- Describe how the nervous system works.
- Describe how the hormones affect the body.
- Explain how large amounts of human hormones can be produced quickly using genetically modified bacteria.
- Calculate median, quartiles and interquartile range of a simple dataset.

- Interpret the use of quartiles in comparing variation in a large continuous dataset.
- Identify suitable apparatus for measuring distribution and abundance.
- Calculate population size using data from abundance investigations
- Determine biodiversity of a sampling area using data obtained during sampling
- Use data from abundance investigations to estimate population size.
- Give examples of how surface area: volume ratio affects organisms.
- Describe how osmosis happens.
- Recall the factors that affect the rate of osmosis
- Perform an investigation into the osmotic effect of differing concentrations of a sucrose solution on potato cylinders

Term 3

Chapter 9 – 9K – Transition to further study – Physics

Approximate length: 7 lessons

In this chapter the students will learn the diversity of topics which will help them link their learning easily to year 10. They learn the skill to ask questions for performing an investigation. They will use the formula of energies to calculate latent heat, potential energy, and kinetic energy. The students will also learn the skill to plot and interpret a graph.

Specific National Curriculum Objectives Covered:

- Decide scientific questions for an investigation.
- Describe how temperature differences can cause convection currents.
- State the meanings of latent heat and specific heat.
- Use the formula for a gravitational potential energy and kinetic energy
- Describe some examples of cause and effect in science.
- Describe the difference between correlation and cause.
- Identify linear and proportional relationships from graphs.
- Use the formula for straight line to help interpret graphs.
- Use gradients to interpret distance-time and speed-time graphs.
- Explain the difference between physical and abstract models.
- Carry out research related to Physics.

Textbooks Exploring Science – 9 (Pearson)

Assessment

Formative: Throughout the chapters, the students will complete end of chapter assessments, quizzes and problem-solving activities which will allow the teacher to assess the students' progress and inform their planning.

Summative: Students will be assessed on their understanding of each chapter with end of topic assessments. At the end of each term, we will complete internal assessments which will be based on certain chapters. Students will also complete standardized tests such as the GL. This allows us to measure the students' attainment throughout the term and year.