Science KS3

Year 8 Curriculum Overview

The Marlborough Science Academy

'shaping futures'

Revised July 2022

KS3 Curriculum Knowledge Development – The Marlborough Science Faculty

Year 8 – 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 8 Content Mapping to GCSE Topics

Big Idea	Sub Topics	AQA GCSE Syllabus Link
Forces	Contact Forces and Pressure	Physics - Forces an Introduction – Paper 2 Physics - Particle Model of Matter – Paper 1
Electromagnets	Magnetism and Electromagnetism	Physics - Magnetism and Electromagnetism – Paper 2
Energy	Work and Heating and Cooling	Physics - Energy Stores and Transfers – Paper 1
Waves	Wave Effects and Wave Properties	Physics - Wave and Wave Properties – Paper 1
Matter	Periodic Table and Elements	Chemistry - Atomic Structure and Periodic Table – Paper 1
Reactions	Chemical Energy and Types of Reaction	Chemistry - Chemical Changes –Paper 1 Chemistry - Energy Changes – Paper 1
Earth	Climate and Earth Resources	Chemistry - Chemistry of the Atmosphere – Paper 2 Chemistry - Using Resources – Paper 2
Organisms	Breathing and Digestion	Biology - Cell Biology – Paper 1 Biology - Organisation – Paper 1
Ecosystems	Respiration and Photosynthesis	Biology – Bioenergetics – Paper 2
Genes	Evolution and Inheritance	Inheritance, Variation and Evolution – Paper 2

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Big Idea – Forces

Previous Knowledge from Year 7

Forces

- Forces can act in any direction, causing stretching, compression and changes in motion.
- Some types of forces require contact whereas others are non-contact forces, such as gravity

Friction and resistance

- Friction is a force that acts between moving surfaces, causing them to slow down or stop
- Air resistance is friction between air and an object moving through it
- A boat moving through water experiences water resistance

Floating and Sinking

- When an object is placed in water, weight will pull it down and an upthrust will act upwards.
- If the weight is greater than upthrust, the object will sink
- If the upthrust is equal to the weight the object will float.

Resultant forces

- There may be several forces acting on an object. To understand how they affect the motion of the object we need to consider all of them.
- If forces are acting in the same direction, we get the resultant by adding them but if they are acting in opposing directions, we subtract one from the other
- If the resultant is zero the object will have a steady speed which might be zero. If the resultant is not zero the object will speed up, slow down or change direction

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Contact forces

Knowledge Development	**R**	**A**	**G**
When the resultant force on an object is zero, it is in equilibrium and does not move, or remains at constant speed in a straight line.			
One effect of a force is to change an object's form, causing it to be stretched or compressed. In some materials, the change is proportional to the force applied.			
Skill Development			
Sketch the forces acting on an object, and label their size and direction.			
Keywords			
Equilibrium: State of an object when opposing forces are balanced.			
Deformation: Changing shape due to a force.			
Linear relationship: When two variables are graphed and show a straight line which goes through the origin, and they can be called proportional.			
Newton: Unit for measuring forces (N).			
Resultant force: Single force which can replace all the forces acting on an object and have the same effect.			
Friction: Force opposing motion which is caused by the interaction of surfaces moving over one another. It is called 'drag' if one is a fluid.			
Tension: Force extending or pulling apart.			
Compression: Force squashing or pushing together.			
Contact force: One that acts by direct contact.			
Application of Knowledge (Grade 2/3)			
Explain whether an object in an unfamiliar situation is in equilibrium.			
Describe factors which affect the size of frictional and drag forces.			
Describe how materials behave as they are stretched or squashed.			
Describe what happens to the length of a spring when the force on it changes.			

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Extension of Knowledge (Grade 3/4)			
Evaluate how well sports or vehicle technology reduces frictional or drag forces.			
Describe the effects of drag and other forces on falling or accelerating objects as they move.			
Using force and extension data, compare the behaviour of different materials in deformation using the idea of proportionality.			

Pressure

Knowledge Development	**R**	**A**	**G**
Pressure acts in a fluid in all directions. It increases with depth due to the increased weight of fluid, and results in an upthrust. Objects sink or float depending on whether the weight of the object is bigger or smaller than the upthrust.			
Different stresses on a solid object can be used to explain observations where objects scratch, sink into or break surfaces.			
Skill Development			
Use the formula: fluid pressure, or stress on a surface = force (N)/area (m2).			
Keywords			
Fluid: A substance with no fixed shape, a gas or a liquid.			
Pressure: The ratio of force to surface area, in N/m2, and how it causes stresses in solids.			
Upthrust: The upward force that a liquid or gas exerts on a body floating in it.			
Atmospheric pressure: The pressure caused by the weight of the air above a surface.			

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Application of Knowledge (Grade 2/3)			
Use diagrams to explain observations of fluids in terms of unequal pressure.			
Explain why objects either sink or float depending upon their weight and the upthrust acting on them.			
Explain observations where the effects of forces are different because of differences in the area over which they apply.			
Given unfamiliar situations, use the formula to calculate fluid pressure or stress on a surface.			
Extension of Knowledge (Grade 3/4)			
Use the idea of pressure changing with depth to explain underwater effects.			
Carry out calculations involving pressure, force and area in hydraulics, where the effects of applied forces are increased.			
Use the idea of stress to deduce potential damage to one solid object by another.			

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Big Idea - Electromagnets

Previous Knowledge from Year 7

Magnetic fields

- Magnetic forces act at a distance; they are non-contact forces.
- A magnet produces a magnetic field.

Magnetic attraction and repulsion

- Magnets have two poles
- Two magnets will attract or repel each other depending on which poles are facing
- Magnetic materials are attracted by a magnet. There are several magnetic materials, including iron and steel, but most metals are not magnetic.

Explaining electric circuits

- Components in circuits can be arranged in series, in parallel or in both. These arrangements have different effects on the voltage and current and provide different applications.
- Current depends on the 'push' given by the battery, known as the voltage

Circuits and components

- The brightness of a lamp or the volume of a buzzer is associated with the number and voltage of cells used in the circuit.
- Symbols can be used to represent a simple circuit in a diagram

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Electromagnets

Knowledge Development	**R**	**A**	**G**
An electromagnet uses the principle that a current through a wire causes a magnetic field. Its strength depends on the current, the core and the number of coils in the solenoid.			
Key Facts			
The magnetic field of an electromagnet decreases in strength with distance.			
Keywords			
Electromagnet: A non-permanent magnet turned on and off by controlling the current through it.			
Solenoid: Wire wound into a tight coil, part of an electromagnet.			
Core: Soft iron metal which the solenoid is wrapped around.			
Application of Knowledge (Grade 2/3)			
Use a diagram to explain how an electromagnet can be made and how to change its strength.			
Explain the choice of electromagnets or permanent magnets for a device in terms of their properties.			
Extension of Knowledge (Grade 3/4)			
Critique the design of a device using an electromagnet and suggest improvements.			
Suggest how bells, circuit breakers and loudspeakers work, from diagrams.			

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Magnetism

Knowledge Development	**R**	**A**	**G**
Magnetic materials, electromagnets and the Earth create magnetic fields which can be described by drawing field lines to show the strength and direction. The stronger the magnet, and the smaller the distance from it, the greater the force a magnetic object in the field experiences.			
Key Facts			
Two 'like' magnetic poles repel and two 'unlike' magnetic poles attract.			
Field lines flow from the north-seeking pole to the south-seeking pole.			
Keywords			
Magnetic force: Non-contact force from a magnet on a magnetic material.			
Permanent magnet: An object that is magnetic all of the time.			
Magnetic poles: The ends of a magnetic field, called north-seeking (N) and south-seeking poles (S).			
Application of Knowledge (Grade 2/3)			
Use the idea of field lines to show how the direction or strength of the field around a magnet varies.			
Explain observations about navigation using Earth's magnetic field.			
Extension of Knowledge (Grade 3/4)			
Predict the pattern of field lines and the force around two magnets placed near each other.			
Predict how an object made of a magnetic material will behave if placed in or rolled through a magnetic field.			

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Big Idea - Energy

Previous Knowledge from Year 7

Energy stores and transfers

- Energy is transferred when changes happen, and this transfer can happen in different ways. Energy may be transferred from place to place in a material or from one for of storage to another.
- The quantity of energy transferred in a change can be measured
- When elastic materials are stretched or squashed they have more energy stored in them

Using simple machines

- Levers enable a small force to have a greater effect. For example, you could use a screwdriver to lever a lid off a pain can, applying a greater force than with your bare hands.
- Pulleys and gears allow us to transfer forces in much more effective ways

Thermal energy

- Conduction and radiation are important ways of moving energy from place to place

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Work

Knowledge Development	**R**	**A**	**G**
Work is done and energy transferred when a force moves an object. The bigger the force or distance, the greater the work. Machines make work easier by reducing the force needed. Levers and pulleys do this by increasing the distance moved, and wheels reduce friction.			
Keywords			
Work: The transfer of energy when a force moves an object, in joules.			
Lever: A type of machine which is a rigid bar that pivots about a point.			
Input force: The force you apply to a machine.			
Output force: The force that is applied to the object moved by the machine.			
Displacement: The distance an object moves from its original position.			
Deformation: When an elastic object is stretched or squashed, which requires work.			
Application of Knowledge (Grade 2/3)			
Draw a diagram to explain how a lever makes a job easier.			
Compare the work needed to move objects different distances.			
Extension of Knowledge (Grade 3/4)			
Use the formula: work done (J) = force (N) x distance moved (m) to compare energy transferred for objects moving horizontally.			
Compare and contrast the advantages of different levers in terms of the forces need and distance moved.			

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Heating & cooling

Knowledge Development	**R**	**A**	**G**
The thermal energy of an object depends upon its mass, temperature and what it's made of. When there is a temperature difference, energy transfers from the hotter to the cooler object.			
Thermal energy is transferred through different pathways, by particles in conduction and convection, and by radiation.			
Keywords			
Thermal conductor: Material that allows heat to move quickly through it.			
Thermal insulator: Material that only allows heat to travel slowly through it.			
Temperature: A measure of the motion and energy of the particles.			
Thermal energy: The quantity of energy stored in a substance due to the vibration of its particles.			
Conduction: Transfer of thermal energy by the vibration of particles.			
Convection: Transfer of thermal energy when particles in a heated fluid rise.			
Radiation: Transfer of thermal energy as a wave.			
Application of Knowledge (Grade 2/3)			
Explain observations about changing temperature in terms of energy transfer.			
Describe how an object's temperature changes over time when heated or cooled.			
Explain how a method of thermal insulation works in terms of conduction, convection and radiation.			
Sketch diagrams to show convection currents in unfamiliar situations.			
Extension of Knowledge (Grade 3/4)			
Sketch a graph to show the pattern of temperature change against time.			
Evaluate a claim about insulation in the home or for clothing technology.			
Compare and contrast the three ways that energy can be moved from one place to another by heating.			

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Big Idea – Waves

Previous Knowledge from Year 7

How sound behaves

- Sound travels as longitudinal waves being passed on by particles of a medium; the denser the medium the faster sound travels
- The greater the amplitude of the sound wave, the louder the sound
- The greater the frequency of the sound wave, the higher the pitch.

How light behaves

- Light travels as transverse waves that can travel through a vacuum.
- White light can be split into a spectrum of colours
- When light is reflected, the angle of incidence equals the angle of reflection. Light can form an image in a mirror.
- Light can be refracted through lenses and prisms
- Wave properties can be described using a ray diagram as a model.

What is true about waves

- Energy can be transferred by waves
- Waves can be represented diagrammatically, showing wavelength, frequency and amplitude
- Waves can be transmitted, reflected or absorbed by different media

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Wave effects

Knowledge Development	**R**	**A**	**G**
When a wave travels through a substance, particles move to and fro. Energy is transferred in the direction of movement of the wave. Waves of higher amplitude or higher frequency transfer more energy.			
Keywords			
Ultrasound: Sound waves with frequencies higher than the human auditory range.			
Ultraviolet (UV): Waves with frequencies higher than light, which human eyes cannot detect.			
Microphone: Turns the pressure wave of sound hitting it into an electrical signal.			
Loudspeaker: Turns an electrical signal into a pressure wave of sound.			
Pressure wave: An example is sound, which has repeating patterns of high-pressure and low-pressure regions.			
Application of Knowledge (Grade 2/3)			
Explain differences in the damage done to living cells by light and other waves, in terms of their frequency.			
Explain how audio equipment converts sound into a changing pattern of electric current.			
Extension of Knowledge (Grade 3/4)			
Suggest reasons why sound waves can agitate a liquid for cleaning objects, or massage muscles for physiotherapy.			
Evaluate electricity production by wave energy using data for different locations and weather conditions.			

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Wave properties

Knowledge Development	**R**	**A**	**G**
A physical model of a transverse wave demonstrates it moves from place to place, while the material it travels through does not, and describes the properties of speed, wavelength and reflection.			
Keywords			
Waves: Vibrations that transport energy from place to place without transporting matter.			
Transverse wave: Where the direction of vibration is perpendicular to that of the wave.			
Transmission: Where waves travel through a medium rather than be absorbed or reflected.			
Application of Knowledge (Grade 2/3)			
Describe the properties of different longitudinal and transverse waves.			
Use the wave model to explain observations of the reflection, absorption and transmission of a wave.			
Extension of Knowledge (Grade 3/4)			
Compare and contrast the properties of sound and light waves.			
Suggest what happens when two waves combine.			

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Big Idea – Matter

Previous Knowledge from Year 7

Materials

- *Different substances are made of different materials. Materials have different properties; some are harder than others, some are shinier and some are heavier.*
- *Glass, for example, is a different material from plastic and metal*
- *Given reasons, based on evidence from comparative and fair tests, for the use of everyday materials.*

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Periodic table

Knowledge Development	**R**	**A**	**G**
The elements in a group all react in a similar way and sometimes show a pattern in reactivity.			
As you go down a group and across a period the elements show patterns in physical properties.			
Key Facts			
Metals are generally found on the left side of the table, non-metals on the right.			
Group 1 contains reactive metals called alkali metals.			
Group 7 contains non-metals called halogens.			
Group 0 contains unreactive gases called noble gases.			
Keywords			
Periodic table: Shows all the elements arranged in rows and columns.			
Physical properties: Features of a substance that can be observed without changing the substance itself.			
Chemical properties: Features of the way a substance reacts with other substances.			
Groups: Columns of the periodic table.			
Periods: Rows of the periodic table.			
Application of Knowledge (Grade 2/3)			
Use data to describe a trend in physical properties.			
Describe the reaction of an unfamiliar Group 1 or 7 element.			
Use data showing a pattern in physical properties to estimate a missing value for an element.			
Use observations of a pattern in chemical reactions to predict the behaviour of an element in a group.			

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Extension of Knowledge (Grade 3/4)			
Predict the position of an element in the periodic table based on information about its physical and chemical properties.			
Choose elements for different uses from their position in the periodic table.			
Use data about the properties of elements to find similarities, patterns and anomalies.			

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Elements

Knowledge Development	**R**	**A**	**G**
Most substances are not pure elements, but compounds or mixtures containing atoms of different elements. They have different properties to the elements they contain.			
Skill Development			
Use particle diagrams to classify a substance as an element, mixture or compound and as molecules or atoms.			
Name simple compounds using rules: change non-metal to –ide; mono, di, tri prefixes; and symbols of hydroxide, nitrate, sulfate and carbonate.			
Key Facts			
The symbols of hydrogen, oxygen, nitrogen, carbon, hydrogen, iron, zinc, copper, sulfur, aluminium, iodine, bromine, chlorine, sodium, potassium and magnesium.			
Keywords			
Elements: What all substances are made up of, and which contain only one type of atom.			
Atom: The smallest particle of an element that can exist.			
Molecules: Two to thousands of atoms joined together. Most non-metals exist either as small or giant molecules.			
Compound: Pure substances made up of two or more elements strongly joined together.			
Chemical formula: Shows the elements present in a compound and their relative proportions.			
Polymer: A molecule made of thousands of smaller molecules in a repeating pattern. Plastics are man-made polymers, starch is a natural polymer.			

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Application of Knowledge (Grade 2/3)			
Name compounds using their chemical formulae.			
Given chemical formulae, name the elements present and their relative proportions.			
Represent atoms, molecules and elements, mixtures and compounds using particle diagrams.			
Use observations from chemical reactions to decide if an unknown substance is an element or a compound.			
Extension of Knowledge (Grade 3/4)			
Use particle diagrams to predict physical properties of elements and compounds.			
Deduce a pattern in the formula of similar compounds and use it to suggest formulae for unfamiliar ones.			
Compare and contrast the properties of elements and compounds and give a reason for their differences.			

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Big Idea – Reactions

Previous Knowledge from Year 7

Changes in chemical reactions

- Chemical reactions occur when the atoms of reactants are rearranged to form new products. Word equations and balanced symbol equations summarise the changes involved. Mass is conserved in all chemical changes.
- Many chemical reactions, such as combustion, transfer energy as heat and light.

Burning

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

Physical and chemical changes

- Melting ice is reversible. We can put water into a freezer and produce ice again. This is a physical change.
- Some changes are not reversible. These are called chemical changes. Making toast is a chemical change; you can't change toast back into the bread it was made from

Chemical energy

Knowledge Development	**R**	**A**	**G**
During a chemical reaction bonds are broken (requiring energy) and new bonds formed (releasing energy). If the energy released is greater than the energy required, the reaction is exothermic. If the reverse, it is endothermic.			
Keywords			
Catalysts: Substances that speed up chemical reactions but are unchanged at the end.			
Exothermic reaction: One in which energy is given out, usually as heat or light.			
Endothermic reaction: One in which energy is taken in, usually as heat.			
Chemical bond: Force that holds atoms together in molecules.			

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Application of Knowledge (Grade 2/3)			
Use experimental observations to distinguish exothermic and endothermic reactions.			
Use a diagram of relative energy levels of particles to explain energy changes observed during a change of state.			
Extension of Knowledge (Grade 3/4)			
Predict whether a chemical reaction will be exothermic or endothermic given data on bond strengths.			
Use energy data to select a reaction for a chemical hand warmer or cool pack.			

Types of reaction

Knowledge Development	**R**	**A**	**G**
Combustion is a reaction with oxygen in which energy is transferred to the surroundings as heat and light.			
Thermal decomposition is a reaction where a single reactant is broken down into simpler products by heating.			
Chemical changes can be described by a model where atoms and molecules in reactants rearrange to make the products and the total number of atoms is conserved.			
Skill Development			
Write word equations from information about chemical reactions.			
Keywords			
Fuel: Stores energy in a chemical store which it can release as heat.			
Chemical reaction: A change in which a new substance is formed.			
Physical change: One that changes the physical properties of a substance, but no new substance is formed.			
Reactants: Substances that react together, shown before the arrow in an equation.			
Products: Substances formed in a chemical reaction, shown after the reaction arrow in an equation.			
Conserved: When the quantity of something does not change after a process takes place.			

Adapted from Harper Collins

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Application of Knowledge (Grade 2/3)			
Explain why a reaction is an example of combustion or thermal decomposition.			
Predict the products of the combustion or thermal decomposition of a given reactant and show the reaction as a word equation.			
Explain observations about mass in a chemical or physical change.			
Use particle diagrams to show what happens in a reaction.			
Extension of Knowledge (Grade 3/4)			
Compare the pros and cons of fuels in terms of their products of combustion.			
Use known masses of reactants or products to calculate unknown masses of the remaining reactant or product.			
Devise a general rule for how a set of compounds reacts with oxygen or thermally decomposes.			
Balance a symbol equation.			
Use mass of reactant in equation to determine mass of product eg magnesium and oxygen.			

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Big Idea - Earth

Previous Knowledge from Year 7

Combustion reactions

- When substances react with oxygen to release energy it is called combustion
- The products of combustion depend on the substance reacting with oxygen
- Most fuels release carbon dioxide and water during combustion.

Changing Earth

- *There are cycles in nature. The water cycle, for example, is the continuous movement of water on, above and below the surface of the Earth*
- *The earth's resources are limited and can be damaged by human activities*

Using and re-using the Earth's resources

- The earth has many useful resources such as metal ores
- The extraction process can damage the environment by, for example, digging mines, pollution caused by waste and subsidence of land
- Some metals are extracted from their ores using carbon, which leads to increased levels of carbon dioxide in the atmosphere
- Waste materials can be recycled instead of extracting new raw materials. This reduces greenhouse gas emissions, uses less energy than making metal from its ore and conserves natural resources
- There are benefits and limitations to the recycling of materials

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Climate

Knowledge Development	**R**	**A**	**G**
Carbon is recycled through natural processes in the atmosphere, ecosystems, oceans and the Earth's crust (such as photosynthesis and respiration) as well as human activities (burning fuels).			
Greenhouse gases reduce the amount of energy lost from the Earth through radiation and therefore the temperature has been rising as the concentration of those gases has risen.			
Scientists have evidence that global warming caused by human activity is causing changes in climate.			
Key Facts			
Methane and carbon dioxide are greenhouse gases.			
Earth's atmosphere contains around 78 % nitrogen, 21 % oxygen, <1 % carbon dioxide, plus small amounts of other gases.			
Keywords			
Global warming: The gradual increase in surface temperature of the Earth.			
Fossil fuels: Remains of dead organisms that are burned as fuels, releasing carbon dioxide.			
Carbon sink: Areas of vegetation, the ocean or the soil, which absorb and store carbon.			
Greenhouse effect: When energy from the sun is transferred to the thermal energy store of gases in Earth's atmosphere.			
Application of Knowledge (Grade 2/3)			
Use a diagram to show how carbon is recycled in the environment and through living things.			
Describe how human activities affect the carbon cycle.			
Describe how global warming can impact on climate and local weather patterns.			

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Extension of Knowledge (Grade 3/4)			
Evaluate the implications of a proposal to reduce carbon emissions.			
Evaluate claims that human activity is causing global warming or climate change.			
Compare the relative effects of human-produced and natural global warming.			

Earth resources

Knowledge Development	**R**	**A**	**G**
There is only a certain quantity of any resource on Earth, so the faster it is extracted, the sooner it will run out. Recycling reduces the need to extract resources.			
Most metals are found combined with other elements, as a compound, in ores. The more reactive a metal, the more difficult it is to separate it from its compound. Carbon displaces less reactive metals, while electrolysis is needed for more reactive metals.			
Keywords			
Natural resources: Materials from the Earth which act as raw materials for making a variety of products.			
Mineral: Naturally occurring metal or metal compound.			
Ore: Naturally occurring rock containing sufficient minerals for extraction.			
Extraction: Separation of a metal from a metal compound.			
Recycling: Processing a material so that it can be used again.			
Electrolysis: Using electricity to split up a compound into its elements.			
Application of Knowledge (Grade 2/3)			
Explain why recycling of some materials is particularly important.			
Describe how Earth's resources are turned into useful materials or recycled.			
Justify the choice of extraction method for a metal, given data about reactivity.			
Suggest factors to take into account when deciding whether extraction of a metal is practical.			

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Extension of Knowledge (Grade 3/4)			
Suggest ways in which changes in behaviour and the use of alternative materials may limit the consumption of natural resources.			
Suggest ways in which waste products from industrial processes could be reduced.			
Use data to evaluate proposals for recycling materials.			

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Big Idea - Organisms

Previous Knowledge from Year 7

Breathing and gas exchange

- Animals, including human, need air to survive
- Breathing is taking air in and out of our lungs
- The air around us contains oxygen

Diet and nutrition

- Animals cannot make their own food and must eat plants or other animals for energy
- Humans must eat a balanced diet containing the correct types of food to stay healthy

Digestion

- We have different types of teeth and each type has a different role in breaking down food
- Several parts of the body help us to digest food – such as teeth, stomach and intestines
- Each part of our digestive system has a different job to do
- Nutrients from digestion are transported round the body in blood

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Breathing

Knowledge Development	**R**	**A**	**G**
In gas exchange, oxygen and carbon dioxide move between alveoli and the blood. Oxygen is transported to cells for aerobic respiration and carbon dioxide, a waste product of respiration, is removed from the body.			
Breathing occurs through the action of muscles in the ribcage and diaphragm. The amount of oxygen required by body cells determines the rate of breathing.			
Keywords			
Breathing: The movement of air in and out of the lungs.			
Trachea (windpipe): Carries air from the mouth and nose to the lungs.			
Bronchi: Two tubes which carry air to the lungs.			
Bronchioles: Small tubes in the lung.			
Alveoli: Small air sacs found at the end of each bronchiole.			
Ribs: Bones which surround the lungs to form the ribcage.			
Diaphragm: A sheet of muscle found underneath the lungs.			
Lung volume: Measure of the amount of air breathed in or out.			
Application of Knowledge (Grade 2/3)			
Explain how exercise, smoking and asthma affect the gas exchange system.			
Explain how the parts of the gas exchange system are adapted to their function.			
Explain observations about changes to breathing rate and volume.			
Explain how changes in volume and pressure inside the chest move gases in and out of the lungs.			
Extension of Knowledge (Grade 3/4)			
Evaluate a possible treatment for a lung disease.			
Predict how a change in the gas exchange system could affect other processes in the body.			
Evaluate a model for showing the mechanism of breathing.			

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Digestion

Knowledge Development	**R**	**A**	**G**
The body needs a balanced diet with carbohydrates, lipids, proteins, vitamins, minerals, dietary fibre and water, for its cells' energy, growth and maintenance.			
Organs of the digestive system are adapted to break large food molecules into small ones which can travel in the blood to cells and are used for life processes.			
Key Facts			
Iron is a mineral important for red blood cells.			
Calcium is a mineral needed for strong teeth and bones.			
Vitamins and minerals are needed in small amounts to keep the body healthy.			
Keywords			
Enzymes: Substances that speed up the chemical reactions of digestion.			
Dietary fibre: Parts of plants that cannot be digested, which helps the body eliminate waste.			
Carbohydrates: The body's main source of energy. There are two types: simple (sugars) and complex (starch).			
Lipids (fats and oils): A source of energy. Found in butter, milk, eggs, nuts.			
Protein: Nutrient your body uses to build new tissue for growth and repair. Sources are meat, fish, eggs, dairy products, beans, nuts and seeds.			
Stomach: A sac where food is mixed with acidic juices to start the digestion of protein and kill microorganisms.			
Small intestine: Upper part of the intestine where digestion is completed and nutrients are absorbed by the blood.			
Large intestine: Lower part of the intestine from which water is absorbed and where faeces are formed.			
Gut bacteria: Microorganisms that naturally live in the intestine and help food break down.			

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Application of Knowledge (Grade 2/3)			
Describe possible health effects of unbalanced diets from data provided.			
Calculate food requirements for a healthy diet, using information provided.			
Describe how organs and tissues involved in digestion are adapted for their role.			
Describe the events that take place in order to turn a meal into simple food molecules inside a cell.			
Extension of Knowledge (Grade 3/4)			
Design a diet for a person with specific dietary needs.			
Critique claims for a food product or diet by analysing nutritional information.			
Make deductions from medical symptoms showing problems with the digestive system.			

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Big Idea – Ecosystem

Previous Knowledge from Year 7

Cells

- One of the largest of the cell's organelles is the mitochondrion
- Energy is released in the mitochondrion

Plants

- Green plants need water and nutrients from the soil in order to grow. They make food in their leaves by photosynthesis using light energy

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Respiration

Knowledge Development			
Respiration is a series of chemical reactions, in cells, that breaks down glucose to provide energy and form new molecules. Most living things use aerobic respiration but switch to anaerobic respiration, which provides less energy, when oxygen is unavailable.			
Key Facts			
Yeast fermentation is used in brewing and breadmaking.			
Keywords			
Aerobic respiration: Breaking down glucose with oxygen to release energy and producing carbon dioxide and water.			
Anaerobic respiration (fermentation): Releasing energy from the breakdown of glucose without oxygen, producing lactic acid (in animals) and ethanol and carbon dioxide (in plants and microorganisms).			
Application of Knowledge (Grade 2/3)			
Use word equations to describe aerobic and anaerobic respiration.			
Explain how specific activities involve aerobic or anaerobic respiration.			
Extension of Knowledge (Grade 3/4)			
Suggest how organisms living in different conditions use respiration to get their energy.			
Describe similarities and differences between aerobic and anaerobic respiration.			

Photosynthesis

Knowledge Development	**R**	**A**	**G**
Plants and algae do not eat, but use energy from light, together with carbon dioxide and water to make glucose (food) through photosynthesis.			
They either use the glucose as an energy source, to build new tissue, or store it for later use.			
Plants have specially-adapted organs that allow them to obtain resources needed for photosynthesis.			

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Key Facts			
Iodine is used to test for the presence of starch.			
Keywords			
Fertilisers: Chemicals containing minerals that plants need to build new tissues.			
Photosynthesis: A process where plants and algae turn carbon dioxide and water into glucose and release oxygen.			
Chlorophyll: Green pigment in plants and algae which absorbs light energy.			
Stomata: Pores in the bottom of a leaf which open and close to let gases in and out.			
Application of Knowledge (Grade 2/3)			
Describe ways in which plants obtain resources for photosynthesis.			
Explain why other organisms are dependent on photosynthesis.			
Sketch a line graph to show how the rate of photosynthesis is affected by changing conditions.			
Use a word equation to describe photosynthesis in plants and algae.			
Extension of Knowledge (Grade 3/4)			
Suggest how particular conditions could affect plant growth.			
Suggest reasons for particular adaptations of leaves, roots and stems.			
Compare the movement of carbon dioxide and oxygen through stomata at different times of day.			

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Big Idea – Genes

Previous Knowledge from Year 7

Evolution

- Environments change and these changes sometimes pose a threat to habitats.
- Some living things are adapted to survive in extreme conditions, for example, cacti, penguins and camels.
- Variation over time can lead to evolution
- The human skeleton has evolved because of changes to the environment.

Inheritance

- Living things produce offspring of the same kind but these offspring are not usually the same as their parents

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Evolution

Knowledge Development	**R**	**A**	**G**
Natural selection is a theory that explains how species evolve and why extinction occurs.			
Biodiversity is vital to maintaining populations.			
Within a species variation helps against environment changes, avoiding extinction.			
Within an ecosystem, having many different species ensures resources are available for other populations, like humans.			
Keywords			
Population: Group of organisms of the same kind living in the same place.			
Natural selection: Process by which species change over time in response to environmental changes and competition for resources.			
Extinct: When no more individuals of a species remain.			
Biodiversity: The variety of living things. It is measured as the differences between individuals of the same species, or the number of different species in an ecosystem.			
Competition: When two or more living things struggle against each other to get the same resource.			
Evolution: Theory that the animal and plant species living today descended from species that existed in the past.			
Application of Knowledge (Grade 2/3)			
Use evidence to explain why a species has become extinct or adapted to changing conditions.			
Evaluate whether evidence for a species changing over time supports natural selection.			
Explain how a lack of biodiversity can affect an ecosystem.			
Describe how preserving biodiversity can provide useful products and services for humans.			

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Extension of Knowledge (Grade 3/4)			
Predict and explain the changes in a population over time due to natural selection.			
Suggest an explanation, based on data, for how a particular evolutionary change occurred.			
Evaluate ways of preserving plant or animal material for future generations.			

Inheritance

Knowledge Development	**R**	**A**	**G**
Inherited characteristics are the result of genetic information, in the form of sections of DNA called genes, being transferred from parents to offspring during reproduction.			
Chromosomes are long pieces of DNA which contain many genes. Gametes, carrying half the total number of chromosomes of each parent, combine during fertilisation.			
Key Facts			
The DNA of every individual is different, except for identical twins.			
There is more than one version of each gene eg different blood groups.			
Keywords			
Inherited characteristics: Features that are passed from parents to their offspring.			
DNA: A molecule found in the nucleus of cells that contains genetic information.			
Chromosomes: Thread-like structures containing tightly coiled DNA.			
Gene: A section of DNA that determines an inherited characteristic.			
Application of Knowledge (Grade 2/3)			
Use a diagram to show the relationship between DNA, chromosomes and genes.			
Use a diagram to show how genes are inherited.			
Explain how a change in the DNA (mutation) may affect an organism and its future offspring.			
Explain why offspring from the same parents look similar but are not usually identical.			

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Extension of Knowledge (Grade 3/4)			
Suggest arguments for and against genetic modification.			
Suggest benefits from scientists knowing all the genes in the human genome.			
Determine how the number of chromosomes changes during cell division, production of sex cells and fertilisation.			
Find out why scientists Watson, Crick and Franklin were so important.			