SCIENCE

Year 9

What are the aims and intentions of this curriculum?

The Year 9 curriculum is being taught in accordance to the National Curriculum for Key Stage 3. The aim of the Year 9 Curriculum is to develop scientific knowledge and conceptual understanding through the specific disciplines of biology, chemistry and physics. Students will develop their scientific thinking and curiosity through hands on investigations, discussions, enquiry and debates. Year 9 will deliver a learning experience that will better equip our students with the scientific knowledge required to understand the uses and implications of science, today and for the future.

Highlighted in green are links to PSHE in the curriculum
Highlighted in blue are links to Careers in the curriculum

Term	Topics	Knowledge and key terms	Skills developed	Assessment
Autumn 1	**Working Scientifically** Enquiry processes **Biology** Organism • Cells • Breathing • Digestion	**Students learn about:** Working safely in the lab, variables, hypothesis, prediction, planning an experiment Cell, uni-cellular, multi-cellular, tissue, organ, diffusion, structural adaptations, cell membrane, nucleus, vacuole mitochondria, cell wall, chloroplast, cytoplasm, immune system, reproductive system, digestive system, circulatory system respiratory system, muscular system Breathing, trachea, bronchi, bronchioles, alveoli, ribs, diaphragm, lung volume Enzymes, dietary fibre carbohydrates, lipids, protein, stomach, small intestine, large intestine, gut bacteria **Key links to other units:** Year 10 – Cell structure and Transport, Cell Division, Organisation and the Digestive System, Organising Animals and Plants, Non-communicable Diseases Year 11- The Nervous System, Hormonal Coordination, Homeostasis in Action	**Students are able to:** • Recognise risks, hazards and understand hazard symbols. • Find out why variables are important in an experiment, including control variables, independent and dependent variables. • Plan an investigation and evaluate the validity of each step leading up to the conclusion • Explain why multi-cellular organisms need organ systems to keep their cells alive. • Suggest what kind of tissue or organism a cell is part of, based on its features. • Explain how to use a microscope to identify and compare different types of cells. • Explain how uni-cellular organisms are adapted to carry out functions that in multi-cellular organisms are done by different types of cell. • Explain how exercise, smoking and asthma affect the gas exchange system.	**Formative:** -Practical activities -Debates -Presentations -Self/ peer assessments -Problem solving activities **Summative:** -Termly exam -Research/Project based learning • Investigate how the cell theory has developed over time. • Find out how recreational drugs can affect different body systems • Write a report showing the effects of dietary deficiency diseases and how they can be alleviated. . **(PSHE-Healthy eating)**

			• Explain how the parts of the gas exchange system are adapted to their function. • Explain observations about changes to breathing rate and volume. • Explain how changes in volume and pressure inside the chest move gases in and out of the lungs. • Describe possible health effects of unbalanced diets from data provided. • Calculate food requirements for a healthy diet, using information provided. • Describe how organs and tissues involved in digestion are adapted for their role. • Describe the events that take place in order to turn a meal into simple food molecules inside a cell. **(PSHE- Drugs, alcohol and tobacco; Physical health and fitness; Healthy eating)** **Working Scientifically: Enquiry** • Use a light microscope to observe and draw cells. • Investigate a claim linking height to lung volume • Evaluating models of the digestive system. **Enrichment opportunities** • Centre of the Cell • Career link https://careerpilot.org.uk/job-sectors/subject/biology	
Autumn 2	**Chemistry** Matter • Elements	**Students learn about:** Elements, atoms, molecules, compounds, chemical formula, polymer	**Students are able to:** • Name compounds using their chemical formulae.	**Formative:** -Practical activities -Debates

	• Periodic Table Reactions • Types of Reaction • Chemical Energy Climate • Global Warming • Earth Resources	Periodic table, physical properties, chemical properties, groups, periods Fuel, chemical reaction, physical change, reactants, products, conserved Catalyst, endothermic reaction, exothermic reaction Global warming, fossil fuels, carbon sink, greenhouse effect Natural resources, mineral, ore, extraction recycling, electrolysis **Key links to other units:** Year 10- Atomic Structure, The Periodic Table, Structure and Bonding, Chemical Changes, Electrolysis, Energy Changes Year 11- Crude Oil and Fuels, Organic Reactions, Chemical Analysis, The Earth's Atmosphere, The Earth's Resources	• Represent atoms, molecules and elements, mixtures and compounds using particle diagrams. • Use observations from chemical reactions to decide if an unknown substance is an element or a compound. • Use data to describe a trend in physical properties. • Describe the reaction of an unfamiliar Group 1 or 7 element. • Use observations of a pattern in chemical reactions to predict the behaviour of an element in a group. • Predict the products of the combustion or thermal decomposition of a given reactant and show the reaction as a word equation. • Use particle diagrams to show what happens in a reaction. • Use experimental observations to distinguish exothermic and endothermic reactions. • Use a diagram of relative energy levels of particles to explain energy changes observed during a change of state. • Use a diagram to show how carbon is recycled in the environment and through living things. • Describe how human activities affect the carbon cycle. • Describe how global warming can impact on climate and local weather patterns. • Explain why recycling of some materials is particularly important. • Justify the choice of extraction method for a metal, given data about reactivity.	-Presentations -Self/ peer assessments -Problem solving activities **Summative:** -Termly exam -Research/Project based learning • Research scientists whose work helped to develop the modern Periodic table • Compare the pros and cons of fuels in terms of their products of combustion • Evaluate claims that human activity is causing global warming or climate change

			• Suggest factors to take into account when deciding whether extraction of a metal is practical **Working Scientifically: Enquiry** • Use particle diagrams to classify a substance as an element, mixture or compound, and as molecules or atoms. • Investigate the everyday application of exothermic and endothermic reactions. For example, handwarmer or a cold pack. **Enrichment opportunities** • Black History Month- *Celebrate persons in STEM* • Science Museum • Career link https://edu.rsc.org/future-in-chemistry/not-a-student/teachers-and-careers-advisers/linking-curriculum-to-careers	
Spring 1	**Physics** Forces • Contact Forces • Pressure Electromagnets • Magnetism • Electromagnets	**Students learn about:** Equilibrium, deformation, linear relationships, Newton, resultant, force, friction, tension, compression, contact force Fluid, pressure, upthrust, atmospheric pressure Magnetic force, permanent magnet, magnetic poles Electromagnetic, solenoid, core **Key links to other units:** Year 10- Forces in balance, Forces and Motion, force and Pressure Year 11- Electromagnetism	**Students are able to:** • Explain whether an object in an unfamiliar situation is in equilibrium. • Describe factors which affect the size of frictional and drag forces. • Describe how materials behave as they are stretched or squashed. • Describe what happens to the length of a spring when the force on it changes. • Use diagrams to explain observations of fluids in terms of unequal pressure. • Explain why objects either sink or float depending upon their weight and the upthrust acting on them.	**Formative:** -Practical activities -Debates -Presentations -Self/ peer assessments -Problem solving activities **Summative:** -Termly exams -Research/Project based learning • Research and comment on atmospheric pressures on different planets • Evaluate how well sports or vehicle

			• Explain observations where the effects of forces are different because of differences in the area over which they apply. • Given unfamiliar situations, use the formula to calculate fluid pressure or stress on a surface. • Use the idea of field lines to show how the direction or strength of the field around a magnet varies. • Explain observations about navigation using Earth's magnetic field. • Use a diagram to explain how an electromagnet can be made and how to change its strength. • Explain the choice of electromagnets or permanent magnets for a device in terms of their properties. **Working Scientifically: Enquiry** • Sketch the forces acting on an object, and label their size and direction. • Use the formula: fluid pressure, or stress on a surface = force (N) / area (m2). • Carry out a simple experiment to investigate how the density of water affects the upthrust of an object. **Enrichment Opportunities** • National Apprenticeship Week • International Day of Women and Girls in Science- *Celebrate persons in STEM* • Career link https://careerpilot.org.uk/job-sectors/subject/physics#link-1	technology reduces frictional or drag forces

Spring 2	**Physics** Energy • Work • Heating and Cooling Waves • Wave Effects • Wave Properties	**Students will learn:** Work, lever, input force, output force, displacement. Thermal conductor, thermal insulator, thermal energy, conduction, convection, radiation Ultrasound, ultraviolet, microphone, loudspeaker, pressure waves Incident ray, reflective ray, normal line, angle of refraction, angle of incidence, refraction, absorption scattering, transparent, translucent, opaque, convex lens, concave lens, retina **Key links to other units:** Year 10- Conservation and Dissipation of Energy, Energy transfer by heating Year 11- Wave Properties, Electromagnetic Waves, Light	**Students are able to**: • Draw a diagram to explain how a lever makes a job easier. • Compare the work needed to move objects different distances. • Explain observations about changing temperature in terms of energy transfer. • Describe how an object's temperature changes over time when heated or cooled. • Explain how a method of thermal insulation works in terms of conduction, convection and radiation. • Sketch diagrams to show convection currents in unfamiliar situations. • Explain differences in the damage done to living cells by light and other waves, in terms of their frequency. • Explain how audio equipment converts sound into a changing pattern of electric current. • Describe the properties of different longitudinal and transverse waves. • Use the wave model to explain observations of the reflection, absorption and transmission of a wave. • Use ray diagrams of eclipses to describe what is seen by observers in different places. • Explain observations where coloured lights are mixed or objects are viewed in different lights. • Use ray diagrams to describe how light passes through lenses and transparent materials.	**Formative:** -Practical activities -Debates -Presentations -Self/ peer assessments -Problem solving activities **Summative:** -Termly exams -Research/Project based learning • Evaluate a claim about insulation in the home or for clothing technology • Research the causes of different sight problems and suggest suitable corrective lenses which could be used to treat these problems

			• Describe how lenses may be used to correct vision. **Working Scientifically: Enquiry** • Investigate how to prevent heat loss by conduction, convection and radiation • Use ray diagrams to model how light passes through lenses and transparent materials **Enrichment Opportunities** • National Careers Week- *celebrate persons in STEM* • British Science Week • Earth Day • Big Bang Competition • Career link https://careerpilot.org.uk/job-sectors/subject/physics#link-1	
Summer 1	**Biology** Ecosystems • Respiration • Photosynthesis Genes • Evolution • Inheritance	**Students will learn about:** Aerobic respiration, anaerobic respiration Fertiliser, photosynthesis, chlorophyll, stomata Population, natural selection, extinct, biodiversity, completion, evolution Inherited characteristics, DNA, chromosomes, gene **Key links to other units:** Year 10- Photosynthesis, Respiration Year 11- Reproduction, Variation and Evolution, Genetics and Evolution, Adaptation, Interdependence and Competition	**Students will be able to:** • Use word equations to describe aerobic and anaerobic respiration. • Explain how specific activities involve aerobic or anaerobic respiration. **(PSHE- Physical health and fitness)** • Describe ways in which plants obtain resources for photosynthesis. • Explain why other organisms are dependent on photosynthesis. • Sketch a line graph to show how the rate of photosynthesis is affected by changing conditions. • Use a word equation to describe photosynthesis in plants and algae. • Use evidence to explain why a species has become extinct or adapted to changing conditions.	**Formative:** -Practical activities -Debates -Presentations -Self/ peer assessments -Problem solving activities **Summative:** -End of Year 9 Exam -Research/Project based learning • Research the production of wine by fermentation • Research the human genome project and suggest benefits that have arisen or may arise from it

			• Evaluate whether evidence for a species changing over time supports natural selection. • Explain how a lack of biodiversity can affect an ecosystem. • Describe how preserving biodiversity can provide useful products and services for humans. • Use a diagram to show the relationship between DNA, chromosomes and genes. • Use a diagram to show how genes are inherited. • Explain how a change in the DNA (mutation) may affect an organism and its future offspring. • Explain why offspring from the same parents look similar but are not usually identical. **Working Scientifically: Enquiry** • Use lab tests on variegated leaves to show that chlorophyll is essential for photosynthesis • Review the evidence for theories about how a particular species went extinct **Enrichment Opportunities** • Kew Gardens • Target Mars- Brunel University • Stem ambassadors- *Career talks* • Career link https://careerpilot.org.uk/job-sectors/subject/biology	
Summer 2	**Biology** Cells and Organisation • Cell structure and transport • Cell Division	**Students will learn about:** Active transport, adult stem cell, agar jelly, cell differentiation, cell membrane, cell wall, chloroplast, chromosomes, concentration gradient, diffusion, eukaryotic cell, magnification, meristematic cells,	**Students are able to:** • Explain how the main sub-cellular structures of eukaryotic cells (plants and animals) and prokaryotic cells are related to their functions.	**Formative:** • Practical activities • Debates • Presentations • Self/ peer assessments

	• Organisation and the Digestive system • Organising animals and plants	mitochondria, mitosis, nucleus, organelle, osmosis, plasmid, prokaryotic cell, resolution, specialised cells, stem cell, surface area, surface area to volume ratio (SA:V), the cell cycle, therapeutic cloning, vacuole Amylase, aorta, artery, alveoli, bile, blood, capillary, enzymes, heart, lipase, organ, organ system, palisade mesophyll, phloem, protease, spongy mesophyll, statin stent, stomata tissue, transpiration, translocation, vein, xylem **Key links to other units:** Revisit the units on Cells, Breathing, Digestion and Inheritance and Evolution in Year 9	• Describe the process of mitosis in growth, including the cell cycle. • Discuss potential benefits and risks associated with the use of stem cells in medicine. (**PSHE- Physical health and fitness)** • Explain how substances are transported into and out of cells through diffusion, osmosis and active transport. • Explain the mechanism of enzyme action. **(PSHE-Healthy eating)** • Describe the human circulatory system, including the relationship with the gaseous exchange system, and explain how the structure of the heart and the blood vessels are adapted to their functions. (**PSHE-Physical health and fitness; Health prevention)** • Explain how the structure of xylem and phloem are adapted to their functions in the plant. **Working Scientifically** • Required practical: Use a light microscope to observe, draw and label a selection of plant and animal cells. • Required practical: Investigate the effect of salt or sugar solutions on plant tissue. • Required practical: Food test • Required practical: Investigate the effect of pH on the rate of reaction of amylase enzyme. **Enrichment opportunities** • Career link https://careerpilot.org.uk/job-sectors/subject/biology	• Problem solving activities **Summative:** • Termly exam