THE STONEHENGE SCHOOL
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Science Department
Curriculum Intent Document

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The Stonehenge School KS3 Science Curriculum Intent.

Pupils study the following areas during the KS3 program of study (see Appendix 1) which takes place over two and a half years from the beginning of Year 7 until January in Year 9.

Working Scientifically and Practical skills are integrated as part of the course and not focussed on independently.

We follow the Oxford Activate KS3 program, supplemented by a range of alternative and/or differentiated resources. All resources are available for use by all members of the department.

Year 7	Year 8	Year 9
Term 1 Cells Particles Forces	**Term 1** Ecosystems The Periodic Table The Earth	**Term 1** Adaptation and Inheritance Metals and Acids Electricity and Magnetism During this term, pupils sit an End of KS3 exam in each of the subjects: Biology Chemistry Physics
Term 2 Structure and Function of Body Systems Elements Sound	**Term 2** Health and Lifestyle Motion and Pressure Space	**January** onwards: AQA GCSE Combined Science Trilogy course or AQA GCSE Biology, Chemistry and Physics. See KS4 Curriculum Intent document
Term 3 Reproduction Reactions Light During term 3 pupils sit an End of year 7 exam	**Term 3** Acids and Alkalis Separating Techniques Energy During term 3 pupils sit an End of year 8 exam	

Content detail for each module

Each list below outlines the sequence of content delivery for that module.

Year 7

Cells

- Cells are the building blocks of life – they are the smallest units in an organism.
- Scientists use microscopes to observe small objects in detail.
- Animal cells contain a nucleus, cytoplasm, cell membrane and mitochondria.
- Plant cells also contain chloroplasts, a vacuole and a cell wall.
- Cytoplasm is where the chemical reactions in a cell take place.
- The cell membrane is a barrier that controls what moves in and out of the cell.
- The nucleus controls the cell, and contains genetic material needed to make new cells.
- Respiration occurs in the mitochondria – this chemical reaction transfers energy.
- The cell wall strengthens the cell and provides support.
- The vacuole contains a watery liquid called sell sap. It keeps the cell firm.
- Photosynthesis takes place inside the chloroplasts.
- Specialised cells have changed their shape and structure so that they are suited to carry out a particular job.
- Nerve cells, red blood cells, sperm cells, leaf cells and root hair cells are specialised cells.
- Diffusion is the movement of particles from a high-concentration area to a low-concentration area. For example, water and oxygen diffuse into a cell.
- A unicellular organism contains only one cell.
- An amoeba is a unicellular organism consisting of a cell membrane, cytoplasm and a nucleus.
- Euglenas appear green as they contain chloroplasts for photosynthesis. Their eye spot locates light, and they use their flagellum to swim towards it. In low light levels they can engulf food.

Particles

- Materials are made up of tiny particles.
- A substance is made up of just one type of material.
- The properties of a substance describe what it looks like and how it behaves.
- The properties of a substance depend on what its particles are like, and how they are arranged.
- There are three states of matter – solid, liquid and gas. For a certain substance, the particles never change. But in different states, the particles move differently, and have different arrangements.
- In the sold state, you cannot compress a substance, or make it flow.

- In the liquid state, you cannot compress a substance, but you can make it flow.
- In the gas state, you can compress a substance, and make it flow.
- The change of state from solid to liquid is melting. A substance melts at its melting point. Pure substances have sharp melting points.
- A substance changes from the liquid to the gas state by evaporating or boiling. A substance boils at its boiling point.
- The change of state from gas to liquid is condensing.
- The change of state from liquid to solid id freezing.
- Some substances change directly from the solid state to the gas state. This is subliming.
- Diffusion is the random moving and mixing of particles.
- Gas particles collide with the walls of their container. The collisions cause gas pressure.

Forces

- Forces are pushes and pulls, measured in newtons (N) using a newton meter.
- Forces exist when objects interact – this produces an interaction pair.
- Forces can deform objects, change their speed or the direction of motion.
- Contact forces occur when objects are touching.
- Friction, air resistance and water resistance are contact forces.
- Friction can be reduced by lubrication. Air resistance and water resistance can be reduced by streamlining.
- Non-contact forces occur when objects are not touching.
- Gravitational, electrostatic, and magnetic forces are non-contact forces.
- Solid surfaces provide a support force when they are compressed.
- Springs or rope extend when you apply a force.
- For some objects if you double the force the extension doubles. This is Hooke's Law.
- A field is a region where something feels a force, for example, a mass in a gravitational field.
- Mass is the amount of stuff an object is made up of, measured in kilograms.
- Weight is the force of the Earth on an object, measured in newtons:
  Weight (N) = mass (kg) × g (N/kg)
- When the forces acting on an object are equal in size and acting in opposite directions they are balanced. The object is in equilibrium.
- If the forces are not balanced the object will speed up, slow down or change direction.

Structure and Function of Body Systems

- Multicellular organisms are made of many cells. They are organised into layers: cells → tissues → organs → organ systems → organisms.

- Gas exchange takes place inside the lungs – oxygen is taken in and carbon dioxide is given out.
- Oxygen enters the body through the mouth and nose. It then travels down the windpipe, through a bronchus, then a bronchiole, into an alveolus and diffuse into the blood.
- Exhaled air is warmer and contains more carbon dioxide and water vapour than inhaled air, but less oxygen.
- When you inhale, muscles between your ribs and the diaphragm contract. This increases the volume inside your chest. The pressure decreases and air is drawn into the lungs.
- When you exhale, muscles between your ribs and the diaphragm relax. This decreases the volume inside your chest. The pressure increases and air is forced out of your lungs.
- The skeleton is made up of bones. It has four important functions – support the body, protect the organs, allow movement and make blood.
- Red and white blood cells are produced in the bone marrow found in the centre of some bones.
- Joints occur where two or more bones join together.
- Cartilage in joints stop bones rubbing together.
- Bones are held together by ligaments. Muscles are attached to bones by tendons.
- Antagonistic muscles are pairs of muscles that work together at a joint. When one muscle contracts, the other relaxes.

Elements

- All materials are made up of one or more elements.
- Elements are substances that cannot be broken down.
- There are 92 elements that exist naturally.
- The Periodic Table lists all the elements.
- Every element has its own chemical symbol.
- An atom is the smallest part of an element that can exist.
- Every element is made up of one type of atom. All the atoms of an element are the same.
- The atoms of one element are different to the atoms of all the other elements.
- The properties of a substance are the properties of many atoms, not just a single atom.
- A compound is a substance made up of atoms of two or more elements strongly joined together.
- The properties of a compound are different to the properties of the elements that it is made of.
- A molecule is a group of two or more atoms that are strongly joined together.
- A chemical formula shows the relative number of atoms of each element in a compound.

Sound

- Waves are oscillations or vibrations that have an amplitude, wavelength and frequency. The top of the wave is a crest and the bottom is a trough.
- In a transverse wave the oscillation is at 90° to the wave direction, and in a longitudinal wave it is parallel to the wave direction.
- Waves can reflect from barriers and add up or cancel out.
- A sound wave is produced by vibrating objects and is longitudinal.
- Sound travels at 340m/s. Sound travels fastest in solids and slowest in gases and cannot travel through a vacuum.
- The loudness of a sound depends on its amplitude, and the pitch depends on its frequency. Frequency is measured in hertz (Hz).
- A human's audible range is from 20 – 20 000 Hz.
- Your outer ear consists of the pinna, auditory canal and eardrum. Your middle ear contains your ossicles. Your inner ear contains your cochlea, and semi-circular canals.
- Vibrations travel from your eardrum to the hairs in your cochlea. This produces a signal that is sent to your brain.
- Loudness is measured in decibels (dB).
- An echo is a reflection of sound that you can use to work out distance. Soft materials absorb sound and don't produce echoes.
- Ultrasound is a sound with a frequency of more than 20,000Hz. Humans use ultrasound to produce images of inside the body, and to find the depths of water.

Reproduction

- Adolescence is the time when you change from a child to an adult.
- The physical changes that your body goes through during adolescence is called puberty. Puberty is caused by hormones.
- Boys and girls both have a growth spurt and grow pubic and underarm hair.
- Girls develop breasts, the ovaries release egg cells and the hips widen.
- Girls begin the menstrual cycle. Periods occur when the lining of the uterus breaks down. This happens once a month.
- Boys voices break, the testes and penis get bigger, the testes start to produce sperm, shoulders widen and hair grows on the face and chest.
- Fertilisation in animals occurs when the nucleus of a sperm joins with the nucleus of an egg.
- The fertilised egg divides several times to form a ball of cells called an embryo. This implants in the lining of the uterus and begins to develop into a baby.
- The fetus receives nutrients and oxygen from the mother through the placenta.
- Pollination occurs when pollen from the anther is transferred to the stigma.
- Fertilisation in plants occurs when the nucleus of a pollen grain joins with the nucleus of an ovule.

- The ovary becomes a fruit and the ovules turn into seeds. The seeds are dispersed by either the wind, water, animals or explosion.
- A seed requires warmth, oxygen and water to germinate.

Reactions

- Physical changes are reversible. They include changes of state and dissolving.
- Chemical reactions are not reversible.
- In a chemical reaction, atoms are rearranged to make new substances.
- In a chemical reaction, the total mass of reactants is equal to the total mass of products. This is conservation of mass.
- In a chemical reaction, the starting substances are called reactants. The substances that are made in the reaction are called reactants.
- Word equations represent reaction simply. They show reactants on the left and products on the right. The arrow means reacts to make.
- In a balanced symbol equation, chemical formulae represent the reactants and products. The equation shows how atoms are re-arranged. It gives the relative amounts of reactants and products.
- Chemical reactions can make useful products and transfer energy.
- In oxidation reactions, substances join with oxygen to form oxides.
- Oxidation reactions include burning and rusting. Burning is also called combustion.
- In a thermal decomposition reaction, a compound breaks down when it is heated. The products are simpler compounds and elements.
- Exothermic changes transfer energy to the surroundings.
- Endothermic reactions transfer energy from the surroundings.
- A hazard is a possible source of danger.
- A risk is the chance of damage or injury from a hazard.

Light

- Light is emitted from luminous sources. It can be transmitted through, reflected or absorbed by non-luminous objects.
- Objects are transparent, translucent or opaque.
- Light travels through a vacuum at 300 000 km/s.
- A light year is the distance light travels in one year. Light years are used to measure very large distances.
- Your brain uses the fact that light travels in straight lines and you see a virtual image when you look in the mirror.
- The law of reflection says that the angle of incidence equals the angle of reflection.
- Images are formed when reflection is specular but not when there is a diffuse scattering from a surface.
- When light slows down it is refracted towards the normal.
- A lens can focus light to a focal point.

- Light enters your eye through the pupil. The cornea and lens focus light to produce a real image on your retina. A chemical reaction in the photoreceptors in your eye produces an electrical signal. The signal travels down the optic nerve to your brain.
- Light forms an image in a camera in the same way. Digital cameras store images produced when light hits a charge-coupled device (CCD).
- Prisms disperse white light to produce a continuous spectrum. Primary colours of light add up to make secondary colours. All three colours add to make white light.
- Filters and coloured objects subtract colours from white light by transmitting or reflecting the colour that they are and absorbing the rest.

Year 8

Ecosystems

- Plants and algae are producers – they make their own food by photosynthesis.
- Photosynthesis: carbon dioxide + water → glucose + oxygen
- Photosynthesis takes place in chloroplasts. Chloroplasts contain chlorophyll which traps the light needed for photosynthesis.
- Stomata allow gases to enter and leave a leaf. Guard cells open the stomata during the day and close them at night.
- Plants need minerals for healthy growth. For example, nitrates are needed to make amino acids. Amino acids joint together to form proteins which are used for growth.
- To transfer energy from glucose, aerobic respiration takes place in mitochondria.
- Aerobic respiration: glucose + oxygen → carbon dioxide + water (+energy)
- If no oxygen is present, energy can be transferred from glucose using anaerobic respiration.
- Anaerobic respiration: glucose→ lactic acid (+energy)
- Fermentation is a type of anaerobic respiration performed by microorganisms. It is used in bread and beer making.
- Fermentation: glucose → ethanol + carbon dioxide (+energy)
- Food chains show the transfer of energy between organisms. A food web is a set of linked food chains.
- Toxic chemicals can build up in organisms in a food chain until they reach harmful levels. This is called bioaccumulation.
- Interdependence is the way in which organisms depend on each other to survive, grow and reproduce.
- Organisms can co-exist within a habitat as they each have a different niche.

The Periodic Table

- In the Periodic Table, metals are on the left of the stepped line and non-metals are on the right.
- Most metals have high melting points. They are good conductors of heat and electricity. They are shiny and high densities. They are malleable, ductile and sonorous.
- Most non-metals have low melting points. They are poor conductors of heat and electricity. In the solid state they are dull and brittle.
- Metal oxides are basic. Those that dissolve in water form alkaline solutions. Non-metal oxides are acidic.
- Physical properties describe things that you can observe and measure.
- Chemical properties describe how substances take part in chemical reactions.
- You can use the arrangement of elements in the Periodic Table to explain and predict patterns in physical and chemical properties.
- In the Periodic Table the horizontal rows are called periods.
- In the Periodic Table the vertical rows are called groups.
- Going across periods and down groups, there are patterns in the elements properties.
- Group 1 elements have low melting and boiling points, and low densities. They are reactive.
- Group 1 elements react vigorously with water to make hydroxides and hydrogen. The reactions get more vigorous from top to bottom of the group.
- Going down Group 7, melting and boiling points increase. The colours of the elements get darker. They are reactive.
- In a displacement reaction a more reactive element displaces a less reactive element from its compounds.
- Group 0 elements are called the Noble gases. They are unreactive.

The Earth

- Everything we use comes from the Earth's crust, atmosphere or oceans.
- The Earth consists of the crust, mantle, outer core and inner core.
- The atmosphere is the mixture of gases around the Earth. It is mainly nitrogen and oxygen, with smaller amounts of argon and carbon dioxide.
- Sedimentary rocks form as a result of weathering, erosion, transport, deposition and compaction or cementation.
- Sedimentary rocks have separate grains. They are porous. Most are soft.
- Igneous rocks form when liquid rock freezes. They consist of crystals. They are non-porous, hard and durable.
- Metamorphic rocks form when heating, high pressure or both, change existing rock. They consist of crystals. They are non-porous.
- The rock cycle shows how materials in rocks are recycled over millions of years.
- Huge forces inside the Earth push rocks upwards to form mountains. This is called uplift.

- Carbon stores include the atmosphere, oceans, sedimentary rocks, fossil fuels and organisms.
- The carbon cycle shows how carbon compounds enter and leave carbon stores.
- The concentration of carbon dioxide in the atmosphere is increasing because of deforestation and burning fossil fuels.
- Extra carbon dioxide in the atmosphere causes climate change.
- Recycling involves collecting and processing materials that have been used to make new objects.

Health and Lifestyle

- Nutrients are essential substances that your body needs to survive. They are carbohydrates, lipids, proteins, vitamins, minerals, water and fibre.
- Food tests are used to find out which nutrients a food contains.
- To remain healthy you need to eat a balanced diet. This means eating foods containing the right nutrients in the correct amounts.
- Underweight people often lack energy. They may also suffer from a vitamin or mineral deficiency, which can cause problems like a poor immune system.
- Overweight people have an increased risk of heart disease, stroke, diabetes and some cancers.
- During digestion large molecules like lipids and proteins are broken down into small molecules. They can then pass into the blood where they are used by the body.
- Enzymes are proteins that can break large molecules into small molecules. They are biological catalysts – they speed up digestion without being used up.
- Drugs are substances that alter the chemical reactions that take place inside your body. Medicinal drugs have health benefits. Recreational drugs are taken for enjoyment.
- If a person becomes dependent on a drug, they have an addiction.
- A person with an addiction can suffer withdrawal symptoms if they stop taking the drug.
- Alcoholic drinks contain the drug ethanol. This is a depressant which slows down the nervous system.
- Drinking large amounts of alcohol over a long time can cause stomach ulcers, heart disease and brain and liver damage. A person with an alcohol addiction is called an alcoholic.
- Smoking tobacco causes breathing problems, cancer, heart attacks and strokes.
- Tobacco smoke contains nicotine. This is a stimulant, which speeds up the nervous system. It is also addictive.

Motion and Pressure

- Speed = distance ÷ time, measured in metres per second (m/s). Average speed is the total distance travelled ÷ total time taken.
- You can show what is happening to the position of an object on a distance-time graph. The slope of the distance-time graph is the speed.
- Gas pressure is due to the collisions of gas molecules with the side of the container or object. If the gas is hotter, or compressed into a smaller volume, or if there are more gas molecules in the same space, there will be more collisions and the pressure will be greater.
- Atmospheric pressure is due to the collisions of air molecules with objects. Atmospheric pressure decreases with height because there are fewer air molecules higher up.
- Liquids are compressible. The pressure at a particular depth in a liquid depends on the weight of the liquid above it. Pressure increases with depth.
- Pressure = force ÷ area, measured in N/m^2 or N/cm^2. The pressure tells you how the force is spread out over an area.
- The turning effect of a force is called a moment. You calculate a moment by multiplying the force by a distance from a pivot.
- If the clockwise moments acting on an object equals the anticlockwise moments the object will be in equilibrium. This is how see-saws balance.
- The centre of gravity is the point at which all the weight of the object appears to act.
- The weight of an object acting through the centre of mass can produce a turning force.

Space

- You can see satellites, the international space station, the moon, comets, meteors, planets, stars and galaxies in the night sky.
- The distances to objects in the night sky can be measured in light time (light-seconds, light-minutes, light-hours and light-years).
- The natural objects that you see are made of mixtures of gas, dust, rock and ice.
- The Universe consists of millions of galaxies. Each galaxy contains billions of stars. Each star may have planets, asteroids and comets in orbit around them. Each planet may have moons in orbit around them.
- There are four rocky inner planets (Mercury, Venus, Earth and Mars), an asteroid belt and four outer planets (Jupiter, Saturn, Uranus and Neptune) made of gas.
- Planets further from the Sun are colder. Venus is hotter than Mercury, even though it is further from the Sun. This is because Mercury does not have an atmosphere to trap energy.
- The Earth spins on its axis once a day. This is why we have day and night and why the Sun and stars appear to move across the sky.

- The Earth orbits the Sun in one year. The axis of the earth is tilted and this explains the height of the Sun at noon, day length, temperature and the constellations that you see at night to change during the year.
- You see phases of the moon because the Moon is orbiting the Earth. Half of the Moon is always lit by the Sun.
- A solar eclipse happens when the Moon is between the Sun and the Earth. A lunar eclipse happens when the Earth is between the Sun and the Moon.

Acids and Alkalis

- The pH scale shows how acidic or alkaline a solution is.
- Acids have pH values below 7. The lower the pH, the more acidic the solution.
- Alkaline solutions have pH values above 7. The higher the pH, the more alkaline the solution.
- Neutral solutions are neither acidic nor alkaline. Their pH is exactly 7.
- Indicators change colour to show whether a solution is acidic or alkaline.
- Universal indicator changes colour to show the pH of the solution.
- Litmus is an indicator. Blue litmus turns red on adding acid. Red litmus turns blue on adding an alkaline solution.
- In a neutralisation reaction, an acid cancels out a base, or a base cancels out an acid.
- A base is a substance that neutralises an acid.
- An alkali is a soluble base.
- Adding bases or acids to soil can change its pH, making it suitable for different crops.
- Adding a base to an acidic lake increases the lake pH, making it suitable for different plants and animals.
- If an acid reacts with a base, there are two products – a salt and water.
- If an acid reacts with a metal, there are two products – a salt and hydrogen.
- Sulfuric acid makes sulfate salts, hydrochloric acid makes chloride salts and nitric acid makes nitrate salts.

Separating Techniques

- A mixture is made up of substances that are not chemically joined together.
- In a mixture, the substances keep their own properties. You can change the amounts of the substances.
- A pure substance has a sharp melting point. An impure substance does not.
- A solution is a mixture of a liquid with a solid or a gas. All parts of the solution are the same. You cannot see the separate substances.
- In a solution, the substance that dissolves is called the solute.
- In a solution, the liquid in which the solute dissolves is called the solvent. Solvents include water, propanone and ethanol.
- When a substance dissolves, solvent particles surround the solute particles.
- A saturated solution is a solution in which no more solute can dissolve.

- The solubility of a substance is the mass that dissolves in 100g of water. Every substance has its own solubility.
- The solubility of a substance varies with temperature.
- Substances that cannot dissolve in a certain solvent are insoluble in that solvent.
- Filtration separates a liquid from an insoluble solid. It also separates a solution from a solid that is mixed with it but not dissolved.
- You can separate a solute from its solution by evaporation.
- You can separate a solvent from its solution by distillation.
- You can separate substances in a mixture by chromatography if all the substances are soluble in the same solvent.

Energy

- There is energy in the chemical stores associated with food and fuel. Energy is measured in joules. You need different amounts of energy for different activities.
- Energy cannot be created or destroyed; it can only be transferred between stores. This is the law of conservation of energy. Light, sound and electricity are ways of transferring energy between stores.
- Temperature is measured using a thermometer. The temperature doesn't depend on the amount of material, but the amount of energy in the thermal store does.
- When a hot object is in contact with a colder one, energy is transferred from the hot object to the colder one. Energy will be transferred and the temperature difference will decrease until the objects are in equilibrium.
- Energy is transferred by conduction in solids and by convection in liquids and gases.
- Energy is transferred by radiation, which does not need a medium to travel through. All objects emit radiation. Infrared radiation can be detected by your skin or a thermal imaging camera. If the energy transferred to an object is less than the energy transferred from the object, it will cool down.
- Fossil fuels such as coal, oil and gas were formed over millions of years and are non-renewable. They can be used to drive a generator in a thermal power station. Wind wave and solar sources are examples of renewable energy resources.
- Power = energy ÷ time, and electrical power = potential difference × current. You can work out the energy transferred by appliances in your home using the unit of kilowatt hours.
- You can calculate work by multiplying a force by a distance. Simple machines like levers and gears can make it easier to do work but you do not get more energy out than you put in.

Adaptation and Inheritance

- Animals compete for food, water, mates and space. Plants compete for light, water, space and minerals.
- Adaptations are characteristics that help an organism to survive and reproduce.
- Predator and prey species are interdependent – a change in the population of one animal directly affects the population of the other.
- Differences in characteristics within a species is known as variation. Inherited variation comes from characteristics inherited from your parents. Variation caused by your surroundings is called environmental variation. Many characteristics are affected by both.
- Characteristics that can only have certain values show discontinuous variation.
- Characteristics that can be any value show continuous variation.
- You inherit characteristics from your parents in you DNA.
- DNA is arranged in long strands called chromosomes. Each chromosome is divided into sections of DNA. The sections of DNA that contain the information to produce a characteristic are called genes.
- Watson, Crick, Franklin and Wilkins worked together to produce a model of the structure of DNA.
- All living organisms have evolved from a common ancestor, through the process of natural selection.
- Fossils provide evidence for evolution.
- If a species is not adapted to its environment, it will not survive. Eventually a species can become extinct.
- Gene banks store genetic samples from organisms. This may help prevent extinction.

Metals and Acids

- The reactivity series lists metals in order of how vigorously they react. The most reactive metals are at the top. The table summarises some reactions:

<table>
<tr><th>Metal</th><th>Reaction with dilute acid</th><th>Reaction on heating in air</th><th>Reaction with water</th></tr>
<tr><td>Potassium</td><td rowspan="3">Explode.
Products are metal salts and hydrogen</td><td rowspan="4">Burn vigorously.
Products are metal oxides.</td><td rowspan="3">React vigorously.
Products are a metal hydroxide solution and hydrogen.</td></tr>
<tr><td>Sodium</td></tr>
<tr><td>Lithium</td></tr>
<tr><td>Calcium</td><td rowspan="2">React, making bubbles.
Products are metal</td></tr>
<tr><td>Magnesium</td><td>React with steam.</td></tr>
</table>

Zinc	salts and hydrogen		Products are hydrogen and a metal oxide.
Iron			
Lead		Do not burn. Form oxide layer on surface	
Copper	Do not react.		Do not react.
Silver		Do not react.	
Gold			

- More reactive metals displace less reactive metals from compounds.
- Zinc, and metals below it in the reactivity series, are extracted by heating their oxides with carbon.
- Ceramic materials include pottery and brick. They are hard and brittle, with high melting points.
- Polymers have long molecules. There are hundreds of polymers. Each has unique properties that make it suitable for particular purposes.
- A composite material is a mixture of materials. It has properties that are a combination of the properties of the materials in the mixture.

Electricity and Magnetism

- Objects can be charged positively or negatively by transferring electrons.
- Like charges repel and unlike charges attract.
- Electric current is the amount of charge flowing per second. You measure current in amps (A) using an ammeter.
- The potential difference of a cell tells you the size of the push on the charges and how much energy can be transferred by them.
- You measure potential difference in volts (V) using a voltmeter. The rating of a cell or battery tells you the potential difference at which it operates.
- Series circuits contain only one loop, and the current is the same everywhere. Parallel circuits have branches and the current in all the branches adds up to the total current.
- A component with a high resistance has a small current through it. Resistance is measured in ohms (Ω). You can calculate the resistance using the potential difference across a component and the current through it. Insulators have a very high resistance and conductors have a very low resistance.
- Magnets have a north pole and a south pole. Like poles repel and unlike poles attract.
- Magnetic materials feel a force in the region around a magnet called a magnetic field. Magnetic field lines show the pattern of the magnetic field.
- A current flowing in a coil of wire wrapped around a magnetic material is an electromagnet. It behaves like a bar magnet but you can turn it on or off.

- Electromagnets are used in Maglev trains, hospitals and cars.

KS3 Assessment

Modular assessment is carried out after each topic has been studied. These are common to all pupils and completed online. Pupils are provided with a word splat mat to assist with the spelling of tier 3 key scientific terms.

The progress of pupils and groups are continually monitored in order to ensure that the level of curriculum and support is appropriate.

Test results are recorded in line with the school's "I can" framework of mastery, secure, developing, emerging and below.

As we use a numerical scoring system we have developed a sliding scale to fit the above framework for every question to ensure consistent application.

KS3 Matrix

Number of marks available	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Marks gained	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		2	2	2	2	2	2	2	2	2	2	2	2	2	2
			3	3	3	3	3	3	3	3	3	3	3	3	3
				4	4	4	4	4	4	4	4	4	4	4	4
					5	5	5	5	5	5	5	5	5	5	5
						6	6	6	6	6	6	6	6	6	6
							7	7	7	7	7	7	7	7	7
								8	8	8	8	8	8	8	8
									9	9	9	9	9	9	9
										10	10	10	10	10	10
											11	11	11	11	11
												12	12	12	12
													13	13	13
														14	14
															15

Below
Emerging
Developing
Secure
Mastered

At the end of Years 7 and 8 pupils undertake a written exam covering all the modules they have studied throughout the year. Each exam contains one extended writing question.

The data from the exams and modular test results in Years 7 and 8 is used as part of the whole school overview in order to monitor progress, as well as informing decisions regarding grouping and banding for the following academic year.

The modular assessment continues for the three topics studied in Year 9. Towards the end of Science KS3 pupils sit three exams. One in each of the subjects: Biology, Chemistry and Physics. This is practice for their GCSE exams where they sit multiple papers. These results, along with test data are used to inform initial GCSE teaching groups for KS4 commencement in January.

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The Stonehenge School KS4 Science Curriculum Intent.

Pupils studying the following areas during the KS4 program of study which takes place from January of Year 9 until the GCSE examinations in the summer of Year 11.

Working Scientifically and Practical skills are integrated as part of the course and not focussed on independently.

Students follow one of two pathways: AQA Combined Science (Trilogy) or Separate Sciences. Both are taught to Foundation and Higher tier.

The approximate timetable for KS4 is as follows (NB unless otherwise stated this is common to both the Combined and the Separate Science courses):

<table>
<tr><th></th><th>Biology</th><th>Chemistry</th><th colspan="2">Physics</th></tr>
<tr><td rowspan="2">Year 9</td><td>Cell Biology</td><td rowspan="2">Atomic structure and the Periodic Table</td><td colspan="2" rowspan="2">Energy</td></tr>
<tr><td rowspan="2">Organisation</td></tr>
<tr><td rowspan="4">Year 10</td><td rowspan="2">Bonding, Structure, and the Properties of Matter</td><td colspan="2" rowspan="2">Electricity</td></tr>
<tr><td>Infection & Response</td><td>Quantitative Chemistry</td><td colspan="2">Particle Model of Matter</td></tr>
<tr><td>Bioenergetics</td><td>Chemical Changes</td><td colspan="2">Atomic Structure</td></tr>
<tr><td rowspan="4">Homeostasis & Response</td><td>Energy Changes</td><td rowspan="2">Forces</td><td rowspan="2">Space (GCSE Physics only)</td></tr>
<tr><td rowspan="3">The Rate and Extent of Chemical Change</td></tr>
<tr><td rowspan="5">Year 11</td><td rowspan="2">Inheritance, Variation & Evolution</td><td>Organic Chemistry</td><td colspan="2" rowspan="2">Waves</td></tr>
<tr><td>Chemical Analysis</td></tr>
<tr><td rowspan="3">Ecology</td><td>Chemistry of the Atmosphere</td><td colspan="2" rowspan="2">Magnetism & Electromagnetism</td></tr>
<tr><td>Using Resources</td></tr>
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Courses content

GCSE Biology/Combined Science (Biology)

Cell Biology

Cells are the basic unit of all forms of life. In this section we explore how structural differences between types of cells enables them to perform specific functions within the organism. These differences in cells are controlled by genes in the nucleus. For an organism to grow, cells must divide by mitosis producing two new identical cells. If cells are isolated at an early stage of growth before they have become too specialised, they can retain their ability to grow into a range of different types of cells. This phenomenon has led to the development of stem cell technology. This is a new branch of medicine that allows doctors to repair damaged organs by growing new tissue from stem cells.

Organisation

In this section we will learn about the human digestive system which provides the body with nutrients and the respiratory system that provides it with oxygen and removes carbon dioxide. In each case they provide dissolved materials that need to be moved quickly around the body in the blood by the circulatory system. Damage to any of these systems can be debilitating if not fatal. Although there has been huge progress in surgical techniques, especially with regard to coronary heart disease, many interventions would not be necessary if individuals reduced their risks through improved diet and lifestyle. We will also learn how the plant's transport system is dependent on environmental conditions to ensure that leaf cells are provided with the water and carbon dioxide that they need for photosynthesis.

Infection and Response

Pathogens are microorganisms such as viruses and bacteria that cause infectious diseases in animals and plants. They depend on their host to provide the conditions and nutrients that they need to grow and reproduce. They frequently produce toxins that damage tissues and make us feel ill. This section will explore how we can avoid diseases by reducing contact with them, as well as how the body uses barriers against pathogens. Once inside the body our immune system is triggered which is usually strong enough to destroy the pathogen and prevent disease. When at risk from unusual or dangerous diseases our body's natural system can be enhanced by the use of vaccination. Since the 1940s a range of antibiotics have been developed which have proved successful against a number of lethal diseases caused by bacteria. Unfortunately many groups of bacteria have now become resistant to these antibiotics. The race is now on to develop a new set of antibiotics.

Bioenergetics

In this section we will explore how plants harness the Sun's energy in photosynthesis in order to make food. This process liberates oxygen which has built up over millions of years in the Earth's atmosphere. Both animals and plants use this oxygen to oxidise food in a process called aerobic respiration which transfers the energy that the organism needs to perform its functions. Conversely, anaerobic respiration does not require oxygen to transfer energy. During vigorous exercise the human body is unable to supply the cells with sufficient oxygen and it switches to anaerobic respiration. This process will supply energy but also causes the build-up of lactic acid in muscles which causes fatigue.

Homeostasis and Response

Cells in the body can only survive within narrow physical and chemical limits. They require a constant temperature and pH as well as a constant supply of dissolved food and water. In order to do this the body requires control systems that constantly monitor and adjust the composition of the blood and tissues. These control systems include receptors which sense changes and effectors that bring about changes. In this section we will explore the structure and function of the nervous system and how it can bring about fast responses. We will also explore the hormonal system which usually brings about much slower changes. Hormonal coordination is particularly important in reproduction since it controls the menstrual cycle. An understanding of the role of hormones in reproduction has allowed scientists to develop not only contraceptive drugs but also drugs which can increase fertility.

Inheritance, Variation and Evolution

In this section we will discover how the number of chromosomes are halved during meiosis and then combined with new genes from the sexual partner to produce unique offspring. Gene mutations occur continuously and on rare occasions can affect the functioning of the animal or plant. These mutations may be damaging and lead to a number of genetic disorders or death. Very rarely a new mutation can be beneficial and consequently, lead to increased fitness in the individual. Variation generated by mutations and sexual reproduction is the basis for natural selection; this is how species evolve. An understanding of these processes has allowed scientists to intervene through selective breeding to produce livestock with favoured characteristics. Once new varieties of plants or animals have been produced it is possible to clone individuals to produce larger numbers of identical individuals all carrying the favourable characteristic. Scientists have now discovered how to take genes from one species and introduce them in to the genome of another by a process called genetic engineering. In spite of the huge potential benefits that this technology can offer, genetic modification still remains highly controversial.

Ecology

The Sun is a source of energy that passes through ecosystems. Materials including carbon and water are continually recycled by the living world, being released through respiration of animals, plants and decomposing microorganisms and taken up by plants in photosynthesis. All species live in ecosystems composed of complex communities of animals and plants dependent on each other and that are adapted to particular conditions, both abiotic and biotic. These ecosystems provide essential services that support human life and continued development. In order to continue to benefit from these services humans need to engage with the environment in a sustainable way. In this section we will explore how humans are threatening biodiversity as well as the natural systems that support it. We will also consider some actions we need to take to ensure our future health, prosperity and well-being.

GCSE Chemistry/Combined Science (Chemistry)

Atomic Structure and the Periodic Table

The periodic table provides chemists with a structured organisation of the known chemical elements from which they can make sense of their physical and chemical properties. The historical development of the periodic table and models of atomic structure provide good examples of how scientific ideas and explanations develop over time as new evidence emerges. The arrangement of elements in the modern periodic table can be explained in terms of atomic structure which provides evidence for the model of a nuclear atom with electrons in energy levels.

Bonding, Structure, and the Properties of Matter

Chemists use theories of structure and bonding to explain the physical and chemical properties of materials. Analysis of structures shows that atoms can be arranged in a variety of ways, some of which are molecular while others are giant structures. Theories of bonding explain how atoms are held together in these structures. Scientists use this knowledge of structure and bonding to engineer new materials with desirable properties. The properties of these materials may offer new applications in a range of different technologies.

Quantitative Chemistry

Chemists use quantitative analysis to determine the formulae of compounds and the equations for reactions. Given this information, analysts can then use quantitative methods to determine the purity of chemical samples and to monitor the yield from chemical reactions. Chemical reactions can be classified in various ways. Identifying different types of chemical reaction allows chemists to make sense of how different chemicals react together, to establish patterns and to make predictions about the behaviour of other chemicals. Chemical equations provide a means of representing chemical reactions and are a key way for chemists to communicate chemical ideas.

Chemical Changes

Understanding of chemical changes began when people began experimenting with chemical reactions in a systematic way and organising their results logically. Knowing about these different chemical changes meant that scientists could begin to predict exactly what new substances would be formed and use this knowledge to develop a wide range of different materials and processes. It also helped biochemists to understand the complex reactions that take place in living organisms. The extraction of important resources from the Earth makes use of the way that some elements and compounds react with each other and how easily they can be 'pulled apart'.

Energy Changes

Energy changes are an important part of chemical reactions. The interaction of particles often involves transfers of energy due to the breaking and formation of bonds. Reactions in which energy is released to the surroundings are exothermic reactions, while those that take in thermal energy are endothermic. These interactions between particles can produce heating or cooling effects that are used in a range of everyday applications. Some interactions between ions in an electrolyte result in the production of electricity. Cells and batteries use these chemical reactions to provide electricity. Electricity can also be used to decompose ionic substances and is a useful means of producing elements that are too expensive to extract any other way.

The Rate and Extent of Chemical Change

Chemical reactions can occur at vastly different rates. Whilst the reactivity of chemicals is a significant factor in how fast chemical reactions proceed, there are many variables that can be manipulated in order to speed them up or slow them down. Chemical reactions may also be reversible and therefore the effect of different variables needs to be established in order to identify how to maximise the yield of desired product. Understanding energy changes that accompany chemical reactions is important for this process. In industry, chemists and chemical engineers determine the effect of different variables on reaction rate and yield of product. Whilst there may be compromises to be made, they carry out optimisation processes to ensure that enough product is produced within a sufficient time, and in an energy-efficient way.

Organic Chemistry

The chemistry of carbon compounds is so important that it forms a separate branch of Chemistry. A great variety of carbon compounds is possible because carbon atoms can form chains and rings linked by C-C bonds. This branch of chemistry gets its name from the fact that the main sources of organic compounds are living, or once-living materials from plants and animals. These sources include fossil fuels which are a major source of feedstock for the petrochemical industry. Chemists are able to take organic molecules and modify them in

many ways to make new and useful materials such as polymers, pharmaceuticals, perfumes and flavourings, dyes and detergents.

Chemical Analysis

Analysts have developed a range of qualitative tests to detect specific chemicals. The tests are based on reactions that produce a gas with distinctive properties, or a colour change or an insoluble solid that appears as a precipitate. Instrumental methods provide fast, sensitive and accurate means of analysing chemicals, and are particularly useful when the amount of chemical being analysed is small. Forensic scientists and drug control scientists rely on such instrumental methods in their work.

Chemistry of the Atmosphere

The Earth's atmosphere is dynamic and forever changing. The causes of these changes are sometimes man-made and sometimes part of many natural cycles. Scientists use very complex software to predict weather and climate change as there are many variables that can influence this. The problems caused by increased levels of air pollutants require scientists and engineers to develop solutions that help to reduce the impact of human activity.

Using Resources

Industries use the Earth's natural resources to manufacture useful products. In order to operate sustainably, chemists seek to minimise the use of limited resources, use of energy, waste and environmental impact in the manufacture of these products. Chemists also aim to develop ways of disposing of products at the end of their useful life in ways that ensure that materials and stored energy are utilised. Pollution, disposal of waste products and changing land use has a significant effect on the environment, and environmental chemists study how human activity has affected the Earth's natural cycles, and how damaging effects can be minimised.

GCSE Physics/Combined Science (Physics)

Energy

Energy is needed keep organisms alive, chemical reactions to happen and to make objects move, to keep devices such as mobile phones working. It is essential to have an understanding of energy resources, how it can be transferred and how it is measured in a variety of different circumstances.

Electricity

Electric charge is a fundamental property of matter everywhere. Understanding the difference in the microstructure of conductors, semiconductors and insulators makes it possible to design components and build electric circuits. Many circuits are powered with mains electricity, but portable electrical devices must use batteries of some kind. Electrical power fills the modern world with artificial light and sound, information and entertainment, remote sensing and control.

Particle Model of Matter

The particle model is widely used to predict the behaviour of solids, liquids and gases and this has many applications in everyday life. It helps us to explain a wide range of observations and engineers use these principles when designing vessels to withstand high pressures and temperatures, such as submarines and spacecraft.

Atomic Structure

Ionising radiation is hazardous but can be very useful. Although radioactivity was discovered over a century ago, it took many nuclear physicists several decades to understand the structure of atoms, nuclear forces and stability. Early researchers suffered from their exposure to ionising radiation. Rules for radiological protection were first introduced in the 1930s and subsequently improved. Today radioactive materials are widely used in medicine, industry, agriculture and electrical power generation.

Forces

Engineers analyse forces when designing a great variety of machines and instruments, from road bridges and fairground rides to atomic force microscopes. Anything mechanical can be analysed in this way. Recent developments in artificial limbs use the analysis of forces to make movement possible.

Waves

Wave behaviour is common in both natural and artificial systems. Waves carry energy from one place to another and can also carry information. Designing comfortable and safe structures such as bridges, houses and music performance halls requires an understanding of mechanical waves. Modern technologies such as imaging and communication systems show how we can make the most of electromagnetic waves.

Magnetism and Electromagnetism

Electromagnetic effects are used in a wide variety of devices. Engineers make use of the fact that a magnet moving in a coil can produce electric current and also that when current flows around a magnet it can produce movement. It means that systems that involve control or communications can take full advantage of this.

Space

Questions about where we are, and where we came from, have been asked for thousands of years. In the past century, astronomers and astrophysicists have made remarkable progress in understanding the scale and structure of the universe, its evolution and ours. New questions have emerged recently. 'Dark matter', which bends light and holds galaxies together but does not emit electromagnetic radiation, is everywhere – what is it? And what is causing the universe to expand ever faster?

KS4 Assessment

Each of the KS4 topics outlined above follow a common assessment pathway as follows:

Topic checklist

An outline of the key areas of the specification to be taught within this topic is given to each student to attach into their exercise books. The document also contains useful links to further support. Students are also advised to enter revision guide page numbers alongside each specification item as they are addressed in class. This helps them when revising and makes this a working document.

End of Topic assessment test

Each of the items on the checklist are assessed after the topic has been taught. This is done via a paper test.

The tests have been carefully compiled in the department to ensure that every area of the course specification is tested and individual tests are available for Triple/Combined courses, as well as for Higher and Foundation tier papers.

The test is marked by the class teacher.

Progress tracking database

End of topic test scores are recorded on the tracking database for that Year group.

This document is then used for reviewing the progress of individual learners, classes of students and the Year group as a whole.

The data from the modular test results in KS4 are used to monitor progress, as well as informing decisions regarding grouping and tier of entry for external exams.

Modular test results from the previous cohort are compared with their GCSE results (UMS points) to produce correlation tables (see Appendix 2) showing the link between them. These tables are then used to derive progress tracking predictions for current cohorts in line with school policy.

Personal Learning Checklist (PLC)

A common matrix (below) is used to convert marks for each specification item into red/amber/green feedback. This is then recorded on the subject PLC database.

Number of marks available	1	2	3	4	5	6	7	8	9	10	11	12
Marks gained	0	0	0	0	0	0	0	0	0	0	0	0
	1	1	1	1	1	1	1	1	1	1	1	1
		2	2	2	2	2	2	2	2	2	2	2
			3	3	3	3	3	3	3	3	3	3
				4	4	4	4	4	4	4	4	4
					5	5	5	5	5	5	5	5
						6	6	6	6	6	6	6
							7	7	7	7	7	7
								8	8	8	8	8
									9	9	9	9
										10	10	10
											11	11
												12

Feedback sentences

In a lesson subsequent to the test, the students are given a list of feedback sentences in the "I can" format. Using the red/amber/green PLC data, the students colour code each of the "I can" statements to reflect their performance on the test. This is intended to inform their ongoing revision.

Reflect & Improve

In addition to the Feedback Sentences being colour coded, the students are encouraged to reflect on which areas of the topic they have performed well and those which represent areas for improvement. To facilitate immediate improvement, the students are provided with the topic Reflect & Improve sheet. This is a worksheet where every specification item is represented. With the help of exercise books, text books and any other resources available, students then work on improving their areas for improvement by answering the questions coloured red initially, followed by the amber questions.

To provide an opportunity for spaced learning, students are encouraged to return to this sheet periodically through the course to continuously refine their understanding.

THE STONEHENGE SCHOOL

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Appendix 1

KS3 Program of Study

KS3 Schedule

Term 1		Term 2		Term 3	Term 4		Term 5	Term 6
(71/2 weeks)		(7 weeks)	(6 weeks)		(6 weeks)	(5 weeks)		(71/2 weeks)
Forces (5)	Cells (5)	Particles (7)	Sound (5)	Body systems (6)	Elements (4)	Light (5)	Reproduction (8)	Reactions (6)
Cells (5)	Particles (7)	Forces (5)	Body systems (6)	Elements (4)	Sound (5)	Reproduction (8)	Reactions (6)	Light (5)
Cells (5)	Particles (7)	Forces (5)	Body systems (6)	Elements (4)	Sound (5)	Reproduction (8)	Reactions (6)	Light (5)
Forces (5)	Cells (5)	Particles (7)	Sound (5)	Body systems (6)	Elements (4)	Light (5)	Reproduction (8)	Reactions (6)
Cells (5)	Particles (7)	Forces (5)	Body systems (6)	Elements (4)	Sound (5)	Reproduction (8)	Reactions (6)	Light (5)
Particles (7)	Forces (5)	Cells (5)	Elements (4)	Sound (5)	Body systems (6)	Reactions (6)	Light (5)	Reproduction (8)
Particles (7)	Forces (5)	Cells (5)	Elements (4)	Sound (5)	Body systems (6)	Reactions (6)	Light (5)	Reproduction (8)
Forces (5)	Cells (5)	Particles (7)	Sound	Body systems (6)	Elements (4)	Light (5)	Reproduction (8)	Reactions (6)
The Earth (7)	Periodic table (5)	Ecosystems (9)	Motion & pressure (6)	Health (8)	Space (4)	Acids & alkalis (4)	Sep techniques (6)	Energy (8)
The Earth (7)	Periodic table (5)	Ecosystems (9)	Motion & pressure (6)	Health (8)	Space (4)	Acids & alkalis (4)	Sep techniques (6)	Energy (8)
The Earth (7)		Ecosystems (9		Space (4)		Acids & alkalis (4)		
Periodic table (5)	Motion & pressure (6)		Health (8)		Sep techniques (6)		Energy (8)	
Periodic table (5)	Motion & pressure (6)		Health (8)	Sep techniques (6)		Energy (8)	Space (4)	
Ecosystems (9)			Acids & alkalis (4)			The Earth (7)		
Ecosystems (9)	Periodic table (5)		Acids & alkalis (4)		Sep techniques (6)		Health (8)	
The Earth (7)		Space (4)		Motion & pressure (6)		Energy (8)		
Ecosystems (9)	Periodic table (5)	Space (4)	Motion & pressure (6)	Energy (8)	Sep techniques (6)	Acids & alkalis (4)		
Periodic table (5)	Ecosystems (9)	Motion & pressure (6)	Space (4)	Acids & alkalis (4)	Sep techniques (6)	Energy (8)		
The Earth (7)				Health (8)				

gy tions	**Chemistry** Metals and acids	**Physics** Electricity & magnetism	GCSE Course
Revision for end of KS3 exams			

Appendix 2

KS4 Correlation Table

Analysis of UMS verses Progress tracker, Class of 2019

Grade	Combined Higher	Combined Foundation	Biology Higher	Chemistry Higher	Physics Higher
9-9			>84	>84	>78
9-8					
8-8	>73		79 - 83	76 - 83	72 - 77
8-7	71 – 72				
7-7	69 – 70		75 – 78	68 - 75	66 - 71
7-6	66 – 68				
6-6	63 – 65		68 - 74	61 - 67	58 - 65
6-5	61- 62				
5-5	58 - 60	>53	63 - 67	53 - 60	51- 57
5-4	55 – 57	49 - 52			
4-4	53 - 54	45 – 48	56 - 62	46 - 52	44 - 50
4-3	51 - 52	40 – 44			
3-3	<51	36 – 39	53 - 55	42 - 45	40 - 43
3-2		31 – 35			
2-2		26 - 30			
2-1		21 - 25			
1-1		17 – 20			
0		<17			

When assigning grades to Combined Science groups consider whether they will be entered at F or H tier and then use the appropriate column.