KS3 Science Curriculum Coverage: 2023 – 2024

Year 9

Sequenced	Practical Skills and Safety (Autumn term)	Ecology (Autumn term)	Waves (Autumn term)	Cellular Biology (Spring term)	Atomic Structure & Periodic Table (Spring Term)
Key Knowledge	**To know:** ● The names of lab equipment used in science. ● The hazard symbols. ● The metric units of length, mass, volume, time and temperature. ● The meaning of independent, dependent and control variables. ● What is meant by categoric and continuous data. ● That ceramics, polymers, and composites are potential materials of the future.	**To know:** ● Heredity as the process by which genetic information is transmitted from one generation to the next. ● A simple model of chromosomes, genes and DNA in heredity, including the part played by Watson, Crick, Wilkins and Franklin in the development of the DNA model. ● Differences between species. ● That variation can be continuous or discontinuous. ● That variation means some organisms compete more successfully, which can drive natural selection. ● Changes in the environment may leave some organisms 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. ● About interdependence of organisms in an ecosystem, including food chains, webs and insect-pollinated crops. ● The 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.	**To know:** ● How transverse waves (e.g. water waves and light waves) travel and can be reflected at a boundary ● Sound waves are longitudinal and travel by vibrations. ● Sound wave's frequency is measured in Hertz. ● Sound waves can be reflected and absorbed at a boundary. ● Sound needs a medium to travel and travels at different speeds in solids, liquids and gases. ● Sound waves can be produced by loudspeakers and detected by microphone diaphragms and the ear. ● Some use and applications of waves (e.g. ultrasound). ● Light waves travel fastest through a vacuum. ● Light can be reflected, transmitted and refracted at a boundary. ● White light is made up of different frequencies of light. ● Sound wave's frequency is measured in Hertz.	**To know:** ● The similarities and differences between eukaryotic and prokaryotic cells and estimate their relative size or area. ● How the structure of different types of cells relate to their function in a tissue, an organ or organ system. ● The importance of cell differentiation in both animals and plants and how it leads to specialised cells. ● How microscopy techniques have developed over time how to carry out calculations involving magnification, real size and image size. ● That an electron microscope has a much higher magnification and resolution than a light microscope. ● How bacteria divide (binary fission), how they can be grown and how to prepare an uncontaminated culture using an aseptic technique. ● That the nucleus contains chromosomes (in pairs) made of DNA. Each chromosome contains many genes. ● How to describe how cells divide via mitosis and knowing how it fits within the stages of the cell cycle. ● The function of stem cells in embryos, in adult animals and in the meristems of plants. ● That substances move in and out of cells across the cell membrane by diffusion, osmosis and active transport.	**To know:** ● The difference between atoms, elements and compounds. ● How mixtures can be separated by physical processes such as filtration, crystallisation, distillation and chromatography. ● How the model of the atom has changed over time – the difference between the plum pudding and nuclear models of the atom. ● The relative masses and charges of the sub-atomic particles in an atom and how this is linked to isotopes. ● How to calculate the number of protons, neutrons and electrons in an atom or ion given the atomic and mass numbers. ● How to calculate the relative atomic mass of an element given the relative abundancies of its isotopes. ● How to represent the electronic structures of the first 20 elements by numbers (2.8.1 for Na) or by diagram; circles (shells) and electrons (x). ● That the position of an element on the periodic table is linked to its atomic number and number of electrons in its outer shell. ● The steps that were taken to develop the periodic table. ● The difference between metals and non-metals. ● The properties of the elements in Group 1 (alkali metals), 7 (halogens) and 0 (noble gases) and how their reactivity is linked to their electron structures and position in the periodic table. ● That the transition elements are metals with similar properties which are different to those of the elements in Group 1.
Key Skills	To be able to: ● Convert between different units. ● Plan an investigation given a specific list of apparatus. ● Identify the variables of an investigation in terms of investigating different insulating materials. ● Draw a line graph including the labelling and scaling of axes and a line of best fit. ● Set up and use a Bunsen burner safely in a variety of contexts (e.g.) when recrystalising and in simple distillation.	**To be able to:** ● Draw and analyse simple food chains and food webs. ● Describe how different animals/plants are adapted to survive in their environment given a specific context. ● Predict reasons why species may become extinct. ● Analyse variation through measurements and when represented graphically.	**To be able to:** ● Compare the similarities and differences between light waves and waves in matter (e.g. sound). ● Label the wavelength and amplitude of a transverse wave. ● Compare two waves with similar/different wavelength and amplitude. ● Calculate the wave speed using the wave equation. ● Describe how light can transfer energy from a source to an observer such as in the retina (eyes) and in cameras	**To be able to:** ● Demonstrate an understanding of the scale and size of cells and make calculations with the use of standard form. ● Recognise, draw and interpret images of cells using a light microscope and a magnification scale. ● Convert and use prefixes centi, milli, micro and nano. ● Calculate the number of the number of bacteria in a population or the cross-sectional area of a colony using πr^2 ● Use models or analogies to develop explanations about how cells divide and recognise contexts when mitosis is occurring. ● Evaluate the practical risks, benefits, social and ethical issues of the use of stem cells in medical research and treatments. ● Recognise, draw and interpret diagrams that model diffusion and osmosis. ● Calculate and compare surface area to volume ratios ● Use percentages and to measure the rate of water uptake. and calculate percentage gain/loss of mass in plant tissue ● Plot, draw and interpret appropriate graphs.	**To be able to:** ● Complete word & balanced symbol equations where appropriate. ● Safe use of a range of equipment to separate chemical mixtures. ● Understand why and how scientific theories develop over time using the development of the model of the atom. ● Relate the size and scale of atoms to objects in the physical world – use SI units, the prefix nano and standard form (radius of an atom/nucleus) ● Visualise and represent 3D structures in 2D (structure of an atom) ● Predict possible reactions and probable reactivity of an element from its position in the periodic table. ● Explain how testing a prediction can support or refute a new scientific idea in terms of the development of the periodic table. ● Predict properties from given trends down a group in the periodic table. ● Use liquids and solids safely, including careful mixing of reagents under controlled conditions, using appropriate apparatus to explore chemical changes and/or products. ● Safe use of heating devices and techniques such as a Bunsen burner and a controlled-temperature water bath.

	Tier 3 key vocabulary	Tier 3 key vocabulary	Tier 3 key vocabulary	Tier 3 key vocabulary	Tier 3 key vocabulary
Subject specific	Beaker, conical flask, thermometer, balance, Bunsen burner, flammable, corrosive, toxic, independent, dependent, control, line of best fit	Nucleus, DNA, genes, chromosomes, hereditary, variation, adaptation, extinction, evolution, genetic, adaptation, natural selection, habitat, environment, ecosystem, biodiversity, interdependence	Vibration, Wavelength, frequency, amplitude, hertz, longitudinal transverse, wave speed, reflection, refraction, absorb, normal, incidence, convex, photo-electric, ultrasound, medium	Eukaryotic, prokaryotic, organelles, nucleus, cell membrane, cytoplasm, mitochondria, ribosome, cell wall, vacuole, chloroplast, differentiation, specialisation, microscopy, magnification, resolution, binary fission, aseptic, chromosomes, gene, mitosis, embryo, meristem, diffusion, osmosis, active transport	Atom, element, compound, molecule, ion, mixture, evaporation, filtration, distillation, chromatography, crystallisation, proton, neutron, electrons, nucleus, isotopes, relative atomic mass, abundance, periodic table, alkali metal, universal indicator, halogen, displacement, reactivity, noble gas, dissolving, soluble, insoluble, exothermic, transition metal, catalyst

KS3 Science Curriculum Coverage: 2023 – 2024

Year 9

Sequenced	**Energy and resources (Summer term)**	**Bonding and properties (Summer Term)**
Key Knowledge	**To know:** ● That a system is an object or group of objects. ● There are changes in the way energy is stored when a system changes. ● The equation to calculate the kinetic energy of a moving object. ● The equation to calculate the amount of elastic potential energy stored in a stretched spring. ● The equation to calculate the amount of gravitational potential energy gained by an object raised above ground level. ● The equation to calculate the amount of energy stored in or released from a system as its temperature changes. ● That the specific heat capacity of a substance is the amount of energy required to raise the temperature of one kilogram of the substance by one degree Celsius. ● That power is defined as the rate at which energy is transferred or the rate at which work is done. ● Energy can be transferred usefully, stored, or dissipated, but cannot be created or destroyed. ● That the higher the thermal conductivity of a material, the higher the rate of energy transfer by conduction across the material. ● The equation to calculate the energy efficiency for any energy transfer. ● The main energy resources available for use on Earth. ● A renewable energy resource is one that is being (or can be) replenished as it is used. ● The uses of energy resources include transport, electricity generation and heating.	**To know:** ● Chemical bonding is either ionic, covalent or metallic and involves electrostatic forces and the transfer or sharing of electrons. ● The charge on an ion relates to the element's group number. ● An ionic compound is a giant structure of ions and understand structures can be represented as dot and cross or ball and stick models ● Covalent bonds are shared pairs of electrons and can be illustrated using a line to represent a single bond. ● Metals consist of a giant structure of positive metal ions surrounded by delocalised electrons that are free to move. ● Substances exist as solids, liquids or gases and can be represented by a simple particle model that has specific limitations; particles shown as inelastic spheres with no forces between them. ● That melting, boiling, freezing and condensing can be explained in terms of particle theory and energy transfer at each change of state. ● That atoms themselves do not have the bulk properties of materials. ● The state symbols are (s) for solid, (l) for liquid, (g) for gas and (aq) for aqueous solutions. ● The properties of ionic compounds and how they are linked to the giant structure of oppositely charged ions. ● The properties of small covalent molecules and link them to the idea that intermolecular forces are weak compared to covalent bonds. ● That polymers are very large covalent molecules that are solids. ● Examples and uses of giant covalent structures and link their properties to their structure – diamond, graphite, graphene and fullerenes. ● The properties of giant metallic structures and alloys. ● That nanoparticles are very small structures (1-100nm) that have unique properties and uses/risks.
Key Skills	**To be able to:** ● Describe all the changes involved in the way energy is stored when a system changes, for common situations. ● Calculate the changes in energy involved when a system is changed by heating, work done by forces and work done when a current flows ● Calculate the energy associated with a moving object, a stretched spring and an object raised above ground level. ● Plan an investigation to determine the specific heat capacity of one or more materials (RP 1) ● Describe, with examples, how in all system changes energy is dissipated, so that it is stored in less useful ways. This energy is often described as being 'wasted'. ● Explain ways of reducing unwanted energy transfers, for example through lubrication and the use of thermal insulation. ● Investigate the effectiveness of different materials as thermal insulators (RP 2) ● Describe ways to increase the efficiency of an energy transfer. ● Compare ways that different energy resources are used, the uses to include transport, electricity generation and heating. ● Describe the environmental impact arising from the use of different energy resources	**To be able to:** ● Visualise and represent 3D bonding in 2D ● Draw dot and cross diagrams to represent ionic and covalent bonding ● Deduce that a compound is either ionic or covalent ● Calculate the empirical formula of an ionic compound and the molecular formula of a covalent substance from a given model ● Recognise covalent structures as being small molecules, polymers or giant structures from diagrams showing their bonding ● Recognise metallic substances as giant structures from given diagrams ● Predict the states of substances at different temperatures ● Include the appropriate state symbol in balanced equations ● Make order of magnitude calculations and calculate areas of triangles and rectangles and surface areas and volumes of cubes (nanoparticles) ● Recognise and use expressions in standard form (nanoparticles) ● Use ratios, fractions and percentages in terms of surface area to volume ratios (nanoparticles) ● Evaluate the use of nanoparticles given the appropriate information
	Tier 3 key vocabulary	**Tier 3 key vocabulary**
Subject specific	Energy, joules, system, kinetic, chemical, thermal, gravitational potential, elastic potential, vibrational, efficiency, dissipated, wasted, work done, power, watts, specific heat capacity, insulation, resources, renewable, non-renewable.	Ionic, covalent, metallic, electrostatic, atom, element, compound, molecule, ion, electrons, delocalised, lattice, melting, freezing, boiling, condensing, intermolecular forces, diamond, graphite, graphene, fullerenes, polymer, empirical, molecular, nanoparticles, properties

Current Year 9 Cohort 2022-2023

Topics already studied in Year 7:

- Cells & Reproduction
- Particles
- Energy
- Separation Techniques
- Fast & Furious
- Forces

Topics already studied in Year 8:

- Keeping Healthy
- Electricity & Magnetism
- Chemical Reactions
- Energy from Food