SCIENCE

Scheme of Work for Academic Year September 2024 - July 2025

	Lesson	Term 1	Lesson	Term 2	Lesson	Term 3	Lesson	Term 4	Lesson	Term 5	Lesson	Term 6
Class		**Materials: Mixtures and separation**		**Properties and Changes**		**Forces and Space : Earth and Space**		**Life Cycles and Reproduction**		**Forces and space: Unbalanced forces**		**Human Timeline and Making Connections**
KS2 - Year 1	1	Knowledge: To describe mixtures. Working scientifically: To research using a range of secondary resources.	1	Knowledge: To determine the hardness of materials and link this to their uses. Working scientifically: To evaluate the hardness test to determine the degree of trust in the results.	1	Knowledge: To compare the contributions of Ptolemy, Alhazen and Copernicus to models of the Solar system. Working scientifically: To pose testable questions about the solar system.	1	Knowledge: To describe the life cycle of a plant, including the reproductive stage. Working scientifically: To observe and compare equivalent parts in different flowers.	1	Knowledge: To describe gravity and its effects. Working scientifically: To analyse data to write a conclusion.	1	Knowledge: To describe how humans change from babies through to old age. Working scientifically: To use a line graph to identify patterns in height and predict values.
	2	Knowledge: To explain the process of sieving. Working scientifically: To draw and annotate a diagram to explain a concept.	2	Knowledge: To determine the transparency of different materials and link this to their uses. Working scientifically: To plan and draw a table of results.	2	Knowledge: To describe the movement and shapes of the celestial bodies in our Solar System. Working scientifically: To develop a model to represent the Solar System.	2	Knowledge: To describe the life cycle of a mammal. Working scientifically: To research the life cycles of different mammals.	2	Knowledge: To describe air resistance and its effects. Working scientifically: To plan a fair test to investigate air resistance.	2	Knowledge: To identify changes in males and females as a result of puberty.
	3	Knowledge: To explain the process of filtering. Working scientifically: To identify testable questions and how to answer them.	3	Knowledge: To determine the conductivity of different materials and link this to their uses. Working scientifically: To write a detailed, organised method that is easy to follow.	3	Knowledge: To describe the movement of the Moon relative to the Earth. Working scientifically: To design and draw a table.	3	Knowledge: To describe the life cycle of a bird and compare it with that of a mammal. Working scientifically: To pose questions to compare the life cycles of different birds.	3	Knowledge: To describe water resistance and its effects. Working scientifically: To design a results table.	3	Knowledge: To explore the gestation periods of humans and other animals. Working scientifically: To plot data on a scatter graph.
	4	Knowledge: To describe solutions and how they can be identified. Working scientifically: To make observations about solutions.	4	Knowledge: To demonstrate reversible changes. Working scientifically: To write a prediction using prior knowledge of the states of matter.	4	Knowledge: To explain the causes of day and night and the seasons. Working scientifically: To draw a diagram to explain day and night.	4	Knowledge: To describe the life cycle of an amphibian. Working scientifically: To suggest how temperature may affect egg hatching.	4	Knowledge: To describe friction and its effects. Working scientifically: To evaluate a method.	4	Knowledge: To revise the units Earth and space and Life cycles and reproduction. Working scientifically: To plan a comparative test.
	5	Knowledge: To identify which factors affect the time taken to dissolve. Working scientifically: To plan a fair test with consideration of variables and measurements.	5	Knowledge: To demonstrate irreversible changes. Working scientifically: To analyse observations about rusting and use them to support a conclusion.	5	Knowledge: To devise a sundial to tell the time. Working scientifically: To calibrate and use a sundial to measure time.	5	Knowledge: To describe the life cycle of an insect and compare it with that of an amphibian. Working scientifically: To use data to describe a relationship and make predictions.	5	Knowledge: To describe the effects of levers, pulleys and simple machines on movement. Working scientifically: To draw and label a diagram.	5	Knowledge: To revise the units Unbalanced forces and Mixtures and separation. Working scientifically: To gather and record data.
	6	Knowledge: To describe the process of evaporation.	6	Knowledge: To demonstrate irreversible changes. Working scientifically: To measure the circumference of a balloon accurately.	6	Science in action: To describe some uses of satellites and the problems posed by space junk. Working scientifically: To use temperature data to make predictions about climate change.	6	Knowledge: To describe asexual reproduction in plants. Working scientifically: To represent root growth over time on a line graph.	6	Knowledge: To describe the relationship between lever length and effort. Working scientifically: To draw an accurate line graph.	6	Knowledge: To revise the units Separating mixtures and Unbalanced forces. Working scientifically: To conclude and evaluate the investigation.
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	Lesson	Term 1	Lesson	Term 2	Lesson	Term 3	Lesson	Term 4	Lesson	Term 5	Lesson	Term 6
Class		**Living things: Classifying big & small**		**Light and Reflection**		**Evolution and inheritance**		**Circuits, batteries and switches**		**Enter This Term's Topic in this box**		**Making connections: Are some sunglasses safer than others?**
KS2 - Year 2	1	To explain how organisms are classified using the Linnaean system.	1	To describe the pathway of light. Working scientifically: To use evidence to form conclusions.	1	Knowledge: To explain why there are differences within a species. Working scientifically: To group factors.	1	Knowledge: To use recognised symbols for electrical components.	1	Knowledge: To identify factors that affect our health and how to reduce their negative impact. Working scientifically: To evaluate sources of information.	1	Knowledge: To revise the units Circulation and health and Light and reflection. Working scientifically: To plan a comparative test.
	2	To classify the cold-blooded vertebrate groups using their common characteristics.	2	To describe how we see. Working scientifically: To draw scientific diagrams.	2	Knowledge: To recognise the inheritance of characteristics in plants and animals.	2	Knowledge: To predict and present results for electrical circuits. Working scientifically: To use standardised symbols when drawing diagrams.	2	Knowledge: To summarise the key structures and purpose of the circulatory system.	2	Knowledge: To revise the units Light and reflection and Circuits, batteries and switches. Working scientifically: To gather and record data.
	3	To classify the warm-blooded vertebrate groups using their common characteristics.	3	To explain how shadows change. Working scientifically: To pose questions.	3	Knowledge: To explain why adaptation is necessary.	3	Knowledge: To recognise a link between the number of components and resistance. Working scientifically: To explain results using scientific knowledge.	3	Knowledge: To identify the key roles of blood. Working scientifically: To evaluate a model.	3	Knowledge: To revise the units Light and reflection and Circulation and health. Working scientifically: To conclude and evaluate the investigation.
	4	To classify invertebrates.	4	To investigate what affects the angle of the reflected ray. Working scientifically: To record results as a line graph.	4	Knowledge: To model how natural selection affects population size. Working scientifically: To evaluate the degree of trust and pose new questions for further enquiry.	4	Knowledge: To identify ways to change voltage within an electrical circuit. Working scientifically: To design a results table.	4	Knowledge: To explore the relationship between animal size and heart rate. Working scientifically: To interpret patterns in data.	4	Knowledge: To revise the units Classifying big and small, Evolution and inheritance, Light and reflection and Circulation and health. Working scientifically: To use further data to inform a conclusion.
	5	To describe how the plant kingdom is organised (based on shared characteristics). Working scientifically: To produce a working classification key.	5	To explain how a periscope works.	5	Knowledge: To model how natural selection affects population size. Working scientifically: To evaluate the degree of trust and pose new questions for further enquiry.	5	Knowledge: To investigate how voltage affects bulb brightness. Working scientifically: To plan an enquiry.	5	Knowledge: To investigate the relationship between exercise and heart rate. Working scientifically: To write a method.	5	Knowledge: To revise the units Light and reflection and Circulation and health. Working scientifically: To report on findings in the form of an advert.
	6	To describe and classify micro-organisms.	6	To explain how mirrors are helpful. Science in action: To explore different jobs or inventions that depend on reflection.	6	Knowledge: To recognise evidence that can be used for evolution. Working scientifically: To consider the degree of trust in the evidence used.	6	Knowledge: To apply knowledge of circuits and components to a practical solution. Science in action: To recognise that scientific knowledge can solve a problem.	6	Knowledge: To describe the relationship between heart rate and fitness. Working scientifically: To draw a line graph.	6	
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	Lesson	Term 1a	Lesson	Term 1b	Lesson	Term 2a	Lesson	Term 2b	Lesson	Term 3a	Lesson	Term 3b
Class		**7A:Cells, Tissues, Organs and Systems / Mixtures and Separations**		**7E:Mixtures and Separations**		**7I:Energy**		**7B:Sexual reproduction in animals**		**7F:Acids and alkalis**		**7J:Current electricity**
KS3 Year 1 - TERMS 1, 2 and 3	1, 2 and 3	- To undertake a Baseline Science Test to ascertain prior knowledge - Describe the life processes. - Use life processes to justify whether something is an organism or is non-living.	10, 11 and 12	- Group materials using their states of matter as justification. - Classify mixtures as suspensions, colloids and solutions, based on what they look like and whether they separate on standing.	1, 2 and 3	Explain the differing energy needs of people of different ages and activity levels	10, 11 and 12	- Compare the amount of care of offspring in fish, birds and mammals. - Compare the sexual reproduction of fish, birds and mammals. - Describe how the fusing of gametes and their nuclei during fertilisation forms a fertilised egg cell.	1, 2 and 3	- Describe how to reduce the risk from acids by dilution. - Describe the difference between substances that are corrosive or irritants. - State the meaning of hazard.	10, 11 and 12	- Describe the effects of breaking or removing bulbs in a circuit. - Describe and explain how adding more bulbs affects the brightness of bulbs in a circuit. - Construct a circuit from instructions provided in the form of a circuit diagram. - Describe how changing the number or type of components in a circuit affects the current. - Describe what the current is like at different points in a series circuit. - Recall the link between current and bulb brightness. - Use the idea of a complete circuit to test whether different materials conduct electricity.
		- Describe the functions of a large range of human, animal and plant organs. - Describe what happens in photosynthesis.		- Describe how factors affect how much of a substance dissolves. - Describe how we know that different solutes have different solubilities.		- Identify situations in which an energy transfer is taking place. - Identify situations in which energy is stored. - Recall the law of conservation of energy. - Describe energy transfer chains for given situations		- Suggest outcomes caused by problems with reproductive organs. - Use knowledge of the positions or shapes of reproductive organs to make deductions about reproductive processes. - Compare the reproductive systems of humans and other animals. - Explain how sperm cells and egg cells are adapted to their functions.		- Use solutions of known acidity/alkalinity in order to deduce a colour chart for an indicator. - Explain why litmus is purple in neutral solutions.		- Construct a circuit from instructions provided in the form of a circuit diagram. - Use a model to describe how an electrical circuit works.
	4, 5 and 6	- Calculate total microscope magnification using a formula. - Describe how to prepare a microscope slide. - Describe how to use a light microscope to examine a slide. - Describe the functions of different tissues in an organ. - Describe the functions of the parts of a light microscope.	13, 14 and 15	- Use a knowledge of dissolving to decide how mixtures should be separated.	4, 5 and 6	- Describe the factors that make up a good fuel. - Describe what happens in a fuel cell. - Compare the temperature rise of water when some fuels are burnt.	13, 14 and 15	- Describe how materials are supplied and removed from the foetus. - Describe what happens during cell division. - Explain how identical and non-identical twins occur.	4, 5 and 6	- Describe solutions as being more or less acidic/alkaline by comparing their pHs. - Describe the use of universal indicator and pH meters to determine the pH of a solution.	13, 14 and 15	- Analyse a given parallel circuit and say which components will be on or off with different combinations of switches closed. - Construct a circuit from instructions provided in the form of a circuit diagram. - Describe how changing the number or type of components in a circuit affects the current. - Explain how switches can be used to control different parts of a parallel circuit. - Explain why the lights in a house are wired in parallel. - Recall the link between current and bulb brightness. -Recall the differences between how current behaves in series and parallel circuits and describe and predict what the current is like at different points in a series circuit and parallel circuit.
		- Describe the function of mitochondria. - Describe what the [cell wall, permanent vacuole, chloroplasts] do. - Describe what the [nucleus, cell membrane, cytoplasm] do. - Identify mitochondria. - Identify the contents of plant cells in unfamiliar plants.		- Explain how chromatography works, and interpret a chromatogram.		- Identify situations in which an energy transfer is taking place. - Identify situations in which energy is stored. - Explain how the Sun is the ultimate source of the energy used in renewable resources. - Describe what happens in a fuel cell. - Describe advantages and disadvantages of different renewable, energy resources.		- Identify stages of growth from embryo to newborn baby and recall how these stages can be checked. - Describe the effects of some substances that may harm a developing foetus. - Describe what happens during labour and birth in humans. - Explain why breast milk is best for newborn babies.		- Describe the reactions of acids with alkalis (including the salts produced by hydrochloric, sulfuric and nitric acids). - Explain how everyday examples of neutralisation are useful (changing the pH of soils). - Model simple reactions using word equations		- Describe how the resistance of a wire varies with its length and thickness. - Describe how voltage varies in a parallel circuit. - Describe the relationship between resistance and current. - Explain why the current increases when the voltage of the supply is increased. - Explain how a variable resistor works. - Describe how voltage is divided between the components in a series circuit.
	7. 8 and 9	- Correctly use the word: urine. - Identify and recall the main parts of the urinary system. - Identify organs working together as a system. - Identify the main parts of the nervous system. - State the function of the nervous system. - State the function of the urinary system. - Describe what the parts of the nervous system are made of.	16, 17 and 18	- Explain how distillation works. - Securing: Identify factors that could affect distillation.	7. 8 and 9	- Identify situations in which an energy transfer is taking place. - Identify situations in which energy is stored. - Suggest ways in which our use of fossil fuels/non-renewable fuels can be reduced. - Explain how the levels of greenhouse gases in the atmosphere can be prevented from increasing further. - Explain the source of the energy in fuels. - Explain how certain gases cause the greenhouse effect. - Identify useful and wasted energies. - Describe advantages and disadvantages of different renewable, energy resources.	16, 17 and 18	- Compare the life cycles of different animals. - Identify the role of sex hormones in puberty. - Describe what happens to parts of the body during puberty and adolescence. - Explain the purpose of the menstrual cycle. - Use knowledge of the menstrual cycle to predict timings (e.g. of menstruation, ovulation, fertile period).	7. 8 and 9	- Describe the reactions of acids with bases. - Explain how everyday examples of neutralisation are useful (antacids, toothpastes, treating waste gases, rust removal).	16, 17 and 18	- Explain some safety precautions to be followed when using electricity. - Explain why electricity is more convenient than other sources of energy, and classify some of its uses. - Explain how a domestic ring main is a form of parallel circuit. - Explain how a fuse works. - Identify errors in the wiring of a plug.
		- To undertake an end of Topic Test to ascertain knowledge		- To undertake an end of Topic Test to ascertain knowledge		- To undertake an end of Topic Test to ascertain knowledge		- To undertake an end of Topic Test to ascertain knowledge		- To undertake an end of Topic Test to ascertain knowledge		- To undertake an end of Topic Test to ascertain knowledge

	Lesson	Term 4a	Lesson	Term 4b	Lesson	Term 5a	Lesson	Term 5b	Lesson	Term 6a	Lesson	Term 6b
Class		**7C:Muscles and Bones**		**7G:The particle model**		**7K:Forces**		**7D:Ecosystems**		**7H: Atoms, elements and compounds**		**7L: Sound**
		- Use a model to explain how lungs expand and contract. - Identify muscles cells as being adapted to their function.		- Describe the properties of the three states of matter in terms of shape, volume and compressibility. - Explain what a landfill site is and some of the problems they cause.		- Describe how to use a force meter, newtonmeter. - Recall the direction in which gravity acts. - Recall the unit for measuring forces. - State what is meant by: mass, weight. - Identify situations and places where different forces are likely to be found. - Classify forces as contact and non-contact. - Explain the difference between mass and weight. - Represent sizes and directions of forces using arrows.		- Tell the difference between and identify examples of continuous and discontinuous variation. - Correctly use the term: species.		- Explain, in terms of atoms and particles, how air is a mixture of elements, compounds, atoms and molecules. - Represent atoms, molecules of elements and simple compounds using a model.		- Relate the size of a source of sound to the pitch of the sound it produces. - Relate the volume/intensity of a sound to the size of the vibrations producing it.

KS3 Year 1 - TERMS 4, 5 and 6

	1, 2 and 3	- Describe the structure of red blood cells. - Describe the functions of red blood cells, white blood cells and plasma. - Explain how the structure of capillaries is related to their function. - Explain why the left-hand side of the heart has a thicker muscle wall than the right-hand side.	10, 11 and 12	- Describe the properties of the three states of matter in terms of shape, volume and compressibility. - Explain what a landfill site is and some of the problems they cause. Some students could:	1, 2 and 3	- Describe how the extension of a spring depends on the force applied. - Explain what is meant by elastic limit, limit of proportionality.	10, 11 and 12	- Correctly use the terms: community, ecosystem. - Explain how inherited variation is caused (does not include genes). - Explain how particular adaptations increase the chances of survival.	1, 2 and 3	- Explain the advantages of recycling metals. - Describe how some elements are found in their native states. - Explain how new evidence has changed ideas about elements. - Explain why some elements have been known for much longer than others.	10, 11 and 12	- Recall that sound does not travel as quickly as light. - Use a model incorporating the idea of vibrations to explain how sound travels through different materials. - Describe how fast sound is transmitted by solids, liquids, gases. - Calculate the speed of sound from data about echoes. - Recall that waves transfer energy without transferring matter. - Use quantitative data to compare the speed of sound in solids, liquids, gases. - Use the terms frequency, amplitude, speed to describe waves. - Draw the arrangement of particles in a solid, liquid and gas. - Explain why sounds are fainter further from the source in terms of the waves spreading out.
	4, 5 and 6	- Classify joints as different types. - Describe the basic parts of joints. - Use a knowledge of bones and joints to identify problems with them.	13, 14 and 15	- Convert metres to nanometres and vice versa. - Explain how Brownian motion occurs, using particle theory.	4, 5 and 6	- Recall some effects of frictional forces. - Explain some ways in which friction can be changed. - Suggest how and why friction has been reduced or increased in unfamiliar situations..	13, 14 and 15	- Explain how changes in a physical environmental factor in a habitat affect populations and communities. - Explain how environmental variation is caused. - Explain how particular adaptations increase the chances of survival.	4, 5 and 6	- Use evidence to classify unfamiliar materials as being metal elements, metallic, non-metal elements, non-metallic. - Use ideas about the periodic table to identify the positions of metal and non-metal elements.	13, 14 and 15	- Evaluate different materials used for soundproofing/ sound insulation. - Describe how microphones convert sound into electrical signals. - Describe the functions of the parts of the ear. - Recall the units for loudness.
		- State the function of and the parts in the locomotor system and correctly use the terms: locomotor system, biomechanics. - Describe how muscle action is controlled by nervous impulses. - Describe the action of the biceps and triceps as an example of an antagonistic pair. - Explain why antagonistic muscles are used to operate bones in many joints.		- Explain why the speed of diffusion in gases is faster than in liquids. - Recognise examples of diffusion causing problems. - Explain how diffusion occurs in terms of movement of particles.		- Recall some common units for measuring pressures. - Use the formula relating force, pressure and area.		- Describe how the distribution of organisms is controlled by the availability of resources. - Explain how changes in a population or community in an ecosystem affect other populations. - Explain why organisms are in competition in a given habitat. - Use food webs to predict the effects of changes in populations.		- Name simple compounds formed from two elements. - Recall that temperature changes occur during many chemical reactions. - Represent atoms, molecules of elements and simple compounds using a model.		- Explain how sonar and echolocation work.
	7, 8 and 9	- Recall the short- and long-term effects of commonly abused substances. - Explain the effects of stimulants and depressants on the body by reference to the nervous system. - Explain the short- and long-term effects of alcohol.	16, 17 and 18	- Describe what a vacuum is. - Explain the ways in which gas pressure can be increased (more particles introduced into a container, container is made smaller, gas is heated). - Explain some of the effects of air pressure (e.g. using a straw, collapsing can).	7, 8 and 9	- Identify situations in which an energy transfer is taking place. - Identify situations in which energy is stored. - Suggest ways in which our use of fossil fuels/non-renewable fuels can be reduced. - Explain how the levels of greenhouse gases in the atmosphere can be prevented from increasing further. - Explain the source of the energy in fuels. - Explain how certain gases cause the greenhouse effect. - Identify useful and wasted energies. - Describe advantages and disadvantages of different renewable, energy resources.	16, 17 and 18	- Sketch pyramids of numbers. - Explain the effects of some persistent pesticides on ecosystems. - Interpret models of energy transfer (pyramids of numbers).	7, 8 and 9	- Describe what happens during thermal decomposition of a metal carbonate. - Model simple reactions using word equations. - Name compounds that contain two elements plus oxygen. - Recall examples of energy being used to start a chemical reaction or keep it going.	16, 17 and 18	- Explain why the intensity of sound waves decreases with increasing distance from a source in terms of the waves spreading out. - Model transverse and longitudinal waves. - State the meaning of superposition, and give examples. - Compare longitudinal and transverse waves.
		- To undertake an end of Topic Test to ascertain knowledge		- To undertake an end of Topic Test to ascertain knowledge		- To undertake an end of Topic Test to ascertain knowledge		- To undertake an end of Topic Test to ascertain knowledge		- To undertake an end of Topic Test to ascertain knowledge		- To undertake an end of Topic Test to ascertain knowledge
	Lesson	**Term 1a**	Lesson	**Term 1b**	Lesson	**Term 2a**	Lesson	**Term 2b**	Lesson	**Term 3a**	Lesson	**Term 3b**
Class		**8A:Food and Nutrition**		**8E:Combustion**		**8I:Fluids**		**8B:Plants and Reproduction**		**8F:The Periodic Table**		**8J:Light**
	1, 2 and 3	- Describe tests for fat and starch. - Describe the uses of fibre and water by the body. - Interpret results from simple food tests (e.g. fat, starch, protein, vitamin C).	10, 11 and 12	- Recall the fuel used in a fuel cell. - Explain the formation of the products when hydrocarbons burn. - Model reactions using word equations.	1, 2 and 3	- Describe how the volumes and densities of substances change at different temperatures. - Explain how density depends on mass and volume. - Identify some consequences of changing the temperature of objects or substances, such as structures expanding or contracting. - Use the particle model of matter/particle theory to explain density changes at different temperatures.	10, 11 and 12	- Explain why preserving biodiversity is important (useful products, organism interactions, enriches our lives, disaster recovery). - Identify the genus and species names from a binomial name.	1, 2 and 3	- Use the idea of atoms to explain why different elements have different physical properties.	10, 11 and 12	- Represent the path of light as straight lines with arrows on diagrams and describe how you can demonstrate that light travels in straight lines. - Compare longitudinal and transverse waves.
		- Describe the relationships between diet, exercise, age, sex and energy. - Explain why body mass changes if energy input into the body does not match energy output. - Recall sources of some individual vitamins and mineral salts (e.g. vitamin A, vitamin C, calcium, iron).		- Explain the change in mass seen in reactions. - Compare and contrast the oxygen and phlogiston theories for combustion.		- Describe the effect of physical weathering on rocks and explain it in terms of expansion and contraction. - Explain what happens to particles and temperature during changes of state, in terms of energy and forces.		- Explain how inherited variation is caused (does not include genes). - Explain the difference in outcomes of asexual and sexual reproduction in plants.		- Describe how atoms are rearranged in chemical reactions. - Interpret formulae to identify the types of and ratio of atoms in a compound. - Model more complex chemical reactions using word equations. - Write simple chemical formulae from information on structure.		- State the meaning of: diffuse, specular, incident ray, reflected ray. - Use ray diagrams to explain the law of reflection and to describe the differences in light reflected from smooth and rough surfaces. - Use the ray model of light to explain how a periscope works. - Describe the characteristics of the image formed by a plane mirror and use ray diagrams to explain its formation.
TERMS 1, 2 and 3		- Describe the effects of obesity on health. - Explain the links between specific forms of malnutrition, diet and lifestyle. - Interpret Reference Intake (RI) information. - Recall and identify examples of deficiency diseases (kwashiorkor, scurvy, rickets). - Use dietary advice and nutrition information to design a healthy diet.		- Compare the temperature rise of water when some fuels are burnt. - Describe what is meant by exothermic changes. - Apply knowledge of explosive reactions to explain why they occur more/less rapidly when variables (proportion of fuel/oxygen mixture, the droplet size, the oxidiser) are changed.		- Explain some effects caused by air or water pressure using ideas about forces. - Use the particle model of matter to explain atmospheric pressure in different situations. - Explain why pressure in a fluid increases with depth. - Use the particle model of matter to explain why gas pressure changes with temperature, number of particles and volume.		- Describe how plants avoid self-pollination. - Describe how the structures of a flower are adapted to their functions. - Identify pollen grains and ovules as containing the male and female gametes. - Explain how some pollen grains are adapted to their functions. - Explain why plants try to avoid self-pollination.		- Explain how Mendeleev made predictions using his table. - Recall the typical properties of alkali metals. - Recall the typical properties of halogens. - Describe how the periodic table is arranged (in terms of elements in groups of similar properties).		- Explain why refraction occurs. - Relate the power of a lens to its shape. - State the meaning of focal length, focus, and principal axis.

KS3 Year 2- TE

	4, 5 and 6	- Describe what happens during ingestion, absorption and egestion. - Explain how food is moved through the digestive system. - Use a model to describe basic enzyme action.	13, 14 and 15	- Explain how neutralisation can be used to reduce pollution from fossil fuel combustion. - Explain how sulfur dioxide and nitrogen oxides are produced in some combustion reactions. - Explain how sulfur dioxide and nitrogen oxides help to cause acid rain. - Explain how vehicle catalytic converters work (to reduce pollution from fossil fuel combustion). - Explain the effects of acid rain on organisms, bodies of water. - Explain the problems caused by incomplete combustion. - Explain the products formed by the complete and incomplete combustion of hydrocarbons.	4, 5 and 6	- Work out if something will float. - Use ideas about density changes to explain how a hot air balloon flies/how the depth of a submarine is controlled.	13, 14 and 15	- Evaluate different methods of seed dispersal. - Explain the functions of the different parts of a seed. - Explain the importance of seed dispersal.	4, 5 and 6	- Recall there is usually a regular gradation in physical properties as you go down a group. - Use data to identify trends in physical properties within a group.	13, 14 and 15	- Describe how secondary colours of or white light can be made from primary colours of light. - Describe some examples of the absorption of energy transferred by light leading to chemical or electrical effects (in the retina or in a camera sensor). - Use ray diagrams to explain image formation in pinhole cameras. - Describe similarities and differences between cameras and eyes. - Describe the way our eyes detect different colours. - Identify which parts of the eye cause refraction of light and describe how light is focused on the retina.
	7, 8 and 9	- Explain how the cells in the small intestine are adapted to absorb nutrients quickly. - Explain how the structure of the small intestine allows efficient absorption of the soluble products of digestion. - Use a knowledge of diffusion to explain how nutrients enter the blood from the small intestine.	16, 17 and 18	- State the meaning of the greenhouse effect. - Explain how carbon dioxide helps to cause the greenhouse effect. - Explain how methods of controlling the levels of carbon dioxide work.	7, 8 and 9	Describe the causes of air and water resistance. - Describe the ways in which the size of drag forces can be changed. - Explain why a vehicle needs a force from the engine to keep moving at a constant speed.	16, 17 and 18	- Describe examples of interdependence and explain how changes in a population or community in an ecosystem affect other populations. - Explain the importance of pollination for the production of foods - Explain the need for the different resources by a seed as it germinates. - Explain how and why some seeds are prevented from germinating until a certain time.	7, 8 and 9	- Compare the physical and chemical properties of metal and non-metal oxides. - Recall there is usually a regular gradation in chemical properties as you go down a group. - Identify a pattern of reactivity in the reaction between some alkali metals and water and use this to predict the reactivity of other alkali metals. - Use data to identify trends in chemical properties within a group.	16, 17 and 18	- Explain how filters can be used to make coloured light. - Explain why coloured objects appear coloured. - Explain why objects look different in light of different colours.
		- To undertake an end of Topic Test to ascertain knowledge		- To undertake an end of Topic Test to ascertain knowledge		- To undertake an end of Topic Test to ascertain knowledge		- To undertake an end of Topic Test to ascertain knowledge		- To undertake an end of Topic Test to ascertain knowledge		- To undertake an end of Topic Test to ascertain knowledge
	Lesson	Term 4a	Lesson	Term 4b	Lesson	Term 5a	Lesson	Term 5b	Lesson	Term 6a	Lesson	Term 6b
Class		8C:Breathing and Respiration		8G:Metals and Their Use		8K:Energy Transfers		8D:Unicellular Organisms		8H:Rocks		8L:Earth and Space
KS3 Year 2 - TERMS 4, 5 and 6	1, 2 and 3	- Compare burning (combustion) and respiration. - Model aerobic respiration using a word equation.	10, 11 and 12	- Describe some applications of catalysts in everyday use. - Describe how catalysts affect the speed or rate of a reaction. - Model simple reactions of metals and non-metals using word equations. - Name the compounds formed by a reaction between a metal and a non-metal.	1, 2 and 3	- Describe the factors that affect the rate of transfer of energy by heating. - Use the particle model of matter to explain energy transfer by evaporation from a surface.	10, 11 and 12	- Use the key characteristics of microorganism cell structure to classify microorganisms. - Justify the lack of a virus kingdom.	1, 2 and 3	- Explain why certain rocks are used for certain applications. - Relate features of a landscape to the type of rock and how it has weathered.	10, 11 and 12	- Use a model to explain why we see phases of the Moon. - Explain how technological developments have increased our knowledge of the Solar System. - Explain why the heliocentric model is our current model of the Solar System.
		- Use a pressure model to explain ventilation. - Explain how specialised cells keep the lungs clean (mucus production and ciliated epithelial cells). - Explain how the lungs are adapted for efficient gas exchange.		- Explain how barrier methods protect iron from rust. - Model simple oxidation reactions using word equations. - Identify the products and reactants using a symbol equation.		- Compare conduction in thermal conductors and thermal insulators. - Explain the process(es) in which energy is transferred by heating in a given situation. - Compare conduction, convection, radiation and evaporation as methods of heat energy transfer.		- Describe how yeast multiply by budding. - Describe what is happening in the different parts of a growth curve.		- Use crystal size to classify igneous rocks as intrusive and extrusive. - Explain the variation in crystal size in an igneous intrusion, in terms of cooling rate		- Use a model to explain the changes in the seasons. - Use a model to explain why the height of the Sun at noon and hours of daylight vary with latitude. - Use a model to explain the pattern of light and dark at the poles. - Explain the effect of the tilt of the Earth's axis on the energy received from the Sun.
	4, 5 and 6	- Explain some of the effects of reduced oxygen supply on the body. - Explain the changes in heartbeat and breathing rate during exercise. - Explain the effects of some chemicals in tobacco smoke on the body.	13, 14 and 15	- Identify and explain the products formed by the reactions of metals with water. - Model simple reactions of metals and water using word equations. - Use information on the reactions of metals with water to place them in an order of reactivity. - Supply missing reactants or products to complete a symbol equation.	4, 5 and 6	- Compare the effects of different rates of conduction in different materials. - Evaluate ways of increasing or decreasing energy transfer by conduction, convection, radiation and evaporation.	13, 14 and 15	- Describe how bacteria multiply by binary fission. - Explain why bacteria grow well in certain conditions.	4, 5 and 6	- Compare the fragment sizes that can be transported by wind, water and ice. - Describe how weathering can break up rocks.	13, 14 and 15	- Explain how a compass can be used together with maps for navigation. - Describe the Earth's magnetic field and explain why a magnetic compass needle points north. - Explain how a plotting compass can be used to show the shape and direction of a magnetic field.
		- Compare the human gaseous exchange system with those of other animals. - Describe how gas exchange occurs in plants.		- Model simple reactions of metals and acids using word equations. - Use information on the reactions of metals with acids to place them in order of reactivity. - Model simple reactions using symbol equations.		- Calculate energy efficiencies. - Explain why the efficiency can never be greater than 100%. - Use Sankey diagrams to compare appliances or processes.		- Explain the functions of light and chlorophyll in photosynthesis (in terms of energy transfer). - Model photosynthesis using a word equation.		- Appreciate the different timescales involved in different rock cycle processes, and give examples of fast and slow processes. - Relate the grain size and roundness to transport history. - Use the rock cycle model to link the formation of igneous, sedimentary and metamorphic rocks. Securing: Describe how fossils are formed.		- Use gravitational field strength to calculate weights. - Describe how gravity affects bodies in space. - Describe how mass and distance affect the strength of gravity.
	7, 8 and 9	- Explain why anaerobic activity cannot be sustained. - Model anaerobic respiration using a word equation. - Recall that anaerobic respiration releases less energy than aerobic respiration. - Analyse and explain the changes in heartbeat and breathing rate during and after exercise (including EPOC/oxygen debt).	16, 17 and 18	- Describe how impurities alter melting, freezing and boiling points. - Identify a pure substance from its melting or boiling point. - State that a pure material has a fixed melting point and boiling point. - Use models to explain why converting pure metals into alloys often increases the strength of the product.	7, 8 and 9	- Evaluate different ways of keeping something warm. - Use data to consider cost efficiency by calculating payback times.	16, 17 and 18	- Make predictions about how changes in physical and biological factors will affect carbon supply in an ecosystem.	7, 8 and 9	- Evaluate the environmental effects of quarrying and mining. - Explain the advantages of recycling metals. - Recall how metals are extracted from ores taken from the Earth's crust.	16, 17 and 18	- Explain that stars in a constellation only appear to be close to each other. - Compare the relative sizes and distances of objects in space.
		- To undertake an end of Topic Test to ascertain knowledge		- To undertake an end of Topic Test to ascertain knowledge		- To undertake an end of Topic Test to ascertain knowledge		- To undertake an end of Topic Test to ascertain knowledge		- To undertake an end of Topic Test to ascertain knowledge		- To undertake an end of Topic Test to ascertain knowledge
	Lesson	Term 1a	Lesson	Term 1b	Lesson	Term 2a	Lesson	Term 2b	Lesson	Term 3a	Lesson	Term 3b
Class		9A:Genetics and Evolution		9E:Making Materials		9I:Forces and Motion		9B:Plant Growth		9F:Reactivity		9J-Forcefields and Electromagnets
	1, 2 and 3	- Explain why environmental variation can confuse the idea of a species and make classification and identification difficult.	10, 11 and 12	- Explain how the properties of a substance depend on the bonding and arrangement of atoms (in terms of strength and number of bonds only). - Explain why crystal size depends on the speed of cooling. - Justify the use of a ceramic material for a given application.	1, 2 and 3	- Calculate the resultant of forces acting along the same line. - Explain why vehicles or other moving objects have a top speed.	10, 11 and 12	- Explain how the rate of photosynthesis can be controlled by a limiting factor. - Use the word equation to identify factors that would affect the rate of photosynthesis.	1, 2 and 3	- Use the kinetic theory to explain why gas pressure increases or decreases as the temperature, number of particles or volume changes.	10, 11 and 12	- Describe how mass and distance affect the strength of gravity. - Describe the variables that affect an object's gravitational potential energy.

KS3 Year 3 - TERMS 1, 2 and 3

Lesson	Term 1a	Lesson	Term 4b	Lesson	Term 5a	Lesson	Term 5b	Lesson	Term 6a	Lesson	Term 6b
Class	9C:Biology Revision and Projects		9C:Chemistry Revision and Projects		9C:Physics Revision and Projects		9D:Biology transition to GCSE		9D:Chemistry transition to GCSE		9D:Physics transition to GCSE
1, 2 and	- Identify normal distribution. - Interpret information on continuous genetic variation using normal distribution curves.	10, 11 and	- Classify changes as exothermic or endothermic from temperature changes. - Explain how the properties of a substance depend on the bonding and arrangement of atoms.	1, 2 and	- State the meaning of efficiency. - Describe the factors that affect an object's kinetic energy and gravitational potential energy.	10, 11 and	- Explain how roots and stems are adapted for their function. - Explain how the features of leaves and plant cells are adaptations for photosynthesis. - Explain how wilting occurs.	1, 2 and	- Use ideas about reactivity to explain how sacrificial metals can protect iron from rusting.	10, 11 and	- Describe the effect of an electric field on electrically charged objects. - Explain why a conducting object cannot be given a charge of static electricity. - State what is meant by electric field, and recall the shape and direction of the electric field around a charged object. - Explain how the transfer of electrons results in the two materials gaining equal and opposite charges.
4, 5 and 6	- Use a model to illustrate the relationship between DNA, chromosomes, genetic information and genes.	13, 14 and 15	- Classify (using temperature change) and explain (in terms of energy transfer) exothermic or endothermic reactions. - Justify the use of a composite material for a given application.	4, 5 and 6	- Explain why the maximum speed on a journey is usually greater than the mean speed. - Calculate speeds from the gradient of a distance-time graph. - Calculate the relative speed between two objects moving along the same line.	13, 14 and 15	- Describe the synthesis of starch and proteins in plants (only in terms of the monomers involved). - Explain the importance of nitrates to plants. - Recall some functions of different proteins.	4, 5 and 6	- Apply knowledge of explosive reactions to explain why they occur more or less rapidly when the particle size or the oxidiser is changed. - Classify changes as exothermic or endothermic from temperature changes. - Describe how some explosive mixtures obtain enough oxygen to explode. - Explain why energy input may be needed to start some reactions or keep them going.	13, 14 and 15	- Describe a current as a flow of electrons. - Describe how voltage and energy are linked.
	- Explain how biodiversity can be preserved using gene banks, seed banks, tissue banks, cryopreservation and pollen banks. - Explain how particular adaptations limit an organism's distribution and abundance.		- Explain how some of the problems of artificial polymers can be overcome. - Explain why biomagnification of toxins can occur. - Suggest ways of reducing the greenhouse effect on Earth.		- Identify the pivot, load and effort in Class 2 and Class 3 levers. - Use the formula relating moment, force and perpendicular distance.		- Explain how food production for humans can be increased using different plant varieties and pest management strategies (including insecticides and herbicides).		- Explain why a displacement reaction may or may not occur. - Use evidence to decide whether a displacement reaction has or has not occurred. - Use results from displacement reactions to produce an order of reactivity.		- Plan an investigation into how the resistance of a wire changes with length or thickness. - Interpret a voltage-current graph for resistors of different values.
7, 8 and 9	- Explain how natural selection can lead to evolution.	16, 17 and 18	- Describe how concrete and paper can be recycled. - Describe how glass can be recycled.	7, 8 and 9	- Use ideas about conservation of energy when explaining how simple machines work. - Use the formula relating work, force and distance moved.	16, 17 and 18	- Make predictions about how changes in physical and biological factors will affect carbon supply in an ecosystem. - Explain the effects of phosphates, nitrates and persistent pesticides on ecosystems. - Make predictions about how changes in physical and biological factors will interact with adaptations and affect survival (e.g. effects of disease on monoculture).	7, 8 and 9	- Describe how metals are extracted from their ores by heating with carbon and electrolysis. - Explain what happens in oxidation and reduction. - Explain why the method used to extract a metal is related to its position in the reactivity series and cost of the extraction process.	16, 17 and 18	- Explain how changing the size or direction of the current affects the magnetic field. - Describe how a wire carrying a current must be oriented in a magnetic field to produce a force. - Explain how electromagnets are used in relays. - Describe how the motor effect is used in a simple electric motor and how the force it produces can be changed.
	- To undertake an end of Topic Test to ascertain knowledge		- To undertake an end of Topic Test to ascertain knowledge		- To undertake an end of Topic Test to ascertain knowledge		- To undertake an end of Topic Test to ascertain knowledge		- To undertake an end of Topic Test to ascertain knowledge		- To undertake an end of Topic Test to ascertain knowledge
	REVISION: WS1: pay attention to objectivity and concern for accuracy WS2: understand that scientific methods and theories develop as earlier explanations are modified to take account of new evidence and ideas, together with the importance of publishing results and peer review WS4: ask questions and develop a line of enquiry based on observations of the real world, alongside prior knowledge and experience WS5: make predictions using scientific knowledge and understanding WS9: apply sampling techniques PROJECT 9C1 Animal smuggling - Q1 -To use their existing knowledge to answer one or more questions about endangered animals, ecosystems, evolution and respiration.		REVISION WS1: pay attention to objectivity and concern for accuracy, precision, repeatability and reproducibility WS6: … identifying independent, dependent and control variables... WS7: … paying attention to health and safety WS8: … evaluate the reliability of methods... WS17: understand and use SI units and IUPAC (International Union of Pure and Applied Chemistry) chemical nomenclature PROJECT 9G1 Carbon capture Q1 - Using existing knowledge answer one or more questions about fossil fuels and the carbon cycle		REVISION WS2: understand that scientific methods and theories develop as earlier explanations are modified to take account of new evidence and ideas, together with the importance of publishing results and peer review WS11: present observations and data using appropriate methods, including tables and graphs WS13: present reasoned explanations, including explaining data in relation to predictions and hypotheses WS14: evaluate data, showing awareness of potential sources of random and systematic error PROJECT - 9K1: Ears and eyes To use existing knowledge to answer one or more questions about detecting sound (via ears and microphones) and detecting light (via eyes and cameras)		9Da Diseases - Identify ways in which different diseases are spread. - Justify the lack of a virus kingdom.		9Ha Ions - Describe metallic bonding and state where it can be found. - Explain why metals conduct electricity. - Describe the structure of an ionic compound. - Describe the properties of ionic compounds and explain their conduction of electricity when molten and in solution.		9La Differences - Describe the effect of a substance's specific heat capacity on its ability to store thermal energy. - Use ideas about latent heat to explain phenomena related to changes of state.

1, 2 and 3	REVISION B1: cells as the fundamental unit of living organisms, including how to observe, interpret and record cell structure using a light microscope B2: the functions of the cell wall, cell membrane, cytoplasm, nucleus, vacuole, mitochondria and chloroplasts B3: the similarities and differences between plant and animal cells B4: the role of diffusion in the movement of materials in and between cells B5: the structural adaptations of some unicellular organisms B6: the hierarchical organisation of multicellular organisms: from cells to tissues to organs to systems to organisms B7: the structure and functions of the human skeleton, to include support, protection, movement and making blood cells B8: biomechanics – the interaction between skeleton and muscles, including the measurement of force exerted by different muscles B9: the function of muscles and examples of antagonistic muscles PROJECT 9C1 Animal smuggling - Q2 -To carry out some research to find out about CITES and what it does.	10, 11 and 12	REVISION C1: the properties of the different states of matter (solid, liquid and gas) in terms of the particle model, including gas pressure C2: changes of state in terms of the particle model C6: conservation of mass, changes of state… C7: the concept of a pure substance C8: mixtures, including dissolving C9: diffusion in terms of the particle model C10: simple techniques for separating mixtures: filtration, evaporation, distillation and chromatography C11: the identification of pure substances C20: energy changes on changes of state (qualitative) PROJECT - 9G1 Carbon capture Q2 - To research how pumping carbon dioxide into oil fields allows more oil to be extracted from the field and to explain why this may not help to limit the amount of carbon dioxide in the atmosphere	1, 2 and 3	REVISION P23: atmospheric pressure, decreases with increase of height as weight of air above decreases with height P24: pressure in liquids, increasing with depth... P50: conservation of material and of mass, and reversibility, in melting, freezing, evaporation, sublimation, condensation, dissolving P51: similarities and differences, including density differences, between solids, liquids and gases P52: Brownian motion in gases P53: diffusion in liquids and gases driven by differences in concentration P54: the difference between chemical and physical changes P55: the differences in arrangements, in motion and in closeness of particles explaining changes of state, shape and density, the anomaly of ice–water transition P56: atoms and molecules as particles P57: changes with temperature in motion and spacing of particles P60: our Sun as a star, other stars in our galaxy, other galaxies P61: the seasons and the Earth's tilt, day length at different times of year, in different hemispheres P62: the light year as a unit of astronomical distance PROJECT - 9K1: Ears and eyes Q2 To carry out some research to find out what causes long sight and short sight, and how lenses can be used to help people with these defects to see clearly	10, 11 and 12	9Db Control systems - Describe how stimulation of receptor cells in sense organs sends electrical impulses along nerve cells. - Use a model to explain how information is transmitted around the body by the nervous system. - Use evidence to determine the target organ (s) of a hormone. - Compare and contrast different systems for transferring information around the body.	1, 2 and 3	9Hb Energy transfers - Summarise energy changes by drawing simple reaction profiles. - Explain how the properties of a metallic substance depend on the bonding and arrangement of its atoms.	10, 11 and 12	9Lb Fields - Evaluate the models used to represent different types of force field. - Use the formula for gravitational potential energy.
	REVISION B10: content of a healthy human diet: carbohydrates, lipids (fats and oils), proteins, vitamins, minerals, dietary fibre and water, and why each is needed B11: calculations of energy requirements in a healthy daily diet B12: the consequences of imbalances in the diet, including obesity, starvation and deficiency diseases B13: the tissues and organs of the human digestive system, including adaptations to function and how the digestive system digests food (enzymes simply as biological catalysts) B14: the importance of bacteria in the human digestive system B15: plants making carbohydrates in their leaves by photosynthesis and gaining mineral nutrients and water from the soil via their roots B16: the structure and functions of the gas exchange system in humans, including adaptations to function B17: the mechanism of breathing to move air in and out of the lungs, using a pressure model to explain the movement of gases, including simple measurements of lung volume B18: the impact of exercise, asthma and smoking on the human gas exchange system B19: the role of leaf stomata in gas exchange in plants PROJECT 9C1 Animal smuggling - Q3 -To find a press release about animal smuggling and use it as the basis for writing an article for an online newspaper		REVISION C3: a simple (Dalton) atomic model C4: differences between atoms, elements and compounds C5: chemical symbols and formulae for elements and compounds C6: conservation of mass, changes of state and chemical reactions C12: chemical reactions as the rearrangement of atoms C13: representing chemical reactions using formulae and using equations C14: combustion C14: thermal decomposition C14: oxidation C14: displacement reactions C19: what catalysts do C21: exothermic and endothermic chemical reactions (qualitative) C35: the carbon cycle PROJECT - 9G2 Investigating Electrolysis - To carry out electrolysis of copper sulfate solution and investigate the effect of one or more variables on the amount of copper produced.		REVISION P1: comparing energy values of different foods (from labels) (kJ) P2: comparing power ratings of appliances in watts (W, kW) P3: comparing amounts of energy transferred (J, kJ, kW hour) P4: domestic fuel bills, fuel use and costs P5: fuels and energy resources P7: heating and thermal equilibrium: temperature difference between two objects leading to energy transfer from the hotter to the cooler one, through contact (conduction) or radiation; such transfers tending to reduce the temperature difference; use of insulators P8: other processes that involve energy transfer: changing motion, dropping an object, completing an electrical circuit, stretching a spring, metabolism of food, burning fuels P9: energy as a quantity that can be quantified and calculated; the total energy has the same value before and after a change P10: comparing the starting with the final conditions of a system and describing increases and decreases in the amounts of energy associated with movements, temperatures, changes in positions in a field, elastic distortions and chemical compositions P11: using physical processes and mechanisms, rather than energy, to explain the intermediate steps that bring about such changes P58: internal energy stored in materials PROJECT - 9K1: Ears and eyes Q3 To research cochlear implants and write a story of 250 words for an online newspaper		9Dc Testing medicines - Describe the use of placebos, randomisation and control groups in drug testing. - Explain the importance of using placebos, sample size, randomisation and control groups in drug testing. - Compare and contrast types of variation by analysis using quartiles and interquartile ranges.		9Hc Rates of reaction - Explain how the frequency of collisions affects the rate of a reaction. - Explain the effects on rates of reaction of changes in the surface area to volume ratio of a reacting solid.		9Lc Cause and effect - Identify action-reaction pairs in simple situations (the term action-reaction is not required). - State that correlation is not an indicator of causation.

KS3 Year 3 - TERMS 4, 5 and 6											
	4, 5 and 6	REVISION B20: reproduction in humans (as an example of a mammal), including the structure and function of the male and female reproductive systems,… B20: … menstrual cycle (without details of hormones),… B20: … gametes, fertilisation,… B20: … gestation and birth, to include the effect of maternal lifestyle on the foetus through the placenta B21: reproduction in plants,… B21: … including flower structure, wind and insect pollination,… B21: … fertilisation, seed and fruit formation and dispersal, including quantitative investigation of some dispersal mechanisms B22: the effects of recreational drugs (including substance misuse) on behaviour, health and life processes PROJECT 9C2 Enzyme investigation - To carry out an investigation to find out how different fruits (and the enzymes that they contain) affect gelling agents	13, 14 and 15	REVISION C15: defining acids and alkalis in terms of neutralisation reactions C16: the pH scale for measuring acidity/alkalinity; and indicators C17: reactions of acids with metals to produce a salt plus hydrogen C18: reactions of acids with alkalis to produce a salt plus water C28: the order of metals and carbon in the reactivity series C29: the use of carbon in obtaining metals from metal oxides C30: properties of ceramics, polymers and composites (qualitative) PROJECT 9G3 Nanoparticles Q1 To describe the elements used in the catalytic converters in small engines. For each element, outline how it is extracted and describe one other use of the metal, with a reason for this use.	4, 5 and 6	REVISION P12: speed and the quantitative relationship between average speed, distance and time (speed = distance ÷ time) P13: the representation of a journey on a distance–time graph P14: relative motion: trains and cars passing one another P15: forces as pushes or pulls, arising from the interaction between two objects P16: using force arrows in diagrams, adding forces in one dimension, balanced and unbalanced forces P18: forces: associated with deforming objects; stretching and squashing – springs; with rubbing and friction between surfaces, with pushing things out of the way; resistance to motion of air and water P19: forces measured in newtons, measurements of stretch or compression as force is changed P20: force–extension linear relation; Hooke's Law as a special case P22: non-contact forces: gravity forces acting at a distance on Earth and in space; forces between magnets and forces due to static electricity P24: ... upthrust effects, floating and sinking P25: pressure measured by ratio of force over area – acting normal to any surface P26: opposing forces and equilibrium: weight held by stretched spring or supported on a compressed surface P27: forces being needed to cause objects to stop or start moving, or to change their speed or direction of motion (qualitative only) P28: change depending on direction of force and its size PROJECT 9K2 Going faster - To investigate the factors affecting acceleration using trolleys and friction-compensated ramps	13, 14 and 15	9Dd Ecology - Predict how changes in physical factors affect abundance and distribution. - Explain the effects of too small and too big a sample size.	4, 5 and 6	9Hd Chemical equations - Model simple reactions using balanced symbol equations. - Use state symbols in equations.	13, 14 and 15	9Ld Links between variables - Identify direct and inverse proportionality using graphs.

	Lesson	Term 1a	Lesson	Term 1b	Lesson	Term 2a	Lesson	Term 2b	Lesson	Term 3a	Lesson	Term 3b
	7, 8 and 9	RESEARCH B23: the reactants in, and products of, photosynthesis, and a word summary for photosynthesis B32: how organisms affect, and are affected by, their environment, including the accumulation of toxic materials B24: the dependence of almost all life on Earth on the ability of photosynthetic organisms, such as plants and algae, to use sunlight in photosynthesis to build organic molecules that are an essential energy store and to maintain levels of oxygen and carbon dioxide in the atmosphere B25: the adaptations of leaves for photosynthesis B26: aerobic and anaerobic respiration in living organisms, including the breakdown of organic molecules to enable all the other chemical processes necessary for life B27: a word summary for aerobic respiration B28: the process of anaerobic respiration in humans and micro-organisms, including fermentation, and a word summary for anaerobic respiration B29: the differences between aerobic and anaerobic respiration in terms of the reactants, the products formed and the implications for the organism B30: the interdependence of organisms in an ecosystem, including food webs and insect pollinated crops B31: the importance of plant reproduction through insect pollination in human food security PROJECT 9C3 Teeth - Design and write a leaflet about 'Looking after your Teeth' using what you know about diet and bacteria, and some research.	16, 17 and 18	REVISION C22: the varying physical and chemical properties of different elements C23: the principles underpinning the Mendeleev Periodic Table C24: the Periodic Table: periods and groups; metals and non-metals C25: how patterns in reactions can be predicted with reference to the Periodic Table C26: the properties of metals and non-metals C27: the chemical properties of metal and nonmetal oxides with respect to acidity C31: the composition of the Earth C36: the composition of the atmosphere PROJECT 9G3 Nanoparticles Q2 - Describe how the ratio between surface area and volume changes as the particles get smaller, and explain why less catalyst can be used if it is made into nanoparticles.	7, 8 and 9	REVISION P29: waves on water as undulations that travel through water with transverse motion; these waves can be reflected, and add or cancel – superposition P30: frequencies of sound waves, measured in hertz (Hz); echoes, reflection and absorption of sound P31: sound needs a medium to travel, the speed of sound in air, in water, in solids P32: sound produced by vibrations of objects, in loud speakers, detected by their effects on microphone diaphragm and the ear drum; sound waves are longitudinal P33: auditory range of humans and animals P34: pressure waves transferring energy: for cleaning and physiotherapy by ultra-sound; waves transferring information for conversion to electrical signals by microphone P35: the similarities and differences between light waves and waves in matter P36: light waves travelling through a vacuum; speed of light P37: the transmission of light through materials: absorption, diffuse scattering and specular reflection at a surface P38: use of ray model to explain imaging in mirrors... P38: ... the pinhole camera... P38: ... the refraction of light and action of convex lens in focusing (qualitative); the human eye P39: light transferring energy from source to absorber leading to chemical and electrical effects; photo-sensitive material in the retina and in cameras P40: colours and the different frequencies of light, white light and prisms (qualitative only); differential colour effects in absorption and diffuse reflection P44: separation of positive or negative charges when objects are rubbed together: transfer of electrons, forces between charged objects P45: the idea of electric field, forces acting across the space between objects not in contact P46: magnetic poles, attraction and repulsion P47: magnetic fields by plotting with compass, representation by field lines P48: Earth's magnetism, compass and navigation P59: gravity force, weight = mass × gravitational field strength (g), on Earth g = 10 N/kg, different on other planets and stars; gravity forces between Earth and Moon, and between Earth and Sun (qualitative only) PROJECT 9K3 Speed limits Design and write a road safety leaflet to be given out with new cars, to encourage drivers to stick to the speed limits	16, 17 and 18	9De In and out - Use a knowledge of diffusion to explain how nutrients enter the blood from the small intestine, by crossing several cell membranes. - Explain the problems caused by diseases of the small intestine/coeliac disease. - Explain the importance of surface area: volume ratio for organisms. - Explain how osmosis occurs. - Identify and explain changes in cells due to osmosis.	7, 8 and 9	9He Equilibria To Describe the nature of the energy changes in the forward and backward reactions.	16, 17 and 18	9Le Models - Evaluate an abstract model.
		REVISION B33: heredity as the process by which genetic information is transmitted from one generation to the next B34: a simple model of chromosomes, genes and DNA in heredity, including the part played by Watson, Crick, Wilkins and Franklin in the development of the DNA model B35: differences between species B36: the variation between individuals within a species being continuous or discontinuous, to include measurement and graphical representation of variation B37: the variation between species and between individuals of the same species means some organisms compete more successfully, which can drive natural selection B38: changes in the environment may leave individuals within a species, and some entire species, less well adapted to compete successfully and reproduce, which in turn may lead to extinction B39: the importance of maintaining biodiversity and the use of gene banks to preserve hereditary material PROJECT 9C3 Teeth Q2 - Research to find out how your body fights infections, what antibiotics are and why antibiotics may be needed		REVISION C32: the structure of the Earth C33: the rock cycle and the formation of igneous, sedimentary and metamorphic rocks C34: Earth as a source of limited resources and the efficacy of recycling C37: the production of carbon dioxide by human activity and the impact on climate PROJECT - COMPLETE ANY UNFINISHED PROJECTS		REVISION P6: simple machines give bigger force but at the expense of smaller movement (and vice versa): product of force and displacement unchanged P17: moment as the turning effect of a force P21: work done and energy changes on deformation P41: electric current, measured in amperes, in circuits, series and parallel circuits, currents add where branches meet and current as flow of charge P42: potential difference, measured in volts, battery and bulb ratings; resistance, measured in ohms, as the ratio of potential difference (p.d.) to current P43: differences in resistance between conducting and insulating components (quantitative) P49: the magnetic effect of a current, electromagnets, D.C. motors (principles only) PROJECT 9K3 Speed limits - To find out how reaction times are measured and what typical reaction times are. - Find out how much longer reaction times are when people are tired or have been drinking alcohol.		- To undertake an end of Topic Test to ascertain knowledge		- To undertake an end of Topic Test to ascertain knowledge		- To undertake an end of Topic Test to ascertain knowledge

Class		Key Concepts in Biology (CB1) / States of Matter (CC1)		Methods of Separating and Purifying Substances (CC2) / Atomic Structure (CC3)		The Periodic Table (CC4) / Cells and Control (CB2)		Ionic Bonding (CC5) / Covalent Bonding (CC6) / Types of Substance (CC7)		Genetics (CB3) / Natural Selection and Genetic Modification (CB4)		Genetic Modification cont (CB4) / Acids and Alkalis (CC8)
Combined Science TERMS 1 - 3	1, 2 and 3	- To undertake a Baseline Science Test to ascertain prior knowledge **CB1a** - Explain how changes in microscope technology, including electron microscopy, have enabled us to see cells with more clarity and detail than in the past. - Demonstrate an understanding of size and scale in relation to microscopy, including magnification calculations. - Demonstrate an understanding of the relationship between quantitative units, including: (a) milli (10-3), (b) micro (10-6), (c) nano (10-9), (d) pico (10-12).	10, 11 and 12	**CC2a** - Explain the differences between a pure substance and a mixture. - Interpret melting point data to distinguish between pure substances, which have a sharp melting point, and mixtures, which melt over a range of temperatures.	1, 2 and 3	**CC4a** - Describe how Mendeleev arranged the elements, known at that time, in a periodic table by using properties of these elements and their compounds. - Describe how Mendeleev used his table to predict the existence and properties of some elements not then discovered. - Recall the formulae of elements, simple compounds and ions.	10, 11 and 12	**CC5a** - Explain how ionic bonds are formed by the transfer of electrons between atoms to produce cations and anions, including the use of dot and cross diagrams. - Recall that an ion is an atom or group of atoms with a positive or negative charge. - Calculate the numbers of protons, neutrons and electrons in simple ions given the atomic number and mass number. - Explain the formation of ions in ionic compounds from their atoms, limited to compounds of elements in groups 1, 2, 6 and 7.	1, 2 and 3	**CB3a** - Explain the role of meiotic cell division, including the production of four daughter cells, each with half the number of chromosomes, and that this results in the formation of genetically different haploid gametes. The stages of meiosis are not required. - Describe the genome as the entire DNA of an organism and a gene as a section of a DNA molecule that codes for a specific protein.	10, 11 and 12	**CB4d** - Explain selective breeding and its impact on food plants and domesticated animals. - Describe genetic engineering as a process which involves modifying the genome of an organism to introduce desirable characteristics.
		CB1b - Explain how the sub-cellular structures of eukaryotic and prokaryotic cells are related to their functions, including: (a) animal cells − nucleus, cell membrane, mitochondria and ribosomes (b) plant cells − nucleus, cell membrane, cell wall, chloroplasts, mitochondria and ribosomes. - Demonstrate an understanding of size and scale in relation to microscopy, including magnification calculations. - Investigate biological specimens using microscopes, including magnification calculations and labelled scientific drawings from observations.		**CC2b** - Explain the experimental techniques for separation of mixtures by: (c) filtration (d) crystallisation. - Describe an appropriate experimental technique to separate a mixture, knowing the properties of the components of the mixture. - Evaluate the risks in a practical procedure and suggest suitable precautions for a range of practicals, including those mentioned in the specification.		**CC4b** - Explain that Mendeleev thought he had arranged elements in order of increasing relative atomic mass but this was not always true because of the relative abundance of isotopes of some pairs of elements in the periodic table. - Explain the meaning of atomic number of an element in terms of position in the periodic table and number of protons in the nucleus. - Describe that in the periodic table: (a) elements are arranged in order of increasing atomic number, in rows called periods (b) elements with similar properties are placed in the same vertical columns called groups - Identify elements as metals or non-metals according to their position in the periodic table.		**CC5b** - Explain the use of the endings –ide and –ate in the names of compounds. - Deduce the formulae of ionic compounds (including oxides, hydroxides, halides, nitrates, carbonates and sulfates) given the formulae of the constituent ions. - Explain the structure of an ionic compound as a lattice structure: (a) consisting of a regular arrangement of ions (b) held together by strong electrostatic forces (ionic bonds) between oppositely-charged ions.		**CB3b** - Describe DNA as a polymer made up of: (a) two strands coiled to form a double helix (b) strands linked by a series of complementary base pairs joined together by weak hydrogen bonds. - Investigate how to extract DNA from fruit.		**CB4e** - Describe the main stages of genetic engineering including the use of: (a) restriction enzymes (b) ligase (c) sticky ends (d) vectors. - Evaluate the benefits and risks of genetic engineering and selective breeding in modern agriculture and medicine including practical and ethical implications. -To undertake an end of Topic Test to ascertain knowledge
		CB1c - Describe how specialised cells are adapted to their function, including (a) sperm cells – acrosome, haploid nucleus, mitochondria and tail, (b) egg cells – nutrients in the cytoplasm, haploid nucleus and changes in the cell membrane after fertilisation, (c) ciliated epithelial cells. - Demonstrate an understanding of size and scale in relation to microscopy, including magnification calculations. - Produce labelled scientific drawings from observations of biological specimens using microscopes.		**CC2c** - Explain the experimental techniques for separation of mixtures by: (e) paper chromatography. - Describe an appropriate experimental technique to separate a mixture, knowing the properties of the components of the mixture. - Describe paper chromatography as the separation of mixtures of soluble substances by running a solvent (mobile phase) through the mixture on the paper (the paper contains the stationary phase), which causes the substances to move at different rates over the paper. - Interpret a paper chromatogram: (a) to distinguish between pure and impure substances (b) to identify substances by comparison with known substances (c) to identify substances by calculation and use of Rf values. - Investigate the composition of inks using simple distillation and paper chromatography.		**CC4c** - Predict the electronic configurations of the first 20 elements in the periodic table as diagrams and in the form, for example, 2.8.1. - Explain how the electronic configuration of an element is related to its position in the periodic table. -To undertake an end of Topic Test to ascertain knowledge		**CC5c** - Explain the properties of ionic compounds limited to: (a) high melting points and boiling points, in terms of forces between ions (b) whether or not they conduct electricity as solids, when molten and in aqueous solution.		**CB3c** - Explain why there are differences in the inherited characteristics as a result of alleles. - Explain the terms: dominant, recessive, homozygous, heterozygous, genotype, phenotype and zygote. - Explain monohybrid inheritance using genetic diagrams…		**CC8a** - Describe the use of hazard symbols on containers (a) to indicate the dangers associated with the contents (b) to inform people about safe-working precautions with these substances in the laboratory. - Recall that acids in solution are sources of hydrogen ions and alkalis in solution are sources of hydroxide ions. - Recall that a neutral solution has a pH of 7 and that acidic solutions have lower pH values and alkaline solutions higher pH values. - Recall the effect of acids and alkalis on indicators, including litmus, methyl orange and phenolphthalein. - Recall that the higher the concentration of hydrogen ions in an acidic solution, the lower the pH; and the higher the concentration of hydroxide ions in an alkaline solution, the higher the pH.
		CB1d - Explain how the sub-cellular structures of eukaryotic and prokaryotic cells are related to their functions, including: (c) bacteria – chromosomal DNA, plasmid DNA, cell membrane, ribosomes and flagella. - Demonstrate an understanding of the relationship between quantitative units, including: (a) milli (10-3) (b) micro (10-6) (c) nano (10-9) (d) pico (10-12) H (e) calculations with numbers written in standard form.		**CC2d** - Explain the experimental techniques for separation of mixtures by: (d) simple distillation (e) fractional distillation. - Describe an appropriate experimental technique to separate a mixture, knowing the properties of the components of the mixture. - Investigate the composition of inks using simple distillation. - Evaluate the risks in a practical procedure and suggest suitable precautions for a range of practicals including those mentioned in the specification.		**CB2a** - Describe mitosis as part of the cell cycle including the stages interphase, prophase, metaphase, anaphase and telophase and cytokinesis. - Describe the importance of mitosis in growth, repair and asexual reproduction. - Describe the division of a cell by mitosis as the production of two daughter cells, each with identical sets of chromosomes in the nucleus to the parent cell, and that this results in the formation of two genetically identical diploid body cells. - Describe cancer as the result of changes in cells that lead to uncontrolled cell division.		**CC6a** - Explain how a covalent bond is formed when a pair of electrons is shared between two atoms. - Recall that covalent bonding results in the formation of molecules. - Explain the formation of simple molecular, covalent substances, using dot and cross diagrams, including: (a) hydrogen (b) hydrogen chloride (c) water (d) methane (e) oxygen (f) carbon dioxide.		**CB3d** - Explain monohybrid inheritance using … Punnett squares and family pedigrees. - Describe how the sex of offspring is determined at fertilisation, using genetic diagrams. - Calculate and analyse outcomes (using probabilities, ratios and percentages) from monohybrid crosses and pedigree analysis for dominant and recessive traits.		**CC8b** - Recall that as hydrogen ion concentration in a solution increases by a factor of 10, the pH of the solution decreases by 1. - Explain the terms dilute and concentrated, with respect to amount of substances in solution. - Explain the terms weak and strong acids, with respect to the degree of dissociation into ions.

Year 1 - GCSE Com

	Lesson	Term 4a	Lesson	Term 4b	Lesson	Term 5a	Lesson	Term 5b	Lesson	Term 6a	Lesson	Term 6b
	4, 5 and 6	**CB1e** - Explain the importance of enzymes as biological catalysts in the synthesis of carbohydrates, proteins and lipids and their breakdown into sugars, amino acids and fatty acids and glycerol.	13, 14 and 15	**CC2e** - Describe an appropriate experimental technique to separate a mixture, knowing the properties of the components of the mixture. - Describe how waste water and ground water can be made potable, including the need for sedimentation, filtration and chlorination. - Describe how seawater can be made potable using distillation. - Explain why water used in analysis must not contain any dissolved salts. - Evaluate the risks in a practical procedure and suggest suitable precautions for a range of practicals, including those mentioned in the specification. - To undertake an end of Term Topic Test to ascertain knowledge	4, 5 and 6	**CB2b** - Describe growth in organisms including: (a) cell division and differentiation in animals. - Explain the importance of cell differentiation in the development of specialised cells. - Demonstrate an understanding of the use of percentile charts to monitor growth.	13, 14 and 15	**CC7a** - Explain the properties of typical covalent, simple molecular compounds limited to: (a) low melting points and boiling points, in terms of forces between molecules (intermolecular forces) (b) poor conduction of electricity. - Describe, using poly(ethene) as the example, that simple polymers consist of large molecules containing chains of carbon atoms.	4, 5 and 6	**CB3e** - State that most phenotypic features are the result of multiple genes rather than single gene inheritance. - Describe the causes of variation that influence phenotype including: (a) genetic variation – different characteristics as a result of mutation and sexual reproduction. - Discuss the outcomes of the Human Genome Project and its potential applications within medicine. - State that there is usually extensive genetic variation within a population of a species and that these arise through mutations. - State that most genetic mutations have no effect on the phenotype, some mutations have a small effect on the phenotype and, rarely, a single mutation will significantly affect the phenotype.	13, 14 and 15	**CC8c** - Write balanced equations, including the use of the state symbols (s), (l), (g) and (aq). - Recall that a base is any substance that reacts with an acid to form a salt and water only. - Explain the general reactions of aqueous solutions of acids with metal oxides to produce salts. - Describe a neutralisation reaction as a reaction between an acid and a base. - Explain why, if soluble salts are prepared from an acid and an insoluble reactant: (a) excess of the reactant is added (b) the excess reactant is removed (c) the solution remaining is only salt and water. - Investigate the preparation of pure, dry hydrated copper sulfate crystals starting from copper oxide, including the use of a water bath.
		CB1f - Explain the mechanism of enzyme action including the active site and enzyme specificity. - Explain how enzymes can be denatured due to changes in the shape of the active site. - Investigate the factors that affect enzyme activity.		**CC3a** - Describe how the Dalton model of an atom has changed because of the discovery of subatomic particles. - Describe the structure of an atom as a nucleus containing protons and neutrons, surrounded by electrons in shells. - Recall the relative charge and relative mass of: (f) a proton (g) a neutron (h) an electron. - Explain why atoms contain equal numbers of protons and electrons. - Describe the nucleus of an atom as very small compared to the overall size of the atom.		**CB2c** - Describe growth in organisms, including: (b) cell division, elongation and differentiation in plants. - Explain the importance of cell differentiation in the development of specialised cells.		**CC7b** - Recall that graphite and diamond are different forms of carbon and that they are examples of covalent, giant molecular substances. - Describe the structures of graphite and diamond. - Explain, in terms of structure and bonding, why graphite is used to make electrodes and as a lubricant, whereas diamond is used in cutting tools. - Explain the properties of fullerenes including C60 and graphene in terms of their structures and bonding.		**CB3f** Describe the causes of variation that influence phenotype including: (a) genetic variation – different characteristics as a result of mutation and sexual reproduction (b) environmental variation – different characteristics caused by an organism's environment (acquired characteristics).		**CC8d** - Recall the formulae of elements, simple compounds and ions. - Write word equations. - Write balanced chemical equations, including the use of the state symbols (s), (l), (g) and (aq). - Investigate the change in pH on adding powdered calcium hydroxide or calcium oxide to a fixed volume of dilute hydrochloric acid. - Recall that alkalis are soluble bases. - Explain the general reactions of aqueous solutions of acids with metal hydroxides to produce salts.
	7, 8 and 9	**CB1g** - Explain the effects of temperature, substrate concentration and pH on enzyme activity. - Demonstrate an understanding of rate calculations for enzyme activity. - Investigate the factors that affect enzyme activity.	16, 17 and 18	**CC3b** - Recall that most of the mass of an atom is concentrated in its nucleus. - Recall the meaning of the term 'mass number' of an atom. - Describe atoms of a given element as having the same number of protons in the nucleus and that this number is unique to that element. - Calculate the numbers of protons, neutrons and electrons in atoms given the atomic number and the mass number.	7, 8 and 9	**CB2d** - Describe the function of embryonic stem cells, stem cells in animals and meristems in plants. - Discuss the potential benefits and risks associated with the use of stem cells in medicine.	16, 17 and 18	**CC7c** - Explain the properties of metals, including malleability and the ability to conduct electricity. - Describe most metals as shiny solids which have high melting points, high density and are good conductors of electricity whereas most non-metals have low boiling points and are poor conductors.	7, 8 and 9	**CB4a** - Describe the evidence for human evolution, based on fossils, including: (a) Ardi from 4.4 million years ago (b) Lucy from 3.2 million years ago (c) Leakey's discovery of fossils from 1.6 million years ago. - Describe the evidence for human evolution based on stone tools, including: (a) the development of stone tools over time (b) how these can be dated from their environment.	16, 17 and 18	**CC8e** - Explain an acid–alkali neutralisation as a reaction in which hydrogen ions (H+) from the acid react with hydroxide ions (OH–) from the alkali to form water. - Explain why, if soluble salts are prepared from an acid and a soluble reactant: (a) titration must be used (b) the acid and the soluble reactant are then mixed in the correct proportions (c) the solution remaining, after reaction, is only salt and water. - Describe how to carry out an acid–alkali titration, using burette, pipette and a suitable indicator, to prepare a pure, dry salt.
		CB1h - Explain how substances are transported by diffusion, osmosis and active transport. - Investigate osmosis in potatoes. - Calculate percentage gain and loss of mass in osmosis. - To undertake an end of Term Topic Test to ascertain knowledge		**CC3c** - Describe isotopes as different atoms of the same element containing the same number of protons but different numbers of neutrons in their nuclei. - Calculate the numbers of protons, neutrons and electrons in atoms given the atomic number and mass number. - Explain how the existence of isotopes results in some relative atomic masses of some elements not being whole numbers. - Calculate the relative atomic mass of an element from the relative masses and abundances of its isotopes.		**CB2e** - Explain the structure and function of sensory neurones in the transmission of electrical impulses including the axon, dendron, myelin sheath.		**CC7d** Explain why elements and compounds can be classified as: (a) ionic (b) covalent, simple molecular (c) covalent, giant molecular (d) metallic and how the structure and bonding of these types of substances results in different physical properties, including relative melting point and boiling point, relative solubility in water and ability to conduct electricity (as solids and in solution). - Describe the limitations of particular representations and models to include dot and cross, ball and stick models and two and three-dimensional representations.		CB4b		**CC8f** - Write balanced ionic equations. - Explain the general reactions of aqueous solutions of acids with (a) metals and (d) metal carbonates to produce salts. - Describe the chemical test for (a) hydrogen and (b) carbon dioxide (using limewater).
		CC1a - Describe the arrangement, movement and the relative energy of particles in each of the three states of matter: solid, liquid and gas. - Recall the names used for the interconversions between the three states of matter, recognising that these are physical changes. - Explain the changes in arrangement, movement and energy of particles during these interconversions. - Predict the physical state of a substance under specified conditions, given suitable data.		End of Topic Test		**CB2f** - Explain the structure and function of motor neurones and synapses in the transmission of electrical impulses including the axon, dendron, myelin sheath and the role of neurotransmitters. - Explain the structure and function of a reflex arc including sensory, relay and motor neurones. -To undertake an end of Topic Test to ascertain knowledge		-To undertake an end of Topic Test to ascertain knowledge		**CB4c** - Describe how genetic analysis has led to the suggestion of the three domains rather than the five kingdoms classification method.		**CC8g** - Recall the general rules which describe the solubility of common types of substances in water: (a) all common sodium, potassium and ammonium salts are soluble (b) all nitrates are soluble (c) common chlorides are soluble except those of silver and lead (d) common sulfates are soluble except those of lead, barium and calcium (e) common carbonates and hydroxides are insoluble except those of sodium, potassium and ammonium. - Predict, using solubility rules, whether or not a precipitate will be formed when named solutions are mixed together, naming the precipitate if any. - Describe the method used to prepare a pure, dry sample of an insoluble salt. -To undertake an end of Topic Test to ascertain knowledge

Class		Calculations Involving Masses (CC9) / Motion (CP1)		Forces and Motion (CP2)		Conservation of Energy (CP3) / Waves (CP4)		Light and the Electromagnetic Spectrum (CP5) / Energy - Forces Doing Work (CP7) / Forces and their Effects (CP8)		Radioactivity (CP6)		REVISION AND END OF YEAR TESTS
ience TERMS 4 - 6	1, 2 and 3	**CC9a** - Calculate relative formula mass given relative atomic masses. - Calculate the formulae of simple compounds from reacting masses and understand that these are empirical formulae. Deduce: a) the empirical formula of a compound from the formula of its molecule b) the molecular formula of a compound from its empirical formula and its relative molecular mass. - Describe an experiment to determine the empirical formula of a simple compound such as magnesium oxide.	10, 11 and 12	**CP2a** - Recall Newton's First Law and use it in the following situations: (a) Where the resultant force on a body is zero i.e. the body is moving at a constant velocity or is at rest. (b) Where the resultant force is not zero i.e. the speed and/or direction of the body changes.	1, 2 and 3	**CP3a** - Explain, with examples, that, where there are energy transfers in a system, there is no net change to the total energy of a closed system. - Analyse the changes involved in the way energy is stored when a system changes, including: (a) an object projected upwards or up a slope (b) a moving object hitting an obstacle (c) an object being accelerated by a constant force (d) a vehicle slowing down (e) bringing water to a boil in an electric kettle. - Use diagrams to represent energy transfers and calculate the before and after energy values. - Explain that, in all system changes, energy is dissipated so that it is stored in less useful ways.	10, 11 and 12	**CP5a** - Recall that all electromagnetic waves are transverse, that they travel at the same speed in a vacuum. - Explain, with examples, that all electromagnetic waves transfer energy from source to observer. - Investigate refraction in rectangular glass blocks in terms of the interaction of electromagnetic waves with matter. - Recall that our eyes can only detect a limited range of frequencies of electromagnetic radiation. - Explain the effects of differences in the velocities of electromagnetic waves in different substances.	1, 2 and 3	**CP6a** - Describe an atom as a positively charged nucleus, consisting of protons and neutrons, surrounded by negatively charged electrons, with the nuclear radius much smaller than that of the atom and with almost all of the mass in the nucleus. - Recall the typical size (order of magnitude) of atoms and small molecules. - Describe how and why the atomic model has changed over time including reference to the plum pudding model and Rutherford alpha particle scattering leading to the Bohr model.	10, 11 and 12	REVISION
		CC9b - Explain the law of conservation of mass applied to: a) a closed system including a precipitation reaction in a closed flask b) a non-enclosed system including a reaction in an open flask that takes in or gives out a gas. - Calculate masses of reactants and products from balanced equations, given the mass of one substance. - Calculate the concentration of solutions in g dm–3.		**CP2b** - Recall Newton's First Law and use it in the following situations: (a) Where the resultant force on a body is zero i.e. the body is moving at a constant velocity or is at rest. (b) Where the resultant force is not zero i.e. the speed and/or direction of the body change(s). - Explain that an object moving in a circular orbit at constant speed has a changing velocity (qualitative only). - Explain that for motion in a circle there must be a resultant force known as a centripetal force that acts towards the centre of the circle.		**CP3b** - Explain that mechanical processes become wasteful when they cause a rise in temperature so dissipating energy in heating the surroundings … . - Explain ways of reducing unwanted energy transfer including through lubrication … . - Calculate efficiency in energy transfers, and H explain how efficiency can be increased. - Recall and use the equation: efficiency = (useful energy transferred by the device) / (total energy supplied to the device).		**CP5b** - Recall the main groupings of the continuous electromagnetic spectrum including (in order) radio waves, microwaves, infrared, visible (including the colours of the visible spectrum), ultraviolet, X-rays and gamma rays. - Describe the electromagnetic spectrum as continuous from radio waves to gamma rays and that the radiations within it can be grouped in order of decreasing wavelength and increasing frequency. - Recall that different substances may absorb, transmit, refract, or reflect electromagnetic waves in ways that vary with wavelength.		**CP6b** - Describe the structure of nuclei of isotopes using the terms atomic (proton) number and mass (nucleon) number and using symbols in the format . - Recall that the nucleus of each element has a characteristic positive charge, but that elements differ in mass by having different numbers of neutrons. - Recall the relative masses and relative electric charges of protons, neutrons, electrons. - Recall that in an atom the number of protons equals the number of electrons and is therefore neutral.		REVISION
		CC9c - Recall that one mole of particles of a substance is defined as: a the Avogadro constant number of particles (6.02 × 1023 atoms, molecules, formulae or ions) of that substance b a mass of 'relative particle mass' g. - Calculate the number of: a) moles of particles of a substance in a given mass of that substance and vice versa b) particles of a substance in a given number of moles of that substance and vice versa c) particles of a substance in a given mass of that substance and vice versa. - Explain why, in a reaction, the mass of product formed is controlled by the mass of the reactant which is not in excess. - Deduce the stoichiometry of a reaction from the masses of the reactants and products.		**CP2c** - Recall and use the equation: weight (newton, N) = mass (kilogram, kg) × gravitational field strength (newton per kilogram, N/kg), W = m × g.		**CP3c** - Explain ways of reducing unwanted energy transfer including through … thermal insulation … . - Describe the effects of the thickness and thermal conductivity of the walls of a building on its rate of cooling qualitatively.		**CP5c** - Recall that different substances may absorb, transmit, refract, or reflect electromagnetic waves in ways that vary with wavelength. - Explain the effects of differences in the velocities of electromagnetic waves in different substances. - Describe some uses of electromagnetic radiation: (a) radio waves: including broadcasting, communications and satellite transmissions (b) microwaves: including cooking, communications and satellite transmissions (c) infrared: including cooking, thermal imaging, short range communications, optical fibres, television remote controls and security systems (d) visible light: including vision, photography and illumination. - Recall that radio waves can be produced by, or can themselves induce, oscillations in electrical circuits.		**CP6c** - Recall that in each atom its electrons orbit the nucleus at different set distances from the nucleus. - Explain that electrons change orbit when there is absorption or emission of electromagnetic radiation. - Explain how atoms may form positive ions by losing outer electrons. - Describe how and why the atomic model has changed over time including reference the Bohr model.		REVISION
		CP1a - Explain the difference between vector and scalar quantities. - Recall vector and scalar quantities including: (a) displacement/distance (b) velocity/speed (c) acceleration (d) force (e) weight/mass (f) momentum (g) energy. - Recall that velocity is speed in a stated direction.		**CP2d** - Recall and use Newton's Second Law as force (newton, N) = mass (kilogram, kg) × acceleration (metre per second squared, m/s2), F = m × a. - Explain that inertial mass is a measure of how difficult it is to change the velocity of an object (including from rest) and know that it is defined as the ratio of force over acceleration. - Investigate the relationship between force, mass and acceleration (such as an investigation that uses stacked trolleys.		**CP3d** - Recall and use the equation to calculate the change in gravitational PE when an object is raised above the ground: change in gravitational potential energy (joule, J) = mass (kilogram, kg) × gravitational field strength (newton per kilogram, N/kg) × change in vertical height (metre, m) ΔGPE = m × g × Δh - Recall and use the equation to calculate the amounts of energy associated with a moving object: kinetic energy (joule, J) = ½ × mass (kilogram, kg) × (speed)2 ((metre/second)2 , (m/s)2) KE = ½ × m × v 2		**CP5d** - Recall that different substances may absorb, transmit, refract or reflect electromagnetic waves in ways that vary with wavelength. - Explain the effects of differences in the velocities of electromagnetic waves in different substances. - Describe some uses of electromagnetic radiation: (e) ultraviolet: including security marking, fluorescent lamps, detecting forged bank notes and disinfecting water (f) X-rays: including observing the internal structure of objects, airport security scanners and medical X-rays (g) gamma rays: including sterilising food and medical equipment, and the detection of cancer and its treatment.		**CP6d** - Explain what is meant by background radiation. - Describe the origins of background radiation from Earth and space. - Describe methods for measuring and detecting radioactivity limited to photographic film and a Geiger–Müller tube.		REVISION

Year 1 - GCSE Combined Sci

Lesson	Term 1a	Lesson	Term 1b	Lesson	Term 2a	Lesson	Term 2b	Lesson	Term 3a	Lesson	Term 3b
4, 5 and 6	**CP1b** Recall and use the equations: (a) (average) speed (metre per second, m/s) = distance (metre, m) / time (second, s) (b) distance travelled (metre, m) = average speed (metre per second, m/s) × time (second, s). - Analyse distance/time graphs including determination of speed from the gradient. - Recall some typical speeds encountered in everyday experience for wind and sound, and for walking, running, cycling and other transportation systems.	13, 14 and 15	**CP2e** - Recall and apply Newton's Third Law to equilibrium situations. - (Apply Newton's Third Law) to collision interactions.	4, 5 and 6	**CP3e** - Describe the main energy sources available for use on Earth (including fossil fuels, nuclear fuel …) and compare the ways in which both renewable and non-renewable sources are used. - Explain patterns and trends in the use of energy resources.	13, 14 and 15	**CP5e** - Recall that the potential danger associated with an electromagnetic wave increases with increasing frequency. - Describe the harmful effects on people of excessive exposure to electromagnetic radiation, including: (a) microwaves: internal heating of body cells (b) infrared: skin burns (c) ultraviolet: damage to surface cells and eyes, leading to skin cancer and eye conditions (d) X-rays and gamma rays: mutation or damage to cells in the body. - Recall that changes in atoms and nuclei can: (a) generate radiations over a wide frequency range (b) be caused by absorption of a range of radiations. -To undertake an end of Topic Test to ascertain knowledge	4, 5 and 6	**CP6e** - Recall the relative masses and relative electric charges of protons, neutrons, electrons and positrons. - Recall that alpha, β- (beta minus), β+ (positron), gamma rays and neutron radiation are emitted from unstable nuclei in a random process. - Recall that alpha, β- (beta minus), β+ (positron) and gamma rays are ionising radiations. - Recall that an alpha particle is equivalent to a helium nucleus, a beta particle is an electron emitted from the nucleus and a gamma ray is electromagnetic radiation. - Compare alpha, beta and gamma radiations in terms of their abilities to penetrate and ionise.	13, 14 and 15	REVISION
	CP1c - Recall and use the equation: acceleration (metre per second squared, m/s2) = change in velocity (metre per second, m/s) / time taken (second, s); a = (v – u) / t. - Use the equation: (final velocity)2 ((metre/second)2, (m/s)2) – (initial velocity)2 ((metre/second)2, (m/s)2) = 2 × acceleration (metre per second squared, m/s2) × distance (metre, m); v2 – u2 = 2 × a × x. - Recall that the acceleration, g, in free fall is 10 m/s2 and be able to estimate the magnitudes of everyday accelerations.		**CP2f** - Recall and apply Newton's Third Law both to equilibrium situations and to collision interactions and relate it to the conservation of momentum in collisions. - Recall and use the equation: momentum (kilogram metre per second, kg m/s) = mass (kilogram, kg) × velocity (metre per second, m/s) p = m × v. - Recall and use Newton's Second Law as: force (newton, N) = change in momentum (kilogram meter per second, kg m/s) / time (second, s) F = (mv – mu) / t.		**CP3f** - Describe the main energy sources available for use on Earth (including … bio-fuel, wind, hydro-electricity, the tides and the Sun) … . - Explain patterns and trends in the use of energy resources. -To undertake an end of Topic Test to ascertain knowledge		**CP7a** - Describe the changes involved in the way energy is stored when systems change. - Identify the different ways that the energy of a system can be changed: a through work done by forces b in electrical equipment c in heating. - Describe how to measure the work done by a force and understand that energy transferred (joule, J) is equal to work done (joule, J). - Recall and use the equation: work done (joule, J) = force (newton, N) × distance moved in the direction of the force (metre, m), E = F × d. - Describe and calculate the changes in energy involved when a system is changed by work done by forces. - Define power as the rate at which energy is transferred and use examples to explain this definition. - Recall and use the equation: power (watt, W) = work done (joule, J) ÷ time taken (second, s), P = E/t. - Recall that one watt is equal to one joule per second, J/s.		**CP6f** - Describe the process of β– decay (a neutron becomes a proton plus an electron). - Describe the process of β+ decay (a proton becomes a neutron plus a positron). - Explain the effects on the atomic (proton) number and mass (nucleon) number of radioactive decays (α, β, γ and neutron emission). - Recall that nuclei that have undergone radioactive decay often undergo nuclear rearrangement with a loss of energy as gamma radiation. - Use given data to balance nuclear equations in terms of mass and charge.		REVISION
7, 8 and 9	**CP1d** - Analyse velocity/time graphs to: (a) compare acceleration from gradients qualitatively (b) calculate the acceleration from the gradient (for uniform acceleration only) (c) determine the distance travelled using the area between the graph line and the time axis (for uniform acceleration only).	16, 17 and 18	**CP2g** - Explain methods of measuring human reaction times and recall typical results. - Recall that the stopping distance of a vehicle is made up of the sum of the thinking distance and the braking distance. - Explain that the stopping distance of a vehicle is affected by a range of factors including: (a) the mass of the vehicle (b) the speed of the vehicle (c) the driver's reaction time (d) the state of the vehicle's brakes (e) the state of the road (f) the amount of friction between the tyre and the road surface. - Describe the factors affecting a driver's reaction time including drugs and distractions	7, 8 and 9	**CP4a** - Recall that waves transfer energy and information without transferring matter. - Define and use the terms frequency and wavelength as applied to waves. - Use the terms, amplitude, period and wave velocity as applied to waves. - Describe the difference between longitudinal and transverse waves by referring to sound, electromagnetic, seismic and water waves.	16, 17 and 18	**CP8a** - Describe, with examples, how objects can interact: a at a distance without contact, linking these to the gravitational, electrostatic and magnetic fields involved b by contact, including normal contact force and friction c producing pairs of forces which can be represented as vectors. - Explain the difference between vector and scalar quantities using examples.	7, 8 and 9	**CP6g** - Describe how the activity of a radioactive source decreases over a period of time. - Recall that the unit of activity of a radioactive isotope is the Becquerel, Bq. - Explain that the half-life of a radioactive isotope is the time taken for half the undecayed nuclei to decay or the activity of a source to decay by half. - Explain that it cannot be predicted when a particular nucleus will decay but half-life enables the activity of a very large number of nuclei to be predicted during the decay process. - Use the concept of half-life to carry out simple calculations on the decay of a radioactive isotope, including graphical representations.	16, 17 and 18	Biology Paper
	-To undertake an end of Topic Test to ascertain knowledge		**CP2h** - Recall and use Newton's Second Law as: force (newton, N) = change in momentum (kilogram meter per second, kg m/s) / time (second, s) F = (mv – mu) / t. - Explain the dangers caused by large decelerations.		**CP4b** - Recall and use both the equations below for all waves: wave speed (metre/second, m/s) = frequency (hertz, Hz) × wavelength (metre, m) v = f × λ wave speed (metre/second, m/s) = distance (metre, m) ÷ time (second, s) v = x/t - Describe how to measure the velocity of sound in air and ripples on water surfaces. - Investigate the suitability of equipment to measure the speed/frequency/wavelength of a wave in a solid and a fluid.		**CP8b** - Use vector diagrams to illustrate resolution of forces, a net force, and equilibrium situations (scale drawings only). - Draw and use free body force diagrams. - Explain examples of the forces acting on an isolated solid object or a system where several forces lead to a resultant force on an object and the special case of balanced forces when the resultant force is zero.		**CP6h** - Describe the dangers of ionising radiation in terms of tissue damage and possible mutations and relate this to the precautions needed. - Explain the precautions taken to ensure the safety of people exposed to radiation, including limiting the dose for patients and the risks to medical personnel. - Describe the differences between contamination and irradiation effects and compare the hazards associated with these two.		Chemistry Paper
					CP4c - Explain how waves will be refracted at a boundary in terms of the change of direction and speed.		-To undertake an end of Topic Test to ascertain knowledge		-To undertake an end of Topic Test to ascertain knowledge		Physics Paper

Class		Health, Disease and the Development of Medicine (CB5) / Plant Structures (CB6)		Plant Structures (CB6) / Electrolytic Processes (CC10) / Obtaining and Using Metals (CC11) / Reversible Reactions and Equilibria (CC12)		Animal Coordination, Control and Homeostasis (CB7) / Groups in the Periodic Table (CC13)		Groups in the Periodic Table (CC13) / Rates of Reaction (CC14) / Heat Energy Changes in Chemical Reactions (CC15) / Forces and Matter (CP13)		Fuels (CC16) / Earth and Atmospheric Science (CC17)		Exchange and Transport in Animals (CB8) / Magnetism and the Motor Effect (CP10) / Ectromagnetic Induction (CP11)
Year 2 - GCSE Combined Science TERMS 1 - 3	1, 2 and 3	**CB5a** - Describe health as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity, as defined by the World Health Organization (WHO). - Describe the difference between communicable and non-communicable diseases. - Explain why the presence of one disease can lead to a higher susceptibility to other diseases.	10, 11 and 12	**CB6b** - Explain the effect of temperature, light intensity and carbon dioxide concentration as limiting factors on the rate of photosynthesis. - Explain the interactions of temperature, light intensity and carbon dioxide concentration in limiting the rate of photosynthesis. - Investigate the effect of light intensity on the rate of photosynthesis. - Explain how the rate of photosynthesis is directly proportional to light intensity and inversely proportional to the distance from a light source, including the use of the inverse square law calculation.	1, 2 and 3	**CC12a** - Recall that chemical reactions are reversible, the use of the symbol â‡Œ in equations and that the direction of some reversible reactions can be altered by changing the reaction conditions. - Explain what is meant by dynamic equilibrium. - Describe the formation of ammonia as a reversible reaction between nitrogen (extracted from the air) and hydrogen (obtained from natural gas) and that it can reach a dynamic equilibrium. - Recall the conditions for the Haber process as: a temperature 450°C b pressure 200 atmospheres c iron catalyst. - Predict how the position of a dynamic equilibrium is affected by changes in: a temperature b pressure c concentration.	10, 11 and 12	**CC13a** - Explain why some elements can be classified as alkali metals (group 1), halogens (group 7) or noble gases (group 0), based on their position in the periodic table. - Recall that alkali metals (a) are soft (b) have relatively low melting points. - Describe the reactions of lithium, sodium and potassium with water. - Describe the pattern in reactivity of the alkali metals, lithium, sodium and potassium, with water; and use this pattern to predict the reactivity of other alkali metals. - Explain this pattern in reactivity in terms of electronic configurations.	1, 2 and 3	**CC16b** - Describe and explain the separation of crude oil into simpler, more useful mixtures by the process of fractional distillation. - Recall the names and uses of the following fractions: a gases, used in domestic heating and cooking b petrol, used as fuel for cars c kerosene, used as fuel for aircraft d diesel oil, used as fuel for some cars and trains e fuel oil, used as fuel for large ships and in some power stations f bitumen, used to surface roads and roofs. - Explain how hydrocarbons in different fractions differ from each other in: a the number of carbon and hydrogen atoms their molecules contain b boiling points c ease of ignition d viscosity	10, 11 and 12	**CB8a** - Describe the need to transport substances into and out of a range of organisms, including oxygen, carbon dioxide, water, dissolved food molecules, mineral ions and urea. - Explain the need for exchange surfaces and a transport system in multicellular organisms including the calculation of surface area : volume ratio. - Explain how alveoli are adapted for gas exchange by diffusion between air in the lungs and blood in capillaries.
		CB5b - Describe that many non-communicable human diseases are caused by the interaction of a number of factors including cardiovascular diseases, many forms of cancer, some lung and liver diseases and diseases influenced by nutrition. - Explain the effect of lifestyle factors on non-communicable diseases at local, national and global levels, including: a diet on malnutrition / b alcohol on liver diseases.		**CB6c** - Explain how substances are transported into and out of cells, including by diffusion, osmosis and active transport. - Explain how the structure of the root hair cells is adapted to absorb water and mineral ions.		- To undertake an end of Term Topic Test to ascertain knowledge		**CC13b** - Recall the colours and physical states of chlorine, bromine and iodine at room temperature. - Describe the pattern in the physical properties of the halogens, chlorine, bromine and iodine, and use this pattern to predict the physical properties of other halogens. - Describe the chemical test for chlorine. - Describe the reactions of the halogens, chlorine, bromine and iodine, with metals to form metal halides, and use this pattern to predict the reactions of other halogens. - Recall that the halogens, chlorine, bromine and iodine, form hydrogen halides which dissolve in water to form acidic solutions, and use this pattern to predict the reactions of other halogens.		**CC16c** - Explain how hydrocarbons in different fractions […] are mostly members of the alkane homologous series. - Explain an homologous series as a series of compounds which: a have the same general formula b differ by CH2 in molecular formulae from neighbouring compounds c show a gradual variation in physical properties, as exemplified by their boiling points d have similar chemical properties.		**CB8b** - Explain how the structure of the blood is related to its function: a red blood cells (erythrocytes) b white blood cells (phagocytes and lymphocytes) c plasma d platelets. - Explain how the structure of the blood vessels is related to their function.
		CB5c - Explain the effect of lifestyle factors on non-communicable diseases at local, national and global levels, including: a exercise and diet on obesity, including BMI and waist : hip calculations c smoking on cardiovascular diseases. - Evaluate some different treatments for cardiovascular disease including: • life-long medication • surgical procedures • lifestyle changes.		**CB6d** - Explain how the structures of the xylem and phloem are adapted to their function in the plant, including: a lignified dead cells in xylem transporting water and minerals through the plant b living cells in phloem using energy to transport sucrose around the plant. - Describe how water and mineral ions are transported through the plant by transpiration, including the structure and function of the stomata. - Describe how sucrose is transported around the plant by translocation. - Explain the effect of environmental factors on the rate of water uptake by a plant, to include light intensity, air movement and temperature. - Demonstrate an understanding of rate calculations for transpiration. - To undertake an end of Term Topic Test to ascertain knowledge		**CB7a** - Describe where hormones are produced and how they are transported from endocrine glands to their target organs, including the pituitary gland, thyroid gland, pancreas, adrenal glands, ovaries and testes.		**CC13c** - Describe the relative reactivity of the halogens chlorine, bromine and iodine, as shown by their displacement reactions with halide ions in aqueous solution, and use this pattern to predict the reactions of astatine. - Explain why these displacement reactions are redox reactions in terms of gain and loss of electrons, identifying which of these are oxidised and which are reduced. - Explain the relative reactivity of the halogens in terms of electronic configurations.		**CC16d** - Describe the complete combustion of hydrocarbon fuels as a reaction in which: a carbon dioxide and water are produced b energy is given out. - Explain why the incomplete combustion of hydrocarbons can produce carbon and carbon monoxide. - Explain how carbon monoxide behaves as a toxic gas. - Describe the problems caused by incomplete combustion producing carbon monoxide and soot in appliances that use carbon compounds as fuels.		**CB8c** - Explain how the structure of the heart and circulatory system is related to its function, including the role of the major blood vessels, the valves and the relative thickness of chamber walls. - Calculate heart rate, stroke volume and cardiac output, using the equation cardiac output = stroke volume × heart rate.
		CB5d - Describe a pathogen as a disease-causing organism including viruses, bacteria, fungi and protists. - Describe some common infections, including: a cholera (bacteria) causes diarrhoea b tuberculosis (bacteria) causes lung damage c chalara ash dieback (fungi) causes leaf loss and bark lesions d malaria (protists) causes damage to blood and liver e HIV (virus) destroys white blood cells, leading to the onset of AIDS.		**CC10a** - Recall that electrolytes are ionic compounds in the molten state or dissolved in water. - Describe electrolysis as a process in which electrical energy, from a direct current supply, decomposes electrolytes. - Explain the movement of ions during electrolysis, in which: a positively charged cations migrate to the negatively charged cathode b negatively charged anions migrate to the positively charged anode. - Investigate the electrolysis of copper sulfate solution with inert electrodes and copper electrodes.		**CB7b** - Explain that adrenalin is produced by the adrenal glands to prepare the body for fight or flight, including: a increased heart rate b increased blood pressure c increased blood flow to the muscles d raised blood sugar levels by stimulating the liver to change glycogen into glucose. - Explain how thyroxine controls metabolic rate as an example of negative feedback, including: a low level of thyroxine stimulates production of TRH in hypothalamus b this causes release of TSH from the pituitary gland c TSH acts on the thyroid to produce thyroxine d when thyroxine levels are normal, thyroxine inhibits the release of TRH and the production of TSH.		**CC13d** - Explain why the noble gases are chemically inert, compared with the other elements, in terms of their electronic configurations. - Explain how the uses of noble gases depend on their inertness, low density and/or non-flammability. - Describe the pattern in the physical properties of some noble gases and use this pattern to predict the physical properties of other noble gases.		**CC16e** - Explain how impurities in some hydrocarbon fuels result in the production of sulfur dioxide. - Explain some problems associated with acid rain caused when sulfur dioxide dissolves in rain water. - Explain why, when fuels are burned in engines, oxygen and nitrogen can react together at high temperatures to produce oxides of nitrogen, which are pollutants.		**CB8d** - Describe cellular respiration as an exothermic reaction which occurs continuously in living cells to release energy for metabolic processes, including aerobic and anaerobic respiration. - Compare the process of aerobic respiration with the process of anaerobic respiration. - Core Practical: Investigate the rate of respiration in living organisms. -To undertake an end of Topic Test to ascertain knowledge

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4, 5 and 6	**CB5e** - Explain how pathogens are spread and how this spread can be reduced or prevented, including: a cholera (bacteria) – water b tuberculosis (bacteria) – airborne c chalara ash dieback (fungi) – airborne d malaria (protists) – animal vectors.	13, 14 and 15	**CC10b** - Explain the formation of the products in the electrolysis, using inert electrodes, of some electrolytes, including: a copper chloride solution b sodium chloride solution c sodium sulfate solution d water acidified with sulfuric acid e molten lead bromide (demonstration). - Predict the products of electrolysis of other binary, ionic compounds in the molten state. - Explain the formation of the products in the electrolysis of copper sulfate solution, using copper electrodes, and how this electrolysis can be used to purify copper.	4, 5 and 6	**CB7c** - Describe the stages of the menstrual cycle, including the roles of the hormones oestrogen and progesterone, in the control of the menstrual cycle. - Explain how hormonal contraception influences the menstrual cycle and prevents pregnancy. - Evaluate hormonal and barrier methods of contraception.	13, 14 and 15	**CC14a** - Investigate the effects of changing the conditions of a reaction on the rates of chemical reactions by: a measuring the production of a gas (in the reaction between hydrochloric acid and marble chips) b observing a colour change (in the reaction between sodium thiosulfate and hydrochloric acid). - Suggest practical methods for determining the rate of a given reaction. - Interpret graphs of mass, volume or concentration of reactant or product against time.	4, 5 and 6	**CC16f** - Evaluate the advantages and disadvantages of using hydrogen, rather than petrol, as a fuel in cars. - Explain how cracking involves the breaking down of larger, saturated hydrocarbon molecules (alkanes) into smaller, more useful ones, some of which are unsaturated (alkenes). - Explain why cracking is necessary. -To undertake an end of Topic Test to ascertain knowledge	13, 14 and 15	**CB10a** - Recall that unlike magnetic poles attract and like magnetic poles repel. - Describe the uses of permanent and temporary magnetic materials including cobalt, steel, iron and nickel. - Explain the difference between permanent and induced magnets. -Describe the shape and direction of the magnetic field around bar magnets and for a uniform field, and relate the strength of the field to the concentration of lines. - Describe the use of plotting compasses to show the shape and direction of the field of a magnet and the Earth's magnetic field. - Explain how the behaviour of a magnetic compass is related to evidence that the core of the Earth must be magnetic.
	CB5f - Explain how sexually transmitted infections (STIs) are spread and how this spread can be reduced or prevented, including: a Chlamydia (bacteria) b HIV (virus). - Describe how the physical barriers and chemical defences of the human body provide protection from pathogens, including: a physical barriers including mucus, cilia and skin b chemical defence including lysozymes and hydrochloric acid.		**CC11a** Deduce the relative reactivity of some metals, by their reactions with water, acids and salt solutions. - Explain the reactivity series of metals (potassium, sodium, calcium, magnesium, aluminium, (carbon), zinc, iron, (hydrogen), copper, silver, gold) in terms of the reactivity of the metals with water and dilute acids and that these reactions show the relative tendency of metal atoms to form cations.		**CB7d** - Explain the interactions of oestrogen, progesterone, FSH and LH in the control of the menstrual cycle, including the repair and maintenance of the uterus wall, ovulation and menstruation. - Explain the use of hormones in Assisted Reproductive Technology (ART) including IVF and clomifene therapy.		**CC14b** - Investigate the effects of changing the conditions of a reaction on the rates of chemical reactions by: a measuring the production of a gas (in the reaction between hydrochloric acid and marble chips) b observing a colour change (in the reaction between sodium thiosulfate and hydrochloric acid). - Explain how reactions occur when particles collide and that rates of reaction are increased when the frequency and/or energy of collisions is increased. - Explain the effects on rates of reaction of changes in temperature, concentration, surface area to volume ratio of a solid and pressure (on reactions involving gases) in terms of frequency and/or energy of collisions between particles.		**CC17a** - Recall that the gases produced by volcanic activity formed the Earth's early atmosphere. - Describe that the Earth's early atmosphere was thought to contain: a little or no oxygen b a large amount of carbon dioxide c water vapour d small amounts of other gases and interpret evidence relating to this. - Explain how condensation of water vapour formed oceans.		**CB10b** - Describe how to show that a current can create a magnetic effect and relate the shape and direction of the magnetic field around a long straight conductor to the direction of the current. - Recall that the strength of the field depends on the size of the current and the distance from the long straight conductor. - Explain how inside a solenoid (an example of an electromagnet) the fields from individual coils a add together to form a very strong almost uniform field along the centre of the solenoid b cancel to give a weaker field outside the solenoid.
7, 8 and 9	**CB5g** - Explain the role of the specific immune system of the human body in defence against disease, including: a exposure to pathogen b the antigens trigger an immune response which causes the production of antibodies c the antigens also trigger production of memory lymphocytes d the role of memory lymphocytes in the secondary response to the antigen. - Explain the body's response to immunisation using an inactive form of a pathogen.	16, 17 and 18	**CC11b** - Recall that: a most metals are extracted from ores found in the Earth's crust b unreactive metals are found in the Earth's crust as the uncombined elements. - Explain why the method used to extract a metal from its ore is related to its position in the reactivity series and the cost of the extraction process, illustrated by: a heating with carbon (including iron) b electrolysis (including aluminium) (knowledge of the blast furnace is not required). Explain oxidation as the gain of oxygen and reduction as the loss of oxygen. - Recall that the extraction of metals involves reduction of ores. - Explain how a metal's relative resistance to oxidation is related to its position in the reactivity series.	7, 8 and 9	**CB7e** - Explain the importance of maintaining a constant internal environment in response to internal and external change. - Explain how the hormone insulin controls blood glucose concentration. - Explain how blood glucose concentration is regulated by glucagon. - Explain the cause of type 1 diabetes and how it is controlled.	16, 17 and 18	**CC14c** - Describe a catalyst as a substance that speeds up the rate of a reaction without altering the products of the reaction, being itself unchanged chemically and in mass at the end of the reaction. - Explain how the addition of a catalyst increases the rate of a reaction in terms of activation energy. - Recall that enzymes are biological catalysts and that enzymes are used in the production of alcoholic drinks.	7, 8 and 9	**CC17b** - Explain how the amount of carbon dioxide in the atmosphere was decreased when carbon dioxide dissolved as the oceans formed. - Explain how the growth of primitive plants used carbon dioxide and released oxygen by photosynthesis and consequently the amount of oxygen in the atmosphere gradually increased. - Describe the chemical test for oxygen.	16, 17 and 18	**CB10c** - Recall that a current-carrying conductor placed near a magnet experiences a force and that an equal and opposite force acts on the magnet. - Explain that magnetic forces are due to interactions between magnetic fields. - Recall and use Fleming's left-hand rule to represent the relative directions of the force, the current and the magnetic field for cases where they are mutually perpendicular. - Use the equation: force on a conductor at right angles to a magnetic field carrying a current (newton, N) = magnetic flux density (newtons per amp metre, N/A m) × current (ampere, A) × length (metre, m): F = B × I × l
	CB5h - Explain that antibiotics can only be used to treat bacterial infections because they inhibit cell processes in the bacterium but not the host organism. - Describe that the process of developing new medicines, including antibiotics, has many stages including discovery, development, preclinical and clinical testing. - To undertake an end of Term Topic Test to ascertain knowledge		**CC11c** - Evaluate the advantages of recycling metals, including economic implications and how recycling can preserve both the environment and the supply of valuable raw materials. - Describe that a life time assessment for a product involves consideration of the effect on the environment of obtaining the raw materials, manufacturing the product, using the product and disposing of the product when it is no longer useful. - Evaluate data from a life cycle assessment of a product.		**CB7f** - Explain the cause of type 2 diabetes and how it is controlled. - Evaluate the correlation between body mass and type 2 diabetes including waist : hip calculations and BMI, using the BMI equation: BMI = weight (kg) ÷ (height (m))2 -To undertake an end of Topic Test to ascertain knowledge		**CC15a** - Recall that changes in heat energy accompany the following changes: a salts dissolving in water b neutralisation reactions c displacement reactions d precipitation reactions and that, when these reactions take place in solution, temperature changes can be measured to reflect the heat changes. - Describe an exothermic change or reaction as one in which heat energy is given out. - Describe an endothermic change or reaction as one in which heat energy is taken in.		**CC17c** - Describe how various gases in the atmosphere, including carbon dioxide, methane and water vapour, absorb heat radiated from the Earth, subsequently releasing energy which keeps the Earth warm: this is known as the greenhouse effect. - Evaluate the evidence for human activity causing climate change, considering: a the correlation between the change in atmospheric carbon dioxide concentration, the consumption of fossil fuels and temperature change b the uncertainties caused by the location where these measurements are taken and historical accuracy.		**CP11a** - Recognise and use expressions in decimal form. - Understand and use the symbols: =, <, <<, >>, >, ∝, ~. - Change the subject of an equation. - Substitute numerical values into algebraic equations using appropriate units for physical quantities. - Solve simple algebraic equations.

		CB6a - Describe photosynthetic organisms as the main producers of food and therefore biomass. - Describe photosynthesis in plants and algae as an endothermic reaction that uses light energy to react carbon dioxide and water to produce glucose and oxygen. - Describe how water and mineral ions are transported through the plant by transpiration, including the structure and function of the stomata.		**CC11d** - Evaluate the advantages of recycling metals, including economic implications and how recycling can preserve both the environment and the supply of valuable raw materials. - Describe that a life time assessment for a product involves consideration of the effect on the environment of obtaining the raw materials, manufacturing the product, using the product and disposing of the product when it is no longer useful. - Evaluate data from a life cycle assessment of a product.		- To undertake an end of Term Topic Test to ascertain knowledge		**CC15b** - Recall that the breaking of bonds is endothermic and the making of bonds is exothermic. - Recall that the overall heat energy change for a reaction is: a exothermic if more heat energy is released in forming bonds in the products than is required in breaking bonds in the reactants b endothermic if less heat energy is released in forming bonds in the products than is required in breaking bonds in the reactants. - Calculate the energy change in a reaction given the energies of bonds (in kJ mol–1). - Explain the term activation energy. - Draw and label reaction profiles for endothermic and exothermic reactions, identifying activation energy. -To undertake an end of Topic Test to ascertain knowledge		**CC17d** - Describe: a the potential effects on the climate of increased levels of carbon dioxide and methane generated by human activity, including burning fossil fuels and livestock farming b that these effects may be mitigated: consider scale, risk and environmental implications. -To undertake an end of Topic Test to ascertain knowledge		**CP11b** - Recall the factors that affect the size and direction of an induced potential difference, and describe how the magnetic field produced opposes the original change. - Explain how an alternating current in one circuit can induce a current in another circuit in a transformer. - Recall that a transformer can change the size of an alternating voltage. - Explain why, in the national grid, electrical energy is transferred at high voltages from power stations, and then transferred at lower voltages in each locality for domestic uses, as it improves the efficiency by reducing heat loss in transmission lines. - Explain where and why step-up and step-down transformers are used in the transmission of electricity in the national grid.
							19	**CP13a** - Explain, using springs and other elastic objects, that stretching, bending or compressing an object requires more than one force. - Describe the difference between elastic and inelastic distortion. - Describe the difference between linear and non-linear relationships between force and extension. - Core Practical: Investigate the extension and work done when applying forces to a spring.				
							20	**CP13b** - Recall and use the equation for linear elastic distortion including calculating the spring constant: force exerted on a spring (newton, N) = spring constant (newton per metre, N/m) × extension (metres, m) F = k × x - Use the equation to calculate the work done in stretching a spring: energy transferred in stretching (joule, J) = 0.5 × spring constant (newton per metre, N/m) × (extension (metres, m))2 E = ½ × k × x2				

	Lesson	Term 4a	Lesson	Term 4b	Lesson	Term 5a	Lesson	Term 5b	Lesson	Term 6a	Lesson	Term 6b
Class		**ElecEcosystems and Material Cycles (CB9)**		**Electricity and Circuits (CP9)**		**Particle Model (CP12)**		**REVISION / EXAM**		**REVISION / EXAM**		
	1, 2 and 3	**CB9a** - Describe the different levels of organisation from individual organisms, populations, communities, to the whole ecosystem. - Describe the importance of interdependence in a community. - Explain how to determine the number of organisms in a given area using raw data from field-work techniques, including quadrats.	10, 11 and 12	**CP9a** - Describe the structure of the atom, limited to the position, mass and charge of protons, neutrons and electrons. - Draw and use electric circuit diagrams representing them with the conventions of positive and negative terminals, and the symbols that represent cells, including batteries, switches, voltmeters, ammeters, resistors, variable resistors, lamps, motors, diodes, thermistors, LDRs and LEDs. - Describe the differences between series and parallel circuits.	1, 2 and 3	**CP12a** - Use a simple kinetic theory model to explain the different states of matter (solids, liquids and gases) in terms of the movement and arrangement of particles. - Recall and use the equation: density (kilograms per cubic metre, kg/m3) = mass (kilograms, kg) / volume (cubic metres, m3). ρ = m/V - Investigate the densities of solids and liquids. - Explain the differences in density between the different states of matter in terms of the arrangements of the atoms or molecules. - Describe that when substances melt, freeze, evaporate, boil, condense or sublimate mass is conserved and that these physical changes differ from some chemical changes because the material recovers its original properties if the change is reversed.	10, 11 and 12	REVISION	1, 2 and 3	REVISION	10, 11 and 12	
		CB9b - Explain how communities can be affected by abiotic factors including a temperature, light, water, pollutants - Core Practical: Investigate the relationship between organisms and their environment using field-work techniques, including quadrats and belt transects. - Explain how to use raw data from field-work techniques, including quadrats and belt transects.		**CP9b** - Recall that a voltmeter is connected in parallel with a component to measure the potential difference (voltage), in volts, across it. - Recall that an ammeter is connected in series with a component to measure the current, in amps, in the component. - Describe that when a closed circuit includes a source of potential difference there will be a current in the circuit. - Recall that current is conserved at a junction in a circuit.		**CP12b** - Explain how heating a system will change the energy stored within the system and raise its temperature or produce changes of state. - Define the terms specific heat capacity and specific latent heat and explain the differences between them. - Explain ways of reducing unwanted energy transfer through thermal insulation. - Core Practical: Investigate the properties of water by determining the specific heat capacity of water and obtaining a temperature-time graph for melting ice.		REVISION		REVISION		

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	CB9c - Explain how communities can be affected by biotic factors including: b competition, predation.		**CP9c** - Explain that potential difference (voltage) is the energy transferred per unit charge passed and hence that the volt is a joule per coulomb. - Recall and use the equation: - Energy transferred (joule, J) = charge moved (coulomb, C) × potential difference (volt, V) E = Q × V - Explain that an electric current is the rate of flow of charge and the current in metals is a flow of electrons. - Recall and use the equation: charge (coulomb, C) = current (ampere, A) × time (second, s) Q = I × t		**CP12c** - Use the equation: change in thermal energy (joule, J) = mass (kilogram, kg) × specific heat capacity (joule per kilogram degree Celsius, J/kg °C) × change in temperature (degree Celsius, °C) ΔQ = m × c × Δθ - Use the equation: thermal energy for a change of state (joule, J) = mass (kilogram, kg) × specific latent heat (joule per kilogram, J/kg) Q = m × L - Core Practical: Investigate the properties of water by determining the specific heat capacity of water and obtaining a temperature-time graph for melting ice.		REVISION		REVISION		
4, 5 and 6	**CB9d** - Describe how the survival of some organisms is dependent on other species, including parasitism and mutualism.	13, 14 and 15	**CP9d** - Draw and use electric circuit diagrams […] and the symbols that represent […] resistors, variable resistors […]. - Explain how changing the resistance in a circuit changes the current and how this can be achieved using a variable resistor. - Recall and use the equation: potential difference (volt, V) = current (ampere, A) × resistance (ohm, Ω) V = I × R - Explain why, if two resistors are in series, the net resistance is increased, whereas with two in parallel the net resistance is decreased. - Calculate the currents, potential differences and resistances in series circuits. - Explain the design and construction of series circuits for testing and measuring.	4, 5 and 6	**CP12d** - Explain the pressure of a gas in terms of the motion of its particles. - Explain the effect of changing the temperature of a gas on the speed of its particles and hence on the pressure produced by a fixed mass of gas at constant volume (qualitative only). - Describe the term absolute zero, −273°C, in terms of the lack of movement of particles. - Convert between the Kelvin and Celsius scales.	13, 14 and 15	EXAM	4, 5 and 6	EXAM	13, 14 and 15	
	CB9e - Explain the positive and negative human interactions within ecosystems and their impacts on biodiversity, including: a fish farming b introduction of non-indigenous species c eutrophication.		**CP9e** - Draw and use electric circuit diagrams […] and the symbols that represent cells, including batteries, switches, voltmeters, ammeters, resistors, variable resistors, lamps, motors, diodes, thermistors, LDRs and LEDs. - Construct electrical circuits to: a investigate the relationship between potential difference, current and resistance for a resistor and a filament lamp b test series and parallel circuits using resistors and filament lamps. - Explain how current varies with potential difference for the following devices and how this relates to resistance: a filament lamps b diodes c fixed resistors. - Describe how the resistance of a light-dependent resistor (LDR) varies with light intensity. - Describe how the resistance of a thermistor varies with change of temperature (negative temperature coefficient thermistors only). - Explain how the design and use of circuits can be used to explore the variation of resistance in the following devices: a filament lamps b diodes c thermistors d LDRs		REVISION		EXAM		EXAM		
	CB9f - Explain the benefits of maintaining local and global biodiversity, including the conservation of animal species and the impact of reforestation.		**CP9f** - Recall that, when there is an electric current in a resistor, there is an energy transfer which heats the resistor. - Explain that electrical energy is dissipated as thermal energy in the surroundings when an electrical current does work against electrical resistance. - Explain the energy transfer (in 10.22 above) as the result of collisions between electrons and the ions in the lattice. - H Explain ways of reducing unwanted energy transfer through low resistance wires. - Describe the advantages and disadvantages of the heating effect of an electric current. - Use the equation: energy transferred (joule, J) = current (ampere, A) × potential difference (volt, V) × time (second, s) E = I × V × t		REVISION		EXAM		EXAM		

	7, 8 and 9	**CB9g** - Describe how different materials cycle through the abiotic and biotic components of an ecosystem. - Explain the importance of the water cycle including the processes involved and the production of potable water in areas of drought including desalination.	16, 17 and 18	**CP9g** - Describe power as the energy transferred per second and recall that it is measured in watts. - Recall and use the equation: power (watt, W) = energy transferred (joule, J)/time taken (second, s) P = E/t - Explain how the power transfer in any circuit device is related to the potential difference across it and the current in it. - Recall and use the equations: electrical power (watt, W) = current (ampere, A) × potential difference (volt, V) P = I × V electrical power (watt, W) = current squared (ampere2, A2) × resistance (ohms, Ω) P = I2 × R	7, 8 and 9	REVISION	16, 17 and 18	REVISION	7, 8 and 9		16, 17 and 18	
		CB9h - Describe how different materials cycle through the abiotic and biotic components of an ecosystem. - Explain the importance of the water cycle including the processes involved and the production of potable water in areas of drought including desalination.		**CP9h** - Describe how, in different domestic devices, energy is transferred from batteries and the a. c. mains to the energy of motors and heating devices. - Explain the difference between direct and alternating voltage. - Describe direct current (d.c.) as movement of charge in one direction only and recall that cells and batteries supply direct current (d.c.). - Describe that in alternating current (a.c.) the movement of charge changes direction. - Recall that in the UK the domestic supply is a.c., at a frequency of 50 Hz and a voltage of about 230 V. - Describe, with examples, the relationship between the power ratings for domestic electrical appliances and the changes in stored energy when they are in use.		REVISION		REVISION				
		CB9i - Explain how nitrates are made available for plant uptake, including the use of fertilisers, crop rotation and the role of bacteria in the nitrogen cycle. - To undertake an end of Term Topic Test to ascertain knowledge (CB9)		**CP9i** - Explain the difference in function between the live and the neutral mains input wires. - Explain the function of an earth wire and of fuses or circuit breakers in ensuring safety. - Explain why switches and fuses should be connected in the live wire of a domestic circuit. - Recall the potential differences between the live, neutral and earth mains wires. - Explain the dangers of providing any connection between the live wire and earth. - To undertake an end of Term Topic Test to ascertain knowledge (CP9)		REVISION		REVISION				