Science

ALDER
Community High School

Year 9

	Topic	Knowledge & understanding		Key Vocabulary
Autumn	**Plants**	**Know that** sexual reproduction requires two individuals to produce an organism of the same type. **Know that** asexual reproduction requires one parent to produce a new organism. **Know that** asexual reproduction produces clones (genetically identical copies), whereas sexual reproduction results in genetic variation within a population. **Know that** the differences in the characteristics of plants produced by sexual reproduction are examples of inherited variation. **Know that** there are various methods of asexual reproduction including potatoes producing tubers, strawberries producing runners, various plants produce spores e.g. ferns and mosses, and onions producing bulbs. **Know that** plants can be artificially created from cuttings taken from the leaf or shoot of an existing plant.	**Know how to** take a cutting from a plant to produce healthy clones. **Know how to** label a diagram of a flower correctly. **Know how** to dissect a flower and present the reproductive organs. **Know how** to dissect a seed and label it correctly. **Know how** to effectively plan an investigation so a variable can be tested in order to obtain valid results. **Know how** to structure a sentence to form a prediction. **Know how** to test leaves for starch. **Know how** to use a microscope and prepare a slide to view stomata from the underside of a leaf.	Tier 2 Variable Hypothesis Product Method Equipment Apparatus Pigment Surface area Broad Flat Obtain Tier 3 Sexual reproduction Asexual reproduction Fertilisation Gamete pollination Pollen tube Zygote Embryo

		Know that the scientific names for sex cells is gametes **Know that** when gametes' nuclei fuse together by the process of fertilisation, a zygote (fertilized egg) is formed. **Know** the structure of a flower including male (Carpel) and female (Stamen) reproductive organs and parts. **Know** the male and female names for gametes in both humans (sperm, egg) and plants (pollen grain, egg). **Know that** pollination is the transfer of pollen from an anther to a stigma. **Know that** anthers are where pollen is produced, ovules are where egg cells are produced, stigma is where pollen grains land during pollination, the ovary contains the ovule, the style holds up the stigma, the filament holds up the anther, flowers attract insects for pollination, and sepals protect unbudded flowers. **Know that** cross pollination is when pollen from one plant is transferred to another plant's stigma, whereas self-pollination is when pollen is transferred from a plants anther to its own stigma, resulting in offspring that are not clones of the parent. **Know** the difference between wind (pollen is light) and insect (pollen is spikey, flower is colourful and scented) pollinated plants and their pollen.		Germination Photosynthesis Diffusion Respiration Chlorophyll Chloroplast Cell Wall Cell Membrane Vacuole Mitochondria Ribosome Nucleus Cytoplasm Stomata Gas exchange Epidermis Palisade Xylem Cuticle Producer Consumer Decomposer Seeds Rooting powder Cuttings Variation

		Know that a fertilised egg grows into a seed. **Know that** when zygotes are fertilised they use a process called mitosis (cell division) to form an embryo, which develops into small roots and shoots. **Know that** germination is when a seed starts to grow after being fertilised and that the ovary will develop into fruit around the seed. **Know that** the seed has a store of food to use during germination, a seed coat to protect the seed, tiny roots to absorb water, and tiny shoots to grow leaves. **Know that** seeds can be dispersed by animal fur, animal faeces, wind, and water. **Know** examples of seed adaptations to allow seed dispersal e.g. spike to stick to animal fur, light or specific shapes to allow floating in air, less dense than water so can float, fruits that animals will consume. **Know** the order of the scientific method – hypothesis, prediction, experiment, observation, results, conclusion, evaluation. **Know** the chemical reaction for photosynthesis and correctly identify reactants and products. **Know that** water for photosynthesis is obtained through the soil via the roots		

		and carbon dioxide is obtained through the leaves via the stomata. **Know that** chloroplasts contain chlorophyl which absorbs sunlight for photosynthesis to take place. **Know that** glucose produced by photosynthesis can be stored as starch for later use by the plant. **Know** the functions of plant organelles: ribosome for protein synthesis, chloroplast to absorb light and carry out photosynthesis, cell membrane to allow substances to move in and out of the cell, cell wall to strengthen and support the cell, cytoplasm is where chemical reactions take place, vacuole contains cell sap and keeps the cell rigid, nucleus contains DNA. **Know that** plants are adapted to obtain light from the sun, water from the soil, and carbon dioxide from the air. **Know that** plant leaves are broad and flat to increase surface area so that more light is trapped. **Know that** roots have root hair cells that increase surface area so that more water can be absorbed from the soil. **Know that** xylem allows water to move up the plant from the roots to the leaves in one direction. **Know that** leaves have small holes on their underside called stomata which allow oxygen to diffuse into the plant		

		and carbon dioxide to diffuse out (gaseous exchange).		
	More Forces	**Know that** speed can be calculated using the formula below: speed = distance ÷ time **Know that** displacement is the distance in a straight line between an object and its starting point. **Know that** a distance- time graph can be used to analyse the movement of an object. **Know that** the area under a speed-time graph can be used to calculate the distance travelled by an object. **Know that** relative motion is the motion of one object with respect to another. **Know that** gravity is a non-contact force acting at a distance on Earth and in space. **Know that** unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object. **Know that** every object with mass will exert a gravitational pull on other objects. **Know that** the greater the mass of an object, and the closer the object is to Earth, the more the force of gravity will act upon it. **Know that** weight can be calculated using the formula below: weight = mass x gravitational field strength. **Know that** gravitational field strength on Earth is 10N/Kg and is different on other planets and stars. **Know that** upthrust is an upward force exerted on an object by a fluid. **Know that** objects less dense than water will float and those that are denser will sink. **Know that** water resistance and water resistance are types of drag. **Know that** streamlining a shape will reduce drag. **Know that** as the speed of an object increases so does the drag. **Know that** when forces on an object are balanced the speed will be unchanged. **Know that** atmospheric pressure decreases with height due to the weight of the air above decreasing. **Know that** pressure in liquids increases with depth.	**Know how** to perform a simple experiment to determine speed. **Know how** to apply the formula speed = distance ÷ time. **Know how** to draw a distance-time graph accurately. **Know how** to interpret a distance-time graph to determine whether an object is stationary or traveling at a constant speed. **Know how** to calculate the speed of an object from a distance-time graph. **Know how** to calculate the relative motion of objects moving towards and away from each other. **Know how** to calculate weight using the formula below; weight = mass x gravitational field strength **Know how** to describe ways in which drag forces can be increased or decreased. **Know how** to calculate moments and describe the subsequent motion if the system is not in equilibrium. **Know how** to calculate the work done using the formula below: work done = force x distance	Tier 2: Speed Mass Weight Gravity Density Balanced Unbalanced Volume Model Rotate Clockwise Anticlockwise Tier 3: Anomaly Exert Relative motion Displace Displacement Upthrust Drag Friction Streamlined Pressure Fluids Inflate Depth Atmosphere Implode Turning force Moment Pivot Fulcrum Lever Effort Load Equilibrium Conservation

		Know that pressure in fluids acts in all directions. **Know that** a moment is the turning effect of a force. **Know that** moments are calculated by multiplying the force by the perpendicular distance. Know that this relationship can be represented by the formula below: Moment = force x perpendicular distance from pivot **Know that** if the clockwise moment is equal to the anticlockwise moment, then the system is in equilibrium **Know that** a lever can be used to multiply forces. **Know that** a simple machine, such a lever or pully, provides a greater force at the expense of smaller movement. **Know that** in a simple machine, the product of force x displacement remains unchanged.		Work Machine
	Chemical reactions	**Know that** an atom is the simplest particle that exists. **Know that** an element is made up of the same type of atoms. **Know that** molecules are two or more atoms chemically bonded together. **Know that** a compound is two or more different types of atoms bonded together **Know that** mixtures are made up out of different substances not chemically bonded to each other. **Know that** John Dalton's atomic theory stated the following: a) that all matter is made up of tiny particles, b) In chemical reactions atoms rearrange to make a new substance. **Know that** Dalton's theory stated that atoms were tiny indestructible spheres with no empty space. **Know that** the modern version of the atom contains protons and neutrons in the nucleus, with electrons orbiting the nucleus on shells. **Know that** non-metal elements are found on the right-hand side of the periodic table and metal elements are found on the left. **Know that** the rows in the periodic table are called periods and the columns are called groups. **Know that** physical changes are reversible, and no new substances are formed. **Know that** chemical changes are irreversible and new substances are formed.	**Know how to** write the chemical symbols of elements, with the first letter always being a capital letter and the second letter as a lower-case letter. **Know how to** write chemical formulae for simple molecules and compounds. **Know how to** balance symbol equations. **Know how to** identify trends in reactivity of alkali metals. **Know how to** determine anomalies from data. **Know how to** calculate mean averages from data, removing anomalies from the calculation. **Know how to** draw a line graph using mean averages calculated to draw a line of best fit. **Know how to** infer data from a line graph by extrapolating data. **Know how to** identify trends in data to draw conclusions. **Know how to** evaluate data for reliability.	Tier 2 conservation properties ratio trends extinguish greenhouse reversible irreversible Tier 3 matter atoms elements compounds chemical formula physical properties chemical properties reactants products combustion Oxidation Reduction Activation energy

		Know that alkali metals react with water, and the reactivity of the alkali metals increase as you move down group 1. **Know that** metals can react with oxygen to form metal oxides and that the appearance of metal oxides are different to the appearance of the metal. **Know that** oxidation is a gain of oxygen and reduction is the loss of oxygen. **Know that** combustion is a type of oxidation reaction as elements combine with oxygen **Know that** fuel, heat, and oxygen are needed for combustion to occur. **Know that** carbon dioxide and water are produced in complete combustion of fuel **Know that** carbon monoxide, carbon and water are produced by incomplete combustion of fuel **Know that** atoms are not created or destroyed in a chemical reaction so the mass of the products in a reaction remains the same as the mass of the reactants. **Know that** metals react with oxygen to form metal oxides **Know that** metals react with water to form metal hydroxides and hydrogen **Know that** exothermic reactions transfer thermal energy to the surroundings and endothermic reactions take in thermal energy from the surroundings. **Know that** every reaction requires bonds to be broken first before new bonds are formed. **Know that** energy must be taken in to break bonds which is an endothermic reaction. **Know that** energy is given out when bonds are formed which is an exothermic reaction. **Know that** combustion and other human activity such as farming of cattle leads to the production of greenhouses gases. **Know that** sulfur is an impurity found in fossil fuels, which combusts to form sulfur dioxide, which dissolves in water vapour to form acid rain. **Know that** acid rain causes limestone to weather, stops fish eggs from hatching and makes soil too acidic for some crops to grow. **Know that** greenhouse gases absorb thermal energy radiated from earth and re-radiates heat back into the atmosphere.		Exothermic endothermic pollutants global warming climate change effervescence reactive

	Electricity, magnetism and energy transfer	**Know that** conduction is the transfer of energy through a material by the movement of its particles **Know that** metals are good conductors of thermal energy **Know that** non-metals are poor conductors of thermal energy **Know that** insulators are poor conductors of thermal energy **Know that** a vacuum is a space totally empty of matter **Know that** stationary air is a good thermal insulator **Know that** convection is the transfer of thermal energy in fluids due to density changes **Know that** more dense fluid will sink, and less dense fluid will rise to the top **Know that** radiation is the transfer of energy via wave or particle **Know that** density is the amount of mass per unit volume **Know that** infrared is the transfer of thermal energy via a radiation pathway **Know that** infrared cameras can be used to produce maps of temperature. **Know that** infrared is used in night vision equipment **Know that** black dull objects are good absorbers and emitters of infrared radiation. **Know that** white or shiny objects are poor absorbers of infrared radiation **Know that** the Greek letter delta is used to represent 'the change in' **Know that** energy can neither be created or destroyed, only transferred between stores via pathways **Know that** dissipated energy is energy that ends up in a non-useful store **Know that** the efficiency of an energy transfer is the ratio between the input energy and the usefully transferred useful energy **Know that** appliances with a lower efficiency rating will cost more to run **Know that** electricity meters measure energy transferred in kilowatt-hours **Know that** power can be calculated by power = energy/time **Know that** power is the rate of transfer of energy **Know that** everything is made of atoms **Know that** atoms are made of protons, neutrons and electrons **Know that** protons and neutrons are in the nucleus **Know that** electrons are in shells around the nucleus	**Know how to** compare the rates of conduction in different conductors **Know how to** use convection currents to ensure circulation of fresh air in a system **Know how to** calculate thermal energy changes using specific heat capacity **Know how to** explain energy transfers and pathways in a variety of situations **Know how to** use Sankey diagrams to show energy transfers and pathways **Know how to** calculate the efficiency of various energy transfers **Know how to** use meter readings to calculate how much energy needs to be paid for **Know how to** graphically compare the resistance of two wires **Know how to** apply and carry out calculations using Ohms law, V = I x R **Know how to** experimentally plot a magnetic field	Tier 2: Vacuum Emit Absorbed Medium Appliance Rate Attract Repel Resistance Tier 3: Conduction Convection Density Radiation Delta Dissipation Efficiency Current Attract Repel Magnetic field Induced magnet

		Know that the atom has no overall charge as it has equal number of positive and negative charges **Know that** a charged object has an electrostatic field around it **Know that** if a charged object is placed in an electrostatic field than it will experience a force acting upon it **Know that** friction between two insulating materials results in a transfer of electrons resulting in the two items having an equal and opposite charge **Know that** current is the rate of flow of charge **Know that** parallel circuits contain branches but series circuits do not **Know that** current is measured in series with a component by an ammeter **Know that** current splits and comes together at junctions in a parallel circuit. **Know that** current is constant in parallel circuits **Know that** potential difference is a measure of the energy transferred by the charge **Know that** potential difference is measured in parallel to a component using a voltmeter **Know that** potential difference is shared across components in a series circuit **Know that** potential difference is the same across all components in a parallel circuit **Know that** resistance in electrical conductors is due to collisions between the electrons and the ions in the lattice. **Know that** the resistance of an electrical conductor will be dependent upon the material it is made from and it's temperature **Know that** the resistance of a conductive wire also depends on its length and thickness **Know that** current flowing against an electrical resistance in an electrical appliance causes the device to heat up **Know that** materials that have very high resistances that stops current flowing are called insulators **Know that** we can calculate voltage using current and resistance **Know that** opposite poles on a magnet attract **Know that** like poles on a magnet repel **Know that** not all metals are magnetic **Know that** a magnetic field is an area around a magnet where magnetic materials experience a force **Know that** an induced magnet has become magnetised by being placed in a magnetic field		

		Know that the magnetic field is strongest at the poles **Know that** the Earth's magnetic field comes from the spinning molten Iron core **Know that** the geographical north pole of the Earth is the magnetic south pole and vice versa **Know that** the north end of a compass points to the geographical north pole as it is attracted to the magnetic south pole of the Earth **Know that** a current flowing through a wire produces a magnetic field **Know that** the magnetic effect of a current flowing through a wire can be increased by arranging the wire into a coil around an iron core **Know that** a coil of wire with a current flowing through it is called a solenoid **Know that** an increase in the number of coils, or in the current flowing will increase the strength of a solenoid.		
Spring	**Metal reactions**	**Know that** corrosion refers to reaction with oxygen that occurs on the surface of the metal **Know that** corrosion is an oxidation reaction. **Know that** oxidation is the gaining of oxygen. **Know that** rusting is the corrosion of iron and requires both water and oxygen to react with iron. **Know that** the reaction between iron, oxygen and water will form iron hydroxide as the product. **Know that** rusting can be prevented by covering the metal's surface with plastic, paint or oil. **Know that** reduction is the losing of oxygen. **Know that** some metals such as the alkali metals will react readily in water to produce a metal hydroxide and hydrogen gas	**Know how to** write a prediction based on scientific knowledge and understanding. **Know how to** place metals in order of reactivity by observing their reactions in water. **Know how to** write a word equation for the reaction of metals with water. **Know how to** write a balanced, symbol equation for the reaction of metals with water. **Know how to** name the salt produced from the reaction of metals with acid. **Know how to** write word and balanced, symbol equations for the reaction between metals and acids. **Know how to** predict the products in a displacement reaction by comparing the	Tier 2 evaluate effervescence displace extract ore malleable Tier 3 prediction salt compound oxidation reduction native state

		Know that when a gas is produced, effervescence is observed. **Know that** alkali metals produce metal hydroxides that are alkali in solution. **Know that** some metals react with acids to produce a salt and hydrogen gas. **Know that** the salts produced are named depending on the acid and metal that had reacted together. **Know that** in a displacement reaction, the more reactive metal takes the place of a less reactive metal from its compound. **Know that** a compound is two or more different types of elements chemically bonded together. **Know that** displacement reactions can be observed by a colour change in a reaction and a formation of a solid metal. **Know that** an ore is a rock that contains a metal compound. **Know that** very unreactive metals such as gold are found native. **Know that** metals must be extracted from their ores by either heating with carbon or by electrolysis. **Know that** metals that are less reactive than carbon in the reactivity series can be extracted from its compound by both heating and carbon and electrolysis. **Know that** heating with carbon is the preferred method for extracting metals from its compound as it is cheaper. **Know that** metals that are more reactive than carbon in the reactivity series can only be extracted by electrolysis. **Know that** a pure substance only contains one type of substance. **Know that** alloys are a mixture of metals and has desirable properties than those of pure metals. **Know that** alloys have a range of melting points as it is a mixture whereas pure metals have a sharp melting point. **Know that** alloys are less malleable than pure metals as the different sized atoms disrupts the layers of atoms so the layers of metal atoms cannot slide over each other easily.	reactivities of the two metals present in the reaction. **Know how to** deduce which substance has been oxidized or reduced in a displacement reaction.	pure

	Genes and inheritance	**To know** what is meant by the term species. **To know** and identify examples of inherited and environmental variation. **To know** the difference between continuous and discontinuous variation **To know** what gametes are. **To know** the process of fertilisation. **To know** what a normal distribution is and that continuous data usually gives a 'bell curve shape'. **To know** that genes are found in chromosomes and that they are made from DNA **To know** the role of chromosomes, genes and DNA in heredity. **To know** and be able to describe the structure of DNA. **To know** the roles played by Watson, Crick, Franklin and Wilkins in the discovery of the structure of DNA. **To know** how individual parts of a model represent the different parts of a DNA molecule. **To know** reasons why Rosalind Franklin's role in the discovery of DNA was misreported. **To know** reasons for preventing species becoming extinct, thereby preserving biodiversity. **To know** ways in which biodiversity can be preserved, including the use of gene banks, and evaluate their effectiveness. **To know** and describe examples of a change to a species that gave it a better chance of survival. **To know** how changes in an environment can lead to changes in species or extinction through natural selection. **To know** about variation and adaptations to explain Darwin's theory of evolution by natural selection.	**Know how** to read data and graphs to identify variation as continuous or discontinuous. **Know how** to create a model to represent scientific ideas. **Know how** to plan a project so a final presentation can be created successfully. **Know how** to present information both verbally and visually to help others and yourself to better understand a topic. **Know how** to use key words to help structure a 6-mark answer. **Know how** to use a model we have created to better help understanding.	Tier 2: Controversial Explain Describe Competition Diversity Sugar Environmental Continuous Discontinuous Tier3: Evolution Natural selection Extinct Biodiversity Ecosystem Guanine Cytosine Adenine Thymine DNA Base Double Helix Chromosome Heredity Gene Phosphate Species
	Plants	**Know that** sexual reproduction requires two individuals to produce an organism of the same type. **Know that** asexual reproduction requires one parent to produce a new organism. **Know that** asexual reproduction produces clones (genetically identical copies), whereas sexual reproduction results in genetic variation within a population. **Know that** the differences in the characteristics of plants produced by sexual reproduction are examples of inherited variation.	**Know how to** take a cutting from a plant to produce healthy clones. **Know how to** label a diagram of a flower correctly. **Know how** to dissect a flower and present the reproductive organs. **Know how** to dissect a seed and label it correctly. **Know how** to effectively plan an investigation so a variable can be tested in order to obtain valid results. **Know how** to structure a sentence to form a prediction.	Tier 2 Variable Hypothesis Product Method Equipment Apparatus Pigment Surface area Broad Flat Obtain

		Know that there are various methods of asexual reproduction including potatoes producing tubers, strawberries producing runners, various plants produce spores e.g. ferns and mosses, and onions producing bulbs. **Know that** plants can be artificially created from cuttings taken from the leaf or shoot of an existing plant. **Know that** the scientific names for sex cells is gametes **Know that** when gametes' nuclei fuse together by the process of fertilisation, a zygote (fertilized egg) is formed. **Know** the structure of a flower including male (Carpel) and female (Stamen) reproductive organs and parts. **Know** the male and female names for gametes in both humans (sperm, egg) and plants (pollen grain, egg). **Know that** pollination is the transfer of pollen from an anther to a stigma. **Know that** anthers are where pollen is produced, ovules are where egg cells are produced, stigma is where pollen grains land during pollination, the ovary contains the ovule, the style holds up the stigma, the filament holds up the anther, flowers attract insects for pollination, and sepals protect unbudded flowers. **Know that** cross pollination is when pollen from one plant is transferred to another plant's stigma, whereas self-pollination is when pollen is transferred from a plants anther to its own stigma, resulting in offspring that are not clones of the parent. **Know** the difference between wind (pollen is light) and insect (pollen is spikey, flower is colourful and scented) pollinated plants and their pollen. **Know that** a fertilised egg grows into a seed. **Know that** when zygotes are fertilised they use a process called mitosis (cell division) to form an embryo, which develops into small roots and shoots. **Know that** germination is when a seed starts to grow after being fertilised and that the ovary will develop into fruit around the seed. **Know that** the seed has a store of food to use during germination, a seed coat to protect the seed, tiny roots to absorb water, and tiny shoots to grow leaves. **Know that** seeds can be dispersed by animal fur, animal faeces, wind, and water. **Know** examples of seed adaptations to allow seed dispersal e.g. spike to stick to animal fur, light or specific	**Know how** to test leaves for starch. **Know how** to use a microscope and prepare a slide to view stomata from the underside of a leaf.	Tier 3 Sexual reproduction Asexual reproduction Fertilisation Gamete pollination Pollen tube Zygote Embryo Germination Photosynthesis Diffusion Respiration Chlorophyll Chloroplast Cell Wall Cell Membrane Vacuole Mitochondria Ribosome Nucleus Cytoplasm Stomata Gas exchange Epidermis Palisade Xylem Cuticle Producer Consumer Decomposer Seeds Rooting powder Cuttings Variation

		shapes to allow floating in air, less dense than water so can float, fruits that animals will consume. **Know** the order of the scientific method – hypothesis, prediction, experiment, observation, results, conclusion, evaluation. **Know** the chemical reaction for photosynthesis and correctly identify reactants and products. **Know that** water for photosynthesis is obtained through the soil via the roots and carbon dioxide is obtained through the leaves via the stomata. **Know that** chloroplasts contain chlorophyl which absorbs sunlight for photosynthesis to take place. **Know that** glucose produced by photosynthesis can be stored as starch for later use by the plant. **Know** the functions of plant organelles: ribosome for protein synthesis, chloroplast to absorb light and carry out photosynthesis, cell membrane to allow substances to move in and out of the cell, cell wall to strengthen and support the cell, cytoplasm is where chemical reactions take place, vacuole contains cell sap and keeps the cell rigid, nucleus contains DNA. **Know that** plants are adapted to obtain light from the sun, water from the soil, and carbon dioxide from the air. **Know that** plant leaves are broad and flat to increase surface area so that more light is trapped. **Know that** roots have root hair cells that increase surface area so that more water can be absorbed from the soil. **Know that** xylem allows water to move up the plant from the roots to the leaves in one direction. **Know that** leaves have small holes on their underside called stomata which allow oxygen to diffuse into the plant and carbon dioxide to diffuse out (gaseous exchange).		
Summer	**More Forces**	**Know that** speed can be calculated using the formula below: speed = distance ÷ time **Know that** displacement is the distance in a straight line between an object and its starting point. **Know that** a distance- time graph can be used to analyse the movement of an object. **Know that** the area under a speed-time graph can be used to calculate the distance travelled by an object.	**Know how** to perform a simple experiment to determine speed. **Know how** to apply the formula speed = distance ÷ time. **Know how** to draw a distance-time graph accurately. **Know how** to interpret a distance-time graph to determine whether an object is stationary or traveling at a constant speed.	Tier 2: Speed Mass Weight Gravity Density Balanced Unbalanced Volume

		Know that relative motion is the motion of one object with respect to another. **Know that** gravity is a non-contact force acting at a distance on Earth and in space. **Know that** unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object. **Know that** every object with mass will exert a gravitational pull on other objects. **Know that** the greater the mass of an object, and the closer the object is to Earth, the more the force of gravity will act upon it. **Know that** weight can be calculated using the formula below: weight = mass x gravitational field strength. **Know that** gravitational field strength on Earth is 10N/Kg and is different on other planets and stars. **Know that** upthrust is an upward force exerted on an object by a fluid. **Know that** objects less dense than water will float and those that are denser will sink. **Know that** water resistance and water resistance are types of drag. **Know that** streamlining a shape will reduce drag. **Know that** as the speed of an object increases so does the drag. **Know that** when forces on an object are balanced the speed will be unchanged. **Know that** atmospheric pressure decreases with height due to the weight of the air above decreasing. **Know that** pressure in liquids increases with depth. **Know that** pressure in fluids acts in all directions. **Know that** a moment is the turning effect of a force. **Know that** moments are calculated by multiplying the force by the perpendicular distance. Know that this relationship can be represented by the formula below: Moment = force x perpendicular distance from pivot **Know that** if the clockwise moment is equal to the anticlockwise moment, then the system is in equilibrium **Know that** a lever can be used to multiply forces. **Know that** a simple machine, such a lever or pully, provides a greater force at the expense of smaller movement. **Know that** in a simple machine, the product of force x displacement remains unchanged.	**Know how** to calculate the speed of an object from a distance-time graph. **Know how** to calculate the relative motion of objects moving towards and away from each other. **Know how** to calculate weight using the formula below; weight = mass x gravitational field strength **Know how** to describe ways in which drag forces can be increased or decreased. **Know how** to calculate moments and describe the subsequent motion if the system is not in equilibrium. **Know how** to calculate the work done using the formula below: work done = force x distance	Model Rotate Clockwise Anticlockwise Tier 3: Anomaly Exert Relative motion Displace Displacement Upthrust Drag Friction Streamlined Pressure Fluids Inflate Depth Atmosphere Implode Turning force Moment Pivot Fulcrum Lever Effort Load Equilibrium Conservation Work Machine

	Chemical reactions	**Know that** an atom is the simplest particle that exists. **Know that** an element is made up of the same type of atoms. **Know that** molecules are two or more atoms chemically bonded together. **Know that** a compound is two or more different types of atoms bonded together **Know that** mixtures are made up out of different substances not chemically bonded to each other. **Know that** John Dalton's atomic theory stated the following: a) that all matter is made up of tiny particles, b) In chemical reactions atoms rearrange to make a new substance. **Know that** Dalton's theory stated that atoms were tiny indestructible spheres with no empty space. **Know that** the modern version of the atom contains protons and neutrons in the nucleus, with electrons orbiting the nucleus on shells. **Know that** non-metal elements are found on the right-hand side of the periodic table and metal elements are found on the left. **Know that** the rows in the periodic table are called periods and the columns are called groups. **Know that** physical changes are reversible, and no new substances are formed. **Know that** chemical changes are irreversible and new substances are formed. **Know that** alkali metals react with water, and the reactivity of the alkali metals increase as you move down group 1. **Know that** metals can react with oxygen to form metal oxides and that the appearance of metal oxides are different to the appearance of the metal. **Know that** oxidation is a gain of oxygen and reduction is the loss of oxygen. **Know that** combustion is a type of oxidation reaction as elements combine with oxygen **Know that** fuel, heat, and oxygen are needed for combustion to occur.	**Know how to** write the chemical symbols of elements, with the first letter always being a capital letter and the second letter as a lower-case letter. **Know how to** write chemical formulae for simple molecules and compounds. **Know how to** balance symbol equations. **Know how to** identify trends in reactivity of alkali metals. **Know how to** determine anomalies from data. **Know how to** calculate mean averages from data, removing anomalies from the calculation. **Know how to** draw a line graph using mean averages calculated to draw a line of best fit. **Know how to** infer data from a line graph by extrapolating data. **Know how to** identify trends in data to draw conclusions. **Know how to** evaluate data for reliability.	Tier 2 conservation properties ratio trends extinguish greenhouse reversible irreversible Tier 3 matter atoms elements compounds chemical formula physical properties chemical properties reactants products combustion Oxidation Reduction Activation energy Exothermic endothermic pollutants global warming climate change effervescence reactive

		Know that carbon dioxide and water are produced in complete combustion of fuel **Know that** carbon monoxide, carbon and water are produced by incomplete combustion of fuel **Know that** atoms are not created or destroyed in a chemical reaction so the mass of the products in a reaction remains the same as the mass of the reactants. **Know that** metals react with oxygen to form metal oxides **Know that** metals react with water to form metal hydroxides and hydrogen **Know that** exothermic reactions transfer thermal energy to the surroundings and endothermic reactions take in thermal energy from the surroundings. **Know that** every reaction requires bonds to be broken first before new bonds are formed. **Know that** energy must be taken in to break bonds which is an endothermic reaction. **Know that** energy is given out when bonds are formed which is an exothermic reaction. **Know that** combustion and other human activity such as farming of cattle leads to the production of greenhouses gases. **Know that** sulfur is an impurity found in fossil fuels, which combusts to form sulfur dioxide, which dissolves in water vapour to form acid rain. **Know that** acid rain causes limestone to weather, stops fish eggs from hatching and makes soil too acidic for some crops to grow. **Know that** greenhouse gases absorb thermal energy radiated from earth and re-radiates heat back into the atmosphere.		
	Electricity, magnetism and energy transfer	**Know that** conduction is the transfer of energy through a material by the movement of its particles **Know that** metals are good conductors of thermal energy **Know that** non-metals are poor conductors of thermal energy **Know that** insulators are poor conductors of thermal energy **Know that** a vacuum is a space totally empty of matter **Know that** stationary air is a good thermal insulator **Know that** convection is the transfer of thermal energy in fluids due to density changes	**Know how to** compare the rates of conduction in different conductors **Know how to** use convection currents to ensure circulation of fresh air in a system **Know how to** calculate thermal energy changes using specific heat capacity **Know how to** explain energy transfers and pathways in a variety of situations **Know how to** use Sankey diagrams to show energy transfers and pathways **Know how to** calculate the efficiency of various energy transfers	Tier 2: Vacuum Emit Absorbed Medium Appliance Rate Attract Repel Resistance Tier 3: Conduction

		Know that more dense fluid will sink, and less dense fluid will rise to the top **Know that** radiation is the transfer of energy via wave or particle **Know that** density is the amount of mass per unit volume **Know that** infrared is the transfer of thermal energy via a radiation pathway **Know that** infrared cameras can be used to produce maps of temperature. **Know that** infrared is used in night vision equipment **Know that** black dull objects are good absorbers and emitters of infrared radiation. **Know that** white or shiny objects are poor absorbers of infrared radiation **Know that** the Greek letter delta is used to represent 'the change in' **Know that** energy can neither be created or destroyed, only transferred between stores via pathways **Know that** dissipated energy is energy that ends up in a non-useful store **Know that** the efficiency of an energy transfer is the ratio between the input energy and the usefully transferred useful energy **Know that** appliances with a lower efficiency rating will cost more to run **Know that** electricity meters measure energy transferred in kilowatt-hours **Know that** power can be calculated by power = energy/time **Know that** power is the rate of transfer of energy **Know that** everything is made of atoms **Know that** atoms are made of protons, neutrons and electrons **Know that** protons and neutrons are in the nucleus **Know that** electrons are in shells around the nucleus **Know that** the atom has no overall charge as it has equal number of positive and negative charges **Know that** a charged object has an electrostatic field around it **Know that** if a charged object is placed in an electrostatic field than it will experience a force acting upon it **Know that** friction between two insulating materials results in a transfer of electrons resulting in the two items having an equal and opposite charge **Know that** current is the rate of flow of charge	**Know how to** use meter readings to calculate how much energy needs to be paid for **Know how to** graphically compare the resistance of two wires **Know how to** apply and carry out calculations using Ohms law, V = I x R **Know how to** experimentally plot a magnetic field	Convection Density Radiation Delta Dissipation Efficiency Current Attract Repel Magnetic field Induced magnet

		Know that parallel circuits contain branches but series circuits do not **Know that** current is measured in series with a component by an ammeter **Know that** current splits and comes together at junctions in a parallel circuit. **Know that** current is constant in parallel circuits **Know that** potential difference is a measure of the energy transferred by the charge **Know that** potential difference is measured in parallel to a component using a voltmeter **Know that** potential difference is shared across components in a series circuit **Know that** potential difference is the same across all components in a parallel circuit **Know that** resistance in electrical conductors is due to collisions between the electrons and the ions in the lattice. **Know that** the resistance of an electrical conductor will be dependent upon the material it is made from and it's temperature **Know that** the resistance of a conductive wire also depends on its length and thickness **Know that** current flowing against an electrical resistance in an electrical appliance causes the device to heat up **Know that** materials that have very high resistances that stops current flowing are called insulators **Know that** we can calculate voltage using current and resistance **Know that** opposite poles on a magnet attract **Know that** like poles on a magnet repel **Know that** not all metals are magnetic **Know that** a magnetic field is an area around a magnet where magnetic materials experience a force **Know that** an induced magnet has become magnetised by being placed in a magnetic field **Know that** the magnetic field is strongest at the poles **Know that** the Earth's magnetic field comes from the spinning molten Iron core **Know that** the geographical north pole of the Earth is the magnetic south pole and vice versa **Know that** the north end of a compass points to the geographical north pole as it is attracted to the magnetic south pole of the Earth **Know that** a current flowing through a wire produces a magnetic field		

		Know that the magnetic effect of a current flowing through a wire can be increased by arranging the wire into a coil around an iron core **Know that** a coil of wire with a current flowing through it is called a solenoid **Know that** an increase in the number of coils, or in the current flowing will increase the strength of a solenoid.		
	Metal reactions	**Know that** corrosion refers to reaction with oxygen that occurs on the surface of the metal **Know that** corrosion is an oxidation reaction. **Know that** oxidation is the gaining of oxygen. **Know that** rusting is the corrosion of iron and requires both water and oxygen to react with iron. **Know that** the reaction between iron, oxygen and water will form iron hydroxide as the product. **Know that** rusting can be prevented by covering the metal's surface with plastic, paint or oil. **Know that** reduction is the losing of oxygen. **Know that** some metals such as the alkali metals will react readily in water to produce a metal hydroxide and hydrogen gas **Know that** when a gas is produced, effervescence is observed. **Know that** alkali metals produce metal hydroxides that are alkali in solution. **Know that** some metals react with acids to produce a salt and hydrogen gas. **Know that** the salts produced are named depending on the acid and metal that had reacted together. **Know that** in a displacement reaction, the more reactive metal takes the place of a less reactive metal from its compound.	**Know how to** write a prediction based on scientific knowledge and understanding. **Know how to** place metals in order of reactivity by observing their reactions in water. **Know how to** write a word equation for the reaction of metals with water. **Know how to** write a balanced, symbol equation for the reaction of metals with water. **Know how to** name the salt produced from the reaction of metals with acid. **Know how to** write word and balanced, symbol equations for the reaction between metals and acids. **Know how to** predict the products in a displacement reaction by comparing the reactivities of the two metals present in the reaction. **Know how to** deduce which substance has been oxidized or reduced in a displacement reaction.	Tier 2 evaluate effervescence displace extract ore malleable Tier 3 prediction salt compound oxidation reduction native state pure

		Know that a compound is two or more different types of elements chemically bonded together. **Know that** displacement reactions can be observed by a colour change in a reaction and a formation of a solid metal. **Know that** an ore is a rock that contains a metal compound. **Know that** very unreactive metals such as gold are found native. **Know that** metals must be extracted from their ores by either heating with carbon or by electrolysis. **Know that** metals that are less reactive than carbon in the reactivity series can be extracted from its compound by both heating and carbon and electrolysis. **Know that** heating with carbon is the preferred method for extracting metals from its compound as it is cheaper. **Know that** metals that are more reactive than carbon in the reactivity series can only be extracted by electrolysis. **Know that** a pure substance only contains one type of substance. **Know that** alloys are a mixture of metals and has desirable properties than those of pure metals. **Know that** alloys have a range of melting points as it is a mixture whereas pure metals have a sharp melting point. **Know that** alloys are less malleable than pure metals as the different sized atoms disrupts the layers of atoms so the layers of metal atoms cannot slide over each other easily.		