Science KS3

Year 7 Curriculum Overview

The Marlborough Science Academy

'shaping futures'

Revised July 2022

KS3 Curriculum Knowledge Development – The Marlborough Science Faculty

Year 7 – Revised 2022

Overview

The KS3 curriculum is divided into 10 big ideas across all of the 3 science disciplines and is based on the Collins AQA KS3 Science published scheme. It is designed as a two year programme to prepare students for a 3 year KS4 GCSE syllabus. These big ideas are used to map the previous knowledge that should have been covered in KS2 and link with the key topics in the GCSE syllabus. In this way the KS3 and KS4 curricula map together to form an effective 5 year course.

The curriculum is designed to encourage students to apply and extend the new knowledge that they learn so that they are able to more effectively able to apply this to contextualised situations. Alongside the knowledge, key scientific vocabulary, mathematical skills and practical skills are identified.

Students are formally assessed summatively and formatively during and after every topic providing a detailed understanding of an individual and cohorts, strengths and areas for improvement and of course progress.

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Year 7 Content Mapping to GCSE Topics

Big Idea	Sub Topics	AQA GCSE Syllabus Link
Forces	Speed and Gravity	Physics - Forces an Introduction – Paper 2 Physics - Forces and Motion – Paper 2
Electromagnets	Voltage, Resistance and Current	Physics - Electricity and Introduction – Paper 1
Energy	Cost of Energy and Energy Transfer	Physics - Energy – Paper 1
Waves	Sound and Light	Physics - Wave and Wave Properties – Paper 1
Matter	Particle Model and Separating Mixtures	Chemistry - Bonding, Structure and Properties of Matter – Paper 1
Reactions	Metals and Non-metals and Acids and Alkalis	Chemistry - Chemical Changes –Paper 1
Earth	Earth structure and Universe	Chemistry - Chemical Changes (Extraction of Metals) – Paper 1 Physics - Space – Paper 2 (Physics only)
Organisms	Movement and Cells	Biology - Cell Biology – Paper 1 Biology - Organisation – Paper 1
Ecosystems	Interdependence and Plant Reproduction	Biology - Inheritance, Variation and Evolution – Paper 2 Biology - Ecology – Paper 2
Genes	Variation and Human Reproduction	Biology - Inheritance, Variation and Evolution – Paper 2

Adapted from Harper Collins

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Big Idea - Forces

Potential Previous Knowledge from KS2

Movement

- Speed is a measurement of how quickly distance is being covered
- The speed of an object can be calculated by dividing the distance travelled by the time taken
- Speed is measured in units such as metres per second (m/s) and kilometres per hours (km/h)

Force

- Forces can be pushes, pulls or turning forces. They can be 'contact' forces or 'non- contact forces.
- Force arrows drawn to scale show the size and direction of forces
- A newton-meter allows us to measure the size of a force
- Force is measured in Newtons

Gravity

- Gravity is a non-contact force
- Large objects, like planets, produce strong gravitational forces on other objects.
- Gravity pulls objects towards the Earth
- Gravity keeps the Moon in orbit around the Earth and the Earth in orbit around the Sun.
- Gravity affects objects such as people and rockets that are exploring space

Speed

Knowledge Development	**R**	**A**	**G**
If the overall, resultant force on an object is non-zero, its motion changes and it slows down, speeds up or changes direction.			
Skill Development			
Use the formula: speed = distance (m)/time (s) or distance-time graphs, to calculate speed.			
Key Facts			
A straight line on a distance-time graph shows constant speed, a curving line shows acceleration.			
The higher the speed of an object, the shorter the time taken for a journey.			

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Keywords			
Speed: How much distance is covered in how much time.			
Average speed: The overall distance travelled divided by overall time for a journey.			
Relative motion: Different observers judge speeds differently if they are in motion too, so an object's speed is relative to the observer's speed.			
Acceleration: How quickly speed increases or decreases.			
Application of Knowledge (Grade 2/3)			
Illustrate a journey with changing speed on a distance-time graph, and label changes in motion.			
Describe how the speed of an object varies when measured by observers who are not moving, or moving relative to the object.			
Extension of Knowledge (Grade 3/4)			
Suggest how the motion of two objects moving at different speeds in the same direction would appear to the other.			
Predict changes in an object's speed when the forces on it change.			

Gravity

Knowledge Development	**R**	**A**	**G**
Mass and weight are different but related. Mass is a property of the object; weight depends upon mass but also on gravitational field strength.			
Every object exerts a gravitational force on every other object. The force increases with mass and decreases with distance. Gravity holds planets and moons in orbit around larger bodies.			
Skill Development			
Use the formula: weight (N) = mass (kg) x gravitational field strength (N/kg).			
Key Fact: g on Earth = 10 N/kg. On the moon it is 1.6 N/kg.			

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Keywords			
Weight: The force of gravity on an object (N).			
Non-contact force: One that acts without direct contact.			
Mass: The amount of stuff in an object (kg).			
Gravitational field strength, g: The force from gravity on 1 kg (N/kg).			
Field: The area where other objects feel a gravitational force.			
Application of Knowledge (Grade 2/3)			
Explain unfamiliar observations where weight changes.			
Draw a force diagram for a problem involving gravity.			
Deduce how gravity varies for different masses and distances.			
Compare your weight on Earth with your weight on different planets using the formula.			
Extension of Knowledge (Grade 3/4)			
Compare and contrast gravity with other forces.			
Draw conclusions from data about orbits, based on how gravity varies with mass and distance.			
Suggest implications of how gravity varies for a space mission.			

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Big Idea Electromagnets

Potential Previous Knowledge from KS2

Components in a circuit

- All materials are good electrical conductors. Materials that do not allow electricity to pass through them are called insulators.
- A simple electrical circuit consists of components such as cells, wires, bulbs, switches and buzzers
- Recognised symbols can be used to represent a simple circuit in a diagram

Making current flow

- Components only work if the circuit is complete and contains a power supply. Then an electric current can flow.
- When the switch is open (off) the circuit is not complete and none of the components will work.

Changing the voltage

- The brightness of a lamp or the loudness of a buzzer is related to the number and voltage of cells used in the circuit
- If more cells are added the brightness and the volume will increase.

Voltage and resistance

Knowledge Development	**R**	**A**	**G**
We can model voltage as an electrical push from the battery, or the amount of energy per unit of charge transferred through the electrical pathway.			
In a series circuit, voltage is shared between each component. In a parallel circuit, voltage is the same across each loop.			
Components with resistance reduce the current flowing and shift energy to the surroundings.			
Skill Development			
Calculate resistance using the formula: resistance (Ω) = potential difference (V) . current (A).			

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Keywords			
Potential difference (voltage): The amount of energy shifted from the battery to the moving charge, or from the charge to circuit components, in volts (V).			
Resistance: A property of a component, making it difficult for charge to pass through, in ohms (Ω).			
Electrical conductor: A material that allows current to flow through it easily, and has a low resistance.			
Electrical insulator: A material that does not allow current to flow easily, and has a high resistance.			
Application of Knowledge (Grade 2/3)			
Draw a circuit diagram to show how voltage can be measured in a simple circuit.			
Use the idea of energy to explain how voltage and resistance affect the way components work.			
Given a table of voltage against current. Use the ratio of voltage to current to determine the resistance.			
Use an analogy like water in pipes to explain why part of a circuit has higher resistance.			
Extension of Knowledge (Grade 3/4)			
Predict the effect of changing the rating of a battery or a bulb on other components in a series or parallel circuit.			
Justify the sizes of voltages in a circuit, using arguments based on energy.			
Draw conclusions about safety risks, from data on voltage, resistance and current.			

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Current

Knowledge Development	**R**	**A**	**G**
Current is a movement of electrons and is the same everywhere in a series circuit. Current divides between loops in a parallel circuit, combines when loops meet, lights up bulbs and makes components work.			
Around a charged object, the electric field affects other charged objects, causing them to be attracted or repelled. The field strength decreases with distance.			
Key Facts			
Two similarly charged objects repel, two differently charged objects attract.			
Keywords			
Negatively charged: An object that has gained electrons as a result of the charging process.			
Positively charged: An object that has lost electrons as a result of the charging process.			
Electrons: Tiny particles which are part of atoms and carry a negative charge.			
Charged up: When materials are rubbed together, electrons move from one surface to the other.			
Electrostatic force: Non-contact force between two charged objects.			
Current: Flow of electric charge, in amperes (A).			
In series: If components in a circuit are on the same loop.			
In parallel: If some components are on separate loops.			
Field: The area where other objects feel a gravitational force.			
Application of Knowledge (Grade 2/3)			
Describe how current changes in series and parallel circuits when components are changed.			
Turn circuit diagrams into real series and parallel circuits, and vice versa.			
Describe what happens when charged objects are placed near to each other or touching.			
Use a sketch to describe how an object charged positively or negatively became charged up.			

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Extension of Knowledge (Grade 3/4)			
Compare the advantages of series and parallel circuits for particular uses.			
Evaluate a model of current as electrons moving from the negative to the positive terminal of a battery, through the circuit.			
Suggest ways to reduce the risk of getting electrostatic shocks.			

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Big Idea Energy

Potential Previous Knowledge from KS2

Materials may change

- Changes such as burning result in new materials
- Some materials change state when they are heated or cooled

Living things need nutrition

- Plants require light and water for growth
- Animals need nutrition, and they cannot make their own food; they get nutrition from what they eat
- Food chains identify producers, predators and prey

Objects can move in various ways

- Unsupported objects fall towards the Earth due to gravity
- Air resistance, water resistance and friction act between moving surfaces

Light and sound travel as waves

- We see things because light travels from a light source to our eyes or from a light source to objects and then to our eyes
- Sounds are made because of something vibrating; these vibrations travel through the air to our ears

Electricity can do useful work

- Many common appliances run on electricity
- Components in circuits can be made to function in different ways, for example lamps can be made brighter and buzzers can be made louder

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Energy costs

Knowledge Development	**R**	**A**	**G**
We pay for our domestic electricity usage based on the amount of energy transferred.			
Electricity is generated by a combination of resources which each have advantages and disadvantages.			
Calculate the cost of home energy usage, using the formula: cost = power (kW) x time (hours) x price (per kWh).			
Key Facts			
Food labels list the energy content of food in kilojoules (kJ).			

Keywords			
Power: How quickly energy is transferred by a device (watts).			
Energy resource: Something with stored energy that can be released in a useful way.			
Non-renewable: An energy resource that cannot be replaced and will be used up.			
Renewable: An energy resource that can be replaced and will not run out. Examples are solar, wind, waves, geothermal and biomass.			
Fossil fuels: Non-renewable energy resources formed from the remains of ancient plants or animals. Examples are coal, crude oil and natural gas.			
Application of Knowledge (Grade 2/3)			
Compare the amounts of energy transferred by different foods and activities.			
Compare the energy usage and cost of running different home devices.			
Explain the advantages and disadvantages of different energy resources.			
Represent the energy transfers from a renewable or non-renewable resource to an electrical device in the home.			

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Extension of Knowledge (Grade 3/4)			
Evaluate the social, economic and environmental consequences of using a resource to generate electricity, from data.			
Suggest actions a government or communities could take in response to rising energy demand.			
Suggest ways to reduce costs, by examining data on a home energy bill.			

Energy transfer

Knowledge Development	**R**	**A**	**G**
We can describe how jobs get done using an energy model where energy is transferred from one store at the start to another at the end.			
Key Fact			
When energy is transferred, the total is conserved, but some energy is dissipated, reducing the useful energy.			
Keywords			
Thermal energy store: Filled when an object is warmed up.			
Chemical energy store: Emptied during chemical reactions when energy is transferred to surroundings.			
Kinetic energy store: Filled when an object speeds up.			
Gravitational potential energy store: Filled when an object is raised.			
Elastic energy store: Filled when a material is stretched or compressed.			
Dissipated: Become spread out wastefully.			
Application of Knowledge (Grade 2/3)			
Describe how the energy of an object depends on its speed, temperature, height or whether it is stretched or compressed.			
Show how energy is transferred between energy stores in a range of real-life examples.			
Calculate the useful energy and the amount dissipated, given values of input and output energy.			
Explain how energy is dissipated in a range of situations.			

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Extension of Knowledge (Grade 3/4)			
Compare the percentages of energy wasted by renewable energy sources.			
Explain why processes such as swinging pendulums or bouncing balls cannot go on forever, in terms of energy.			
Evaluate analogies and explanations for the transfer of energy.			

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Big Idea Waves

Potential Previous Knowledge from KS2

Different types of sound

- Sounds are possible when vibrations occur
- We can change the vibrations of a sound by giving them more energy. The stronger the vibrations the louder the sound.
- Some sounds have a high pitch, like a whistle or siren. Others have a low pitch, like the rumble of thunder. When we change the pitch we change how rapidly the object vibrates.

How sounds behave

- We hear sounds because of the vibrations travel through a material, like air, to the ear.
- Sounds may be reflected by hard materials and absorbed by soft materials
- Sounds get fainter as they travel further from the source.

How light behaves

- Light appears to travel in straight lines
- Shadows have the same shape as the objects that made them because of light travelling in straight lines

How we see things

- We see objects because they emit or reflect light into our eyes
- We can see objects that don't emit their own light because they reflect light from other sources into our eyes
- We can explain this using the idea that light travels in straight lines

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Sound

Knowledge Development	**R**	**A**	**G**
Sound consists of vibrations which travel as a longitudinal wave through substances. The denser the medium, the faster sound travels.			
The greater the amplitude of the waveform, the louder the sound. The greater the frequency (and therefore the shorter the wavelength), the higher the pitch.			
Key Facts			
Sound does not travel through a vacuum.			
The speed of sound in air is 330 m/s, a million times slower than light.			
Keywords			
Vibration: A back and forth motion that repeats.			
Longitudinal wave: Where the direction of vibration is the same as that of the wave.			
Volume: How loud or quiet a sound is, in decibels (dB).			
Pitch: How low or high a sound is. A low (high) pitch sound has a low (high) frequency.			
Amplitude: The maximum amount of vibration, measured from the middle position of the wave, in metres.			
Wavelength: Distance between two corresponding points on a wave, in metres.			
Frequency: The number of waves produced in one second, in hertz.			
Vacuum: A space with no particles of matter in it.			
Oscilloscope: Device able to view patterns of sound waves that have been turned into electrical signals.			
Absorption: When energy is transferred from sound to a material.			
Auditory range: The lowest and highest frequencies that a type of animal can hear.			
Echo: Reflection of sound waves from a surface back to the listener.			

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Application of Knowledge (Grade 2/3)			
Explain observations where sound is reflected, transmitted or absorbed by different media.			
Explain observations of how sound travels using the idea of a longitudinal wave.			
Describe the amplitude and frequency of a wave from a diagram or oscilloscope picture.			
Use drawings of waves to describe how sound waves change with volume or pitch.			
Extension of Knowledge (Grade 3/4)			
Suggest the effects of particular ear problems on a person's hearing.			
Evaluate the data behind a claim for a sound creation or blocking device, using the properties of sound waves.			
Use diagrams to compare the waveforms a musical instrument makes when playing different pitches or volumes.			

Light

Knowledge	**R**	**A**	**G**
When a light ray meets a different medium, some of it is absorbed and some reflected. For a mirror, the angle of incidence equals the angle of reflection. The ray model can describe the formation of an image in a mirror and how objects appear different colours.			
When light enters a denser medium it bends towards the normal; when it enters a less dense medium it bends away from the normal.			
Refraction through lenses and prisms can be described using a ray diagram as a model.			
Skill Development			
Construct ray diagrams to show how light reflects off mirrors, forms images and refracts.			

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Key Facts			
Light travels at 300 million metres per second in a vacuum.			
Different colours of light have different frequencies.			
Keywords			
Incident ray: The incoming ray.			
Reflected ray: The outgoing ray.			
Normal line: From which angles are measured, at right angles to the surface.			
Angle of reflection: Between the normal and reflected ray.			
Angle of incidence: Between the normal and incident ray.			
Refraction: Change in the direction of light going from one material into another.			
Absorption: When energy is transferred from light to a material.			
Scattering: When light bounces off an object in all directions.			
Transparent: A material that allows all light to pass through it.			
Translucent: A material that allows some light to pass through it.			
Opaque: A material that allows no light to pass through it.			
Convex lens: A lens that is thicker in the middle which bends light rays towards each other.			
Concave lens: A lens that is thinner in the middle which spreads out light rays.			
Retina: Layer at the back of the eye with light detecting cells and where image is formed.			
Application of Knowledge (Grades 2/3)			
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.			
Describe how lenses may be used to correct vision.			

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Extension of Knowledge (Grades 3/4)			
Use a ray diagram to predict how an image will change in different situations.			
Predict whether light will reflect, refract or scatter when it hits the surface of a given material.			
Use ray diagrams to explain how a device with multiple mirrors works.			

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Big Idea of Matter

Potential Previous Knowledge from KS2

States of matter

- Solid liquid and gas are the three main states of matter and most of these materials can be grouped into one of these
- When materials are heated or cooled, they may change from one state to another. Water freezes to become ice at 0OC and boils to become a gas at 100OC.
- In the water cycle, water evaporates to become a gas, condenses in clouds and forms water droplets. It falls back to Earth as precipitation.

Reversible changes

- Physical changes, such as changes of state, are reversible
- Dissolving and mixing are also reversible changes – salt can be added to water, which can be evaporated to recover the salt.

Dissolving and solubility

- Some material – such as salt and sugar – can dissolve in water. We say that these are soluble and the mixture forms a solution
- Other materials – such as sand – do not dissolve in water. We say that these are insoluble

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Particle model

Knowledge	R	A	G
Properties of solids, liquids and gases can be described in terms of particles in motion but with differences in the arrangement and movement of these same particles: closely spaced and vibrating (solid), in random motion but in contact (liquid), or in random motion and widely spaced (gas).			
Observations where substances change temperature or state can be described in terms of particles gaining or losing energy.			
Key Fact			
A substance is a solid below its melting point, a liquid above it, and a gas above its boiling point.			
Keywords			
Particle: A very tiny object such as an atom or molecule, too small to be seen with a microscope.			
Particle model: A way to think about how substances behave in terms of small, moving particles.			
Diffusion: The process by which particles in liquids or gases spread out through random movement from a region where there are many particles to one where there are fewer.			
Gas pressure: Caused by collisions of particles with the walls of a container.			
Density: How much matter there is in a particular volume, or how close the particles are.			
Evaporate: Change from liquid to gas at the surface of a liquid, at any temperature.			
Boil: Change from liquid to a gas of all the liquid when the temperature reaches boiling point.			
Condense: Change of state from gas to liquid when the temperature drops to the boiling point.			
Melt: Change from solid to liquid when the temperature rises to the melting point.			
Freeze: Change from liquid to a solid when the temperature drops to the melting point.			
Sublime: Change from a solid directly into a gas.			

Adapted from Harper Collins

Application of Knowledge Grade (2/3)			
Explain unfamiliar observations about gas pressure in terms of particles.			
Explain the properties of solids, liquids and gases based on the arrangement and movement of their particles.			
Explain changes in states in terms of changes to the energy of particles.			
Draw before and after diagrams of particles to explain observations about changes of state, gas pressure and diffusion.			
Extension of Knowledge Grade (3/4)			
Argue for how to classify substances which behave unusually as solids, liquids or gases.			
Evaluate observations that provide evidence for the existence of particles.			
Make predictions about what will happen during unfamiliar physical processes, in terms of particles and their energy.			

Separating mixtures

Knowledge	**R**	**A**	**G**
A pure substance consists of only one type of element or compound and has a fixed melting and boiling point. Mixtures may be separated due to differences in their physical properties.			
The method chosen to separate a mixture depends on which physical properties of the individual substances are different.			
Key Skill			
Use techniques to separate mixtures.			
Key Facts			
Air, fruit juice, sea water and milk are mixtures.			
Liquids have different boiling points.			

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Keywords			
Solvent: A substance, normally a liquid, that dissolves another substance.			
Solute: A substance that can dissolve in a liquid.			
Dissolve: When a solute mixes completely with a solvent.			
Solution: Mixture formed when a solvent dissolves a solute.			
Soluble (insoluble): Property of a substance that will (will not) dissolve in a liquid.			
Solubility: Maximum mass of solute that dissolves in a certain volume of solvent.			
Pure substance: Single type of material with nothing mixed in.			
Mixture: Two or more pure substances mixed together, whose properties are different to the individual substances.			
Filtration: Separating substances using a filter to produce a filtrate (solution) and residue.			
Distillation: Separating substances by boiling and condensing liquids.			
Evaporation: A way to separate a solid dissolved in a liquid by the liquid turning into a gas.			
Chromatography: Used to separate different coloured substances.			
Application of Knowledge Grade (2/3)			
Explain how substances dissolve using the particle model.			
Use the solubility curve of a solute to explain observations about solutions.			
Use evidence from chromatography to identify unknown substances in mixtures.			
Choose the most suitable technique to separate out a mixture of substances.			
Extension of Knowledge Grade (3/4)			
Analyse and interpret solubility curves.			
Suggest a combination of methods to separate a complex mixture and justify the choices.			
Evaluate the evidence for identifying a unknown substance using separating techniques.			

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Big Idea Reactions

Potential Previous Knowledge from KS2

Metals

- Materials can be grouped based on their properties such as hardness, solubility, conductivity and response to magnets.
- Many useful materials, including plastics, wood and metals, have uses that exploit their properties
- Metals are shiny solids that we use for many applications, such as making cars, computers, bridges and so on
- Metals are good electrical conductors, which is why we use them to make wires for circuits

Chemical Changes

- Changes can occur when materials are mixed. Some of these changes are non-reversible – these are called chemical changes, or chemical reactions
- The new materials made in chemical reactions can be useful

Burning

- Burning materials (such as wood, wax and gas) produces new materials
- Burning is a chemical change. Burning is also known as combustion.

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Metals & non-metals

Knowledge	**R**	**A**	**G**
Metals and non-metals react with oxygen to form oxides which are either bases or acids.			
Metals can be arranged as a reactivity series in order of how readily they react with other substances.			
Some metals react with acids to produce salts and hydrogen.			
Key Facts			
Iron, nickel and cobalt are magnetic elements.			
Mercury is a metal that is liquid at room temperature.			
Bromine is a non-metal that is liquid at room temperature.			
Keywords			
Metals: Shiny, good conductors of electricity and heat, malleable and ductile, and usually solid at room temperature.			
Non-metals: Dull, poor conductors of electricity and heat, brittle and usually solid or gaseous at room temperature.			
Displacement: Reaction where a more reactive metal takes the place of a less reactive metal in a compound.			
Oxidation: Reaction in which a substance combines with oxygen.			
Reactivity: The tendency of a substance to undergo a chemical reaction.			
Application of Knowledge Grade (2/3)			
Describe an oxidation, displacement, or metal-acid reaction with a word equation.			
Use particle diagrams to represent oxidation, displacement and metal-acid reactions.			
Identify an unknown element from its physical and chemical properties.			
Place an unfamiliar metal into the reactivity series based on information about its reactions.			

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Extension of Knowledge Grade (3/4)			
Deduce the physical or chemical changes a metal has undergone from its appearance.			
Justify the use of specific metals and non-metals for different applications, using data provided.			
Deduce a rule from data about which reactions will occur or not, based on the reactivity series.			

Acids & alkalis

Knowledge	**R**	**A**	**G**
The pH of a solution depends on the strength of the acid: strong acids have lower pH values than weak acids.			
Mixing an acid and alkali produces a chemical reaction, neutralisation, forming a chemical called a salt and water.			
Key Facts			
Acids have a pH below 7, neutral solutions have a pH of 7, alkalis have a pH above 7.			
Acids and alkalis can be corrosive or irritant and require safe handling.			
Hydrochloric, sulfuric and nitric acid are strong acids.			
Acetic and citric acid are weak acids.			
Keywords			
pH: Scale of acidity and alkalinity from 0 to 14.			
Indicators: Substances used to identify whether unknown solutions are acidic or alkaline.			
Base: A substance that neutralises an acid –those that dissolve in water are called alkalis.			
Concentration: A measure of the number of particles in a given volume.			

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Application of Knowledge Grade (2/3)			
Identify the best indicator to distinguish between solutions of different pH, using data provided.			
Use data and observations to determine the pH of a solution and explain what this shows.			
Explain how neutralisation reactions are used in a range of situations.			
Describe a method for how to make a neutral solution from an acid and alkali.			
Extension of Knowledge Grade (3/4)			
Given the names of an acid and an alkali, work out the name of the salt produced when they react.			
Deduce the hazards of different alkalis and acids using data about their concentration and pH.			
Estimate the pH of an acid based on information from reactions.			

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Big Idea Earth

Potential Previous Knowledge from KS2

Rocks have properties that can be studied

- Rocks can be grouped together based on their appearance such as whether they have grains or crystals
- Different kinds of rock can be compared and grouped together on the basis of their physical properties

Formation of rocks

- Fossils are formed when organisms are trapped within the layers of sedimentary rock
- Soils are made from rocks and organic matter

The Earth in space

- The Sun, the Earth and the Moon are approximately spherical objects
- The Sun is our nearest star but there is an unimaginable number of other stars

The Earth and other objects in space move

- The movement of the Earth and other planets in the solar system, can be described relative to the Sun
- The Earths spinning motion explains day and night and the apparent movement of the Sun across the sky
- The movement of the Moon can be described relative to the Earth

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Earth structure

Knowledge	**R**	**A**	**G**
Sedimentary, igneous and metamorphic rocks can be inter converted over millions of years through weathering and erosion, heat and pressure, and melting and cooling.			
Key Fact			
The three rock layers inside Earth are the crust, the mantle and the core.			
Keywords			
Rock cycle: Sequence of processes where rocks change from one type to another.			
Weathering: The wearing down of rock by physical, chemical or biological processes.			
Erosion: Movement of rock by water, ice or wind (transportation).			
Minerals: Chemicals that rocks are made from.			
Sedimentary rocks: Formed from layers of sediment, and which can contain fossils. Examples are limestone, chalk and sandstone.			
Igneous rocks: Formed from cooled magma, with minerals arranged in crystals. Examples are granite, basalt and obsidian.			
Metamorphic rocks: Formed from existing rocks exposed to heat and pressure over a long time. Examples are marble, slate and schist.			
Strata: Layers of sedimentary rock.			
Application of Knowledge Grade (2/3)			
Explain why a rock has a particular property based on how it was formed.			
Identify the causes of weathering and erosion and describe how they occur.			
Construct a labelled diagram to identify the processes of the rock cycle.			
Extension of Knowledge Grade (3/4)			
Identify circumstances that indicate fast processes of change on Earth and those that indicate slower processes.			
Predict planetary conditions from descriptions of rocks on other planets.			
Describe similarities and differences between the rock cycle and everyday physical and chemical processes.			
Suggest how ceramics might be similar to some types of rock.			

Adapted from Harper Collins

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Universe

Knowledge	**R**	**A**	**G**
The solar system can be modelled as planets rotating on tilted axes while orbiting the Sun, moons orbiting planets and sunlight spreading out and being reflected. This explains day and year length, seasons and the visibility of objects from Earth.			
Our solar system is a tiny part of a galaxy, one of many billions in the Universe. Light takes minutes to reach Earth from the Sun, four years from our nearest star and billions of years from other galaxies.			
Keywords			
Galaxy: Collection of stars held together by gravity. Our galaxy is called the Milky Way.			
Light year: The distance light travels in a year (over 9 million, million kilometres).			
Stars: Bodies which give out light, and which may have a solar system of planets.			
Orbit: Path taken by a satellite, planet or star moving around a larger body. Earth completes one orbit of the Sun every year.			
Exoplanet: Planet that orbits a star outside our solar system.			
Application of Knowledge Grade (2/3)			
Describe the appearance of planets or moons from diagrams showing their position in relation to the Earth and Sun.			
Explain why places on the Earth experience different daylight hours and amounts of sunlight during the year.			
Describe how space exploration and observations of stars are affected by the scale of the universe.			
Explain the choice of particular units for measuring distance.			

Extension of Knowledge Grade (3/4)			
Predict patterns in day length, the Sun's intensity or an object's shadow at different latitudes.			

Adapted from Harper Collins

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Make deductions from observation data of planets, stars and galaxies.			
Compare explanations from different periods in history about the motion of objects and structure of the Universe.			

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Big Idea Organisms

Potential Previous Knowledge from KS2

Movement

- Humans and some other have a skeleton to support and protect them
- Animals with a backbone are called vertebrates

Body Systems

- We can think of the body as being made up of different systems
- Each system has a specific purpose in the body
- We have a circulatory system that pumps blood around, a skeletal system that supports us and a digestive system that provides energy from the food that we eat.

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Movement

Knowledge	**R**	**A**	**G**
The parts of the human skeleton work as a system for support, protection, movement and the production of new blood cells.			
Antagonistic pairs of muscles create movement when one contracts and the other relaxes.			
Keywords			
Joints: Places where bones meet.			
Bone marrow: Tissue found inside some bones where new blood cells are made.			
Ligaments: Connect bones in joints.			
Tendons: Connect muscles to bones.			
Cartilage: Smooth tissue found at the end of bones, which reduces friction between them.			
Antagonistic muscle pair: Muscles working in unison to create movement.			
Application of Knowledge Grade (2/3)			
Explain how a physical property of part of the skeleton relates to its function.			
Explain why some organs contain muscle tissue.			
Explain how antagonistic muscles produce movement around a joint.			
Use a diagram to predict the result of a muscle contraction or relaxation.			
Extension of Knowledge Grade (3/4)			
Predict the consequences of damage to a joint, bone or muscle.			
Suggest factors that affect the force exerted by different muscles.			
Consider the benefits and risks of a technology for improving human movement.			

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Cells

Knowledge	**R**	**A**	**G**
Multicellular organisms are composed of cells which are organised into tissues, organs and systems to carry out life processes.			
There are many types of cell. Each has a different structure or feature so it can do a specific job.			
Key Skill			
Use a light microscope to observe and draw cells.			
Key Facts			
Both plant and animal cells have a cell membrane, nucleus, cytoplasm and mitochondria.			
Plant cells also have a cell wall, chloroplasts and usually a permanent vacuole.			
Keywords			
Cell: The unit of a living organism, contains parts to carry out life processes.			
Uni-cellular: Living things made up of one cell.			
Multi-cellular: Living things made up of many types of cell.			
Tissue: Group of cells of one type.			
Organ: Group of different tissues working together to carry out a job.			
Diffusion: One way for substances to move into and out of cells.			
Structural adaptations: Special features to help a cell carry out its functions.			
Cell membrane: Surrounds the cell and controls movement of substances in and out.			
Nucleus: Contains genetic material (DNA) which controls the cell's activities.			
Vacuole: Area in a cell that contains liquid, and can be used by plants to keep the cell rigid and store substances.			
Mitochondria: Part of the cell where energy is released from food molecules.			
Cell wall: Strengthens the cell. In plant cells it is made of cellulose.			
Chloroplast: Absorbs light energy so the plant can make food.			
Cytoplasm: Jelly-like substance where most chemical processes happen.			
Immune system: Protects the body against infections.			

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Reproductive system: Produces sperm and eggs, and is where the foetus develops.			
Digestive system: Breaks down and then absorbs food molecules.			
Circulatory system: Transports substances around the body.			
Respiratory system: Replaces oxygen and removes carbon dioxide from blood.			
Muscular skeletal system: Muscles and bones working together to cause movement and support the body.			
Application of Knowledge Grade (2/3)			
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.			
Extension of Knowledge Grade (3/4)			
Make deductions about how medical treatments work based on cells, tissues, organs and systems.			
Suggest how damage to, or failure of, an organ would affect other body systems.			
Deduce general patterns about how the structure of different cells is related to their function.			
Find out how recreational drugs might affect different body systems.			

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Big Idea Ecosystem

Potential Previous Knowledge from KS2

The environment

- All living things depend on one another to survive
- A food chain shows how each living thing gets food for energy

Reproduction in plants

- The roots, stems, leaves and flowers of a plant each have a specific purpose
- Flowers enable reproduction in plants, through pollination and seed dispersal.
- Plants have evolved different ways of carrying out these processes.

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Interdependence

Knowledge	**R**	**A**	**G**
Organisms in a food web (decomposers, producers and consumers) depend on each other for nutrients. So, a change in one population leads to changes in others.			
The population of a species is affected by the number of its predators and prey, disease, pollution and competition between individuals for limited resources such as water and nutrients.			
Key Fact			
Insects are needed to pollinate food crops.			
Keywords			
Food web: Shows how food chains in an ecosystem are linked.			
Food chain: Part of a food web, starting with a producer, ending with a top predator.			
Ecosystem: The living things in a given area and their non-living environment.			
Environment: The surrounding air, water and soil where an organism lives.			
Population: Group of the same species living in an area.			
Producer: Green plant or algae that makes its own food using sunlight.			
Consumer: Animal that eats other animals or plants.			
Decomposer: Organism that breaks down dead plant and animal material so nutrients can be recycled back to the soil or water.			
Application of Knowledge Grade (2/3)			
Describe how a species' population changes as its predator or prey population changes.			
Explain effects of environmental changes and toxic materials on a species' population.			
Combine food chains to form a food web.			
Explain issues with human food supplies in terms of insect pollinators.			

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Extension of Knowledge Grade (3/4)			
Suggest what might happen when an unfamiliar species is introduced into a food web.			
Develop an argument about how toxic substances can accumulate in human food.			
Make a deduction based on data about what caused a change in the population of a species.			

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Plant reproduction

Knowledge			
Plants have adaptations to disperse seeds using wind, water or animals.			
Plants reproduce sexually to produce seeds, which are formed following fertilisation in the ovary.			
Key Facts			
Flowers contain the plant's reproductive organs.			
Pollen can be carried by the wind, pollinating insects or other animals.			
Keywords			
Pollen: Contains the plant male sex cells found on the stamens.			
Ovules: Female sex cells in plants found in the ovary.			
Pollination: Transfer of pollen from the male part of the flower to the female part of the flower on the same or another plant.			
Fertilisation: Joining of a nucleus from a male and female sex cell.			
Seed: Structure that contains the embryo of a new plant.			
Fruit: Structure that the ovary becomes after fertilisation, which contains seeds.			
Carpel: The female part of the flower, made up of the stigma where the pollen lands, style and ovary.			
Application of Knowledge Grade (2/3)			
Describe the main steps that take place when a plant reproduces successfully.			
Identify parts of the flower and link their structure to their function.			
Suggest how a plant carried out seed dispersal based on the features of its fruit or seed.			
Explain why seed dispersal is important to survival of the parent plant and its offspring.			

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Extension of Knowledge Grade (3/4)			
Describe similarities and differences between the structures of wind pollinated and insect pollinated plants.			
Suggest how plant breeders use knowledge of pollination to carry out selective breeding.			
Develop an argument why a particular plant structure increases the likelihood of successful production of offspring.			

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Big Idea Genes

Potential Previous Knowledge from KS2

Variation and Classification

- Living things are classified into broad groups according to observable characteristics, similarities and differences

Adaptations

- Animals and plants are adapted to the conditions of the habitats in which they live
- An adaptation is a way an animal's body helps it survive in its environment.

Human Reproduction and development

- The gametes in animals are the egg cell and the sperm cell
- Fertilisation happens when the nucleus of the male gamete fuses with the nucleus of a female gamete.
- Humans change throughout their lifetime, from the moment of conception to the time when they grow old.
- Some changes occur much faster than others. We change fastest during the first few months of our existence.

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Variation

Knowledge	**R**	**A**	**G**
There is variation between individuals of the same species. Some variation is inherited, some is caused by the environment and some is a combination.			
Variation between individuals is important for the survival of a species, helping it to avoid extinction in an always changing environment.			
Keywords			
Species: A group of living things that have more in common with each other than with other groups.			
Variation: The differences within and between species.			
Continuous variation: Where differences between living things can have any numerical value.			
Discontinuous variation: Where differences between living things can only be grouped into categories.			
Application of Knowledge Grade (2/3)			
Explain whether characteristics are inherited, environmental or both.			
Plot bar charts or line graphs to show discontinuous or continuous variation data.			
Explain how variation helps a particular species in a changing environment.			
Explain how characteristics of a species are adapted to particular environmental conditions.			
Extension of Knowledge Grade (3/4)			
Predict implications of a change in the environment on a population.			
Use the ideas of variation to explain why one species may adapt better than another to environmental change.			
Critique a claim that a particular characteristic is inherited or environmental.			

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Human reproduction

Knowledge	**R**	**A**	**G**
The menstrual cycle prepares the female for pregnancy and stops if the egg is fertilised by a sperm.			
The developing foetus relies on the mother to provide it with oxygen and nutrients, to remove waste and protect it against harmful substances.			
Key Facts			
The menstrual cycle lasts approximately 28 days.			
If an egg is fertilised it settles into the uterus lining.			
Keywords			
Gamete: The male gamete (sex cell) in animals is a sperm, the female an egg.			
Fertilisation: Joining of a nucleus from a male and female sex cell.			
Ovary: Organ which contains eggs.			
Testicle: Organ where sperm are produced.			
Oviduct, or fallopian tube: Carries an egg from the ovary to the uterus and is where fertilisation occurs.			
Uterus, or womb: Where a baby develops in a pregnant woman.			
Ovulation: Release of an egg cell during the menstrual cycle, which may be met by a sperm.			
Menstruation: Loss of the lining of the uterus during the menstrual cycle.			
Reproductive system: All the male and female organs involved in reproduction.			
Penis: Organ which carries sperm out of the male's body.			
Vagina: Where the penis enters the female's body and sperm is received.			
Foetus: The developing baby during pregnancy.			
Gestation: Process where the baby develops during pregnancy.			
Placenta: Organ that provides the foetus with oxygen and nutrients and removes waste substances.			
Amniotic fluid: Liquid that surrounds and protects the foetus.			
Umbilical cord: Connects the foetus to the placenta.			

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Application of Knowledge Grade (2/3)			
Explain whether substances are passed from the mother to the foetus or not.			
Use a diagram to show stages in development of a foetus from the production of sex cells to birth.			
Describe causes of low fertility in male and female reproductive systems.			
Identify key events on a diagram of the menstrual cycle.			
Extension of Knowledge Grade (3/4)			
Explain why pregnancy is more or less likely at certain stages of the menstrual cycle.			
Make deductions about how contraception and fertility treatments work.			
Predict the effect of cigarettes, alcohol or drugs on the developing foetus.			