KS4 SCIENCE

TEACHING OVERVIW AND TIMELINE

KS4 foundation year

Biology Chemistry Physics

Yr 9 ELC/Combined Science Trilogy:

Autumn	Half Term 1							Half Term 2						
Week:	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Topic:	Elements, Mixtures and Compounds							Energy, Forces and Structure of Matter						
								The Human Body						

Spring	Half Term 3						Half Term 4					
Week:	1	2	3	4	5	6	1	2	3	4	5	6
Topic:			Chemistry in our world				Environment, Evolution and Inheritance					

Summer	Half Term 5						Half Term 6						
Week:	1	2	3	4	5	6	1	2	3	4	5	6	7
Topic:	Electricity, magnetism and waves			Atomic Structure and the Periodic Table			Atomic Structure			Cell Biology			

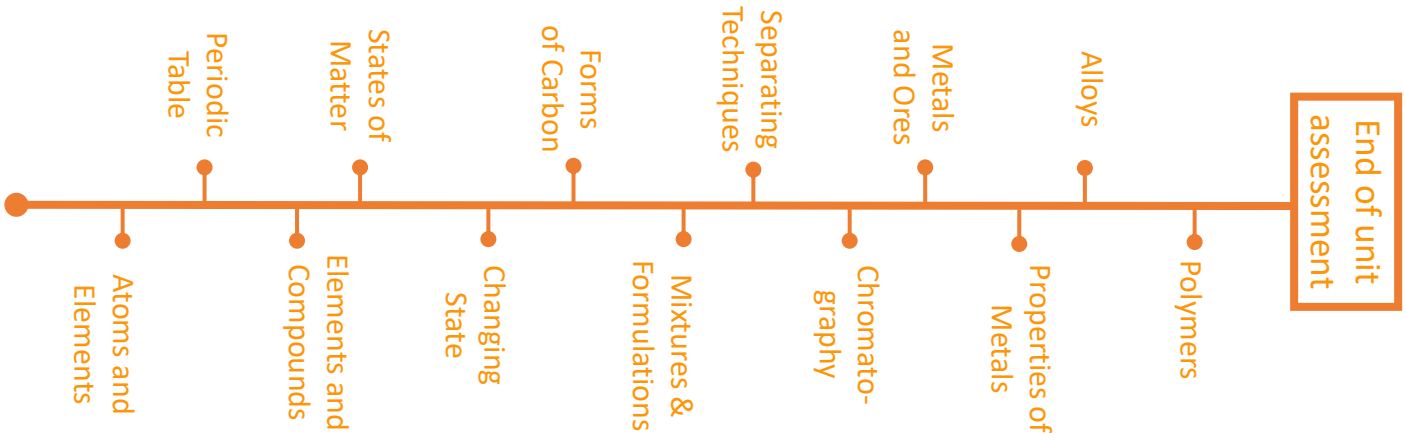
Yr 9 ELC/Triple Science:

Autumn	Half Term 1							Half Term 2						
Week:	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Bio:	The Human Body													
Chem:	Elements, Mixtures and Compounds							Chemistry in our world						
Phys:	Energy, Forces and Structure of Matter							Electricity, magnetism and waves						

Autumn	Half Term 3						Half Term 4					
Week:	1	2	3	4	5	6	1	2	3	4	5	6
Bio:	The Environment, Evolution and Inheritance										Cell Biology	
Chem:			Atomic Structure and the Periodic Table									
Phys:		Energy					Electricity					

Autumn	Half Term 5						Half Term 6						
Week:	1	2	3	4	5	6	1	2	3	4	5	6	7
Bio:	Cell Biology												
Chem:	Binding, Structure and Properties of Matter						Energy changes						
Phys:		Atomic structure									Review		

Elements, Mixtures and Compounds



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Homework and revision platforms:

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Big idea:

MATTER

TIMELINE

Overarching context:

- Matter is composed of tiny particles called atoms and there are about 100 naturally occurring types of atoms called elements.
- Elements are shown in the periodic table and are either metals or non-metals. Atoms are the building blocks for all substances. When two or more elements combine chemically a compound is produced.
- Different substances have different combinations of atoms joined together in different ways, which gives them different properties, such as whether they are solid, liquid or gaseous at room temperature. Many materials we use are mixtures. Mixtures can be separated by processes such as filtration. Polymers have many useful applications

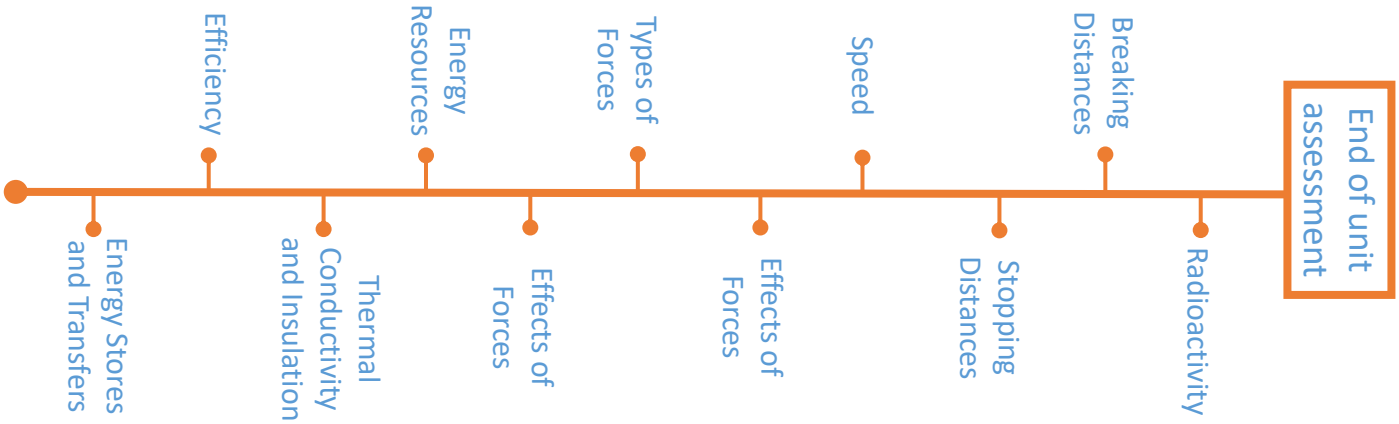
Key Vocabulary:

Atom, Balanced equation, Bond, Chromatography, Compound, Diatomic, Displacement, Element, Electron, Electron shell, Filtration, Formulae, Group, Ions, Isotope, Mass number, Metals, Mixture, Negative charge, Neutron, Nuclear model, Non-metals, Particle, Period, Periodic table of elements, Plum pudding model, Positive charge, Polymers, Products, Proton, Purification, Reactants, Simple molecule, Separation

Skills:

How Science Works	Maths	Literacy
Predicting reactions and properties, using models, separating mixtures	Balancing equations, percentages, fractions, SI units and orders of magnitude	Discussion, extended writing, historical timelines

Energy, Forces and Structure of Matter



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Homework and revision platforms:

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Big idea:

ENERGY

FORCES

TIMELINE

Overarching context:

- Forces are pushes or pulls, and if a force causes an object to move then work is done and energy is transferred. Energy can be transferred usefully, stored or dissipated, but cannot be created or destroyed. A braking force will cause an energy transfer that makes a vehicle slow down and heats the brakes. The braking distance of a vehicle depends on many different things, such as the speed of the vehicle.
- The energy resources available to use may be divided into renewable and non-renewable. Energy can also be released from atoms, which contain smaller particles such as neutrons and protons in the nucleus, because atoms can break down to emit particles or gamma rays.

Key Vocabulary:

Acceleration, Aplha, Beta, Biofuel, Deceleration, Conduction, Energy resources, Elastic potential energy, Efficiency, Force, Fossil fuels, Gravitational field strength, Energy store, Geothermal, Gravity, Gravitational potential energy, Lubrication, Hydroelectric, Heating, Power, Non-renewable, Joules, Thermal conductivity, Nuclear fuel, Kinetic, Thermal insulation, Renewable, Radioactive, Mass, Solar, Series, Tidal, Specific heat capacity, Speed, Spring constant, System, Temperature, Thermal, Transfer, Volts, Magnitude, Mass, Newtonmeter, Newtons (N), Non-contact forces, Pull, Push, Resultant force

Skills:

How Science Works	Maths	Literacy
Analysis and evaluation, quantities, units and symbols	Arithmetic and numerical computation, handling data, algebra	Discussion, evaluating, written equations, extended writing

The Human Body

TAKE IT FURTHER

Homework and revision platforms:

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Big idea:

ORGANISMS

TIMELINE

Overarching context:

- The human body is made up of organs, which are organised into organ systems. These systems require energy. The organ systems are responsible for delivering food and oxygen to the cells and taking away waste. All these key processes are coordinated by the nervous system and a hormone system.
- A healthy body can be maintained by a balanced diet, exercise and a healthy lifestyle. Health can be damaged by microbes, which can cause infectious diseases. The body can defend itself against most diseases but will sometimes need drugs.

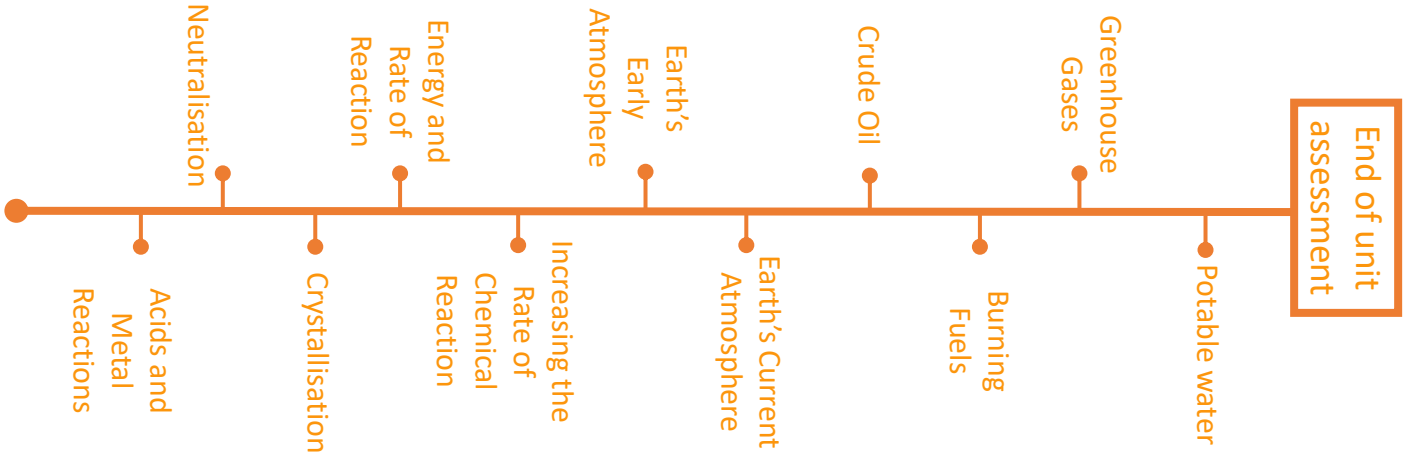
Key Vocabulary:

Antibodies, Antitoxins, antibiotics, Bacteria, Blood cell, Bone marrow, Chromosomes, Clone, Cellulose, Chloroplast, Cytoplasm, Embryo, Concentration gradient, Contraception, Diffusion, Differentiation, Drug, DNA, Eukaryote, FSH, Gene, Hormone, LH, Magnification, Membrane, Microscope, Mitochondria, Mitosis, Nucleus, Neurone, Osmosis, Organelle, Organism, Pathogen, Plasmids, Permeable, Plasma Prokaryote, Placebo, Progesterone, Respiration, Ribosome, Undifferentiated, Vaccination

Skills:

How Science Works	Maths	Literacy
Analysing patterns, drawing conclusions, collecting data, using apparatus, biological drawings	Calculations, orders of magnitude, standard units and conversions	Labeling diagrams, comprehension, discussion, using articles, extended writing

Chemistry in Our World



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Homework and revision platforms:

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Big idea:

REACTIONS

EARTH

TIMELINE

Overarching context:

- Acids react with metals, alkalis and bases to produce compounds known as salts.
- Many chemical reactions produce a change in temperature. Chemical reactions can be made to go faster or slower by changing the conditions.
- The Earth's atmosphere has changed over billions of years.
- Human activities increase the amounts of some substances in the atmosphere.
- Water that is safe to drink is essential for human health.

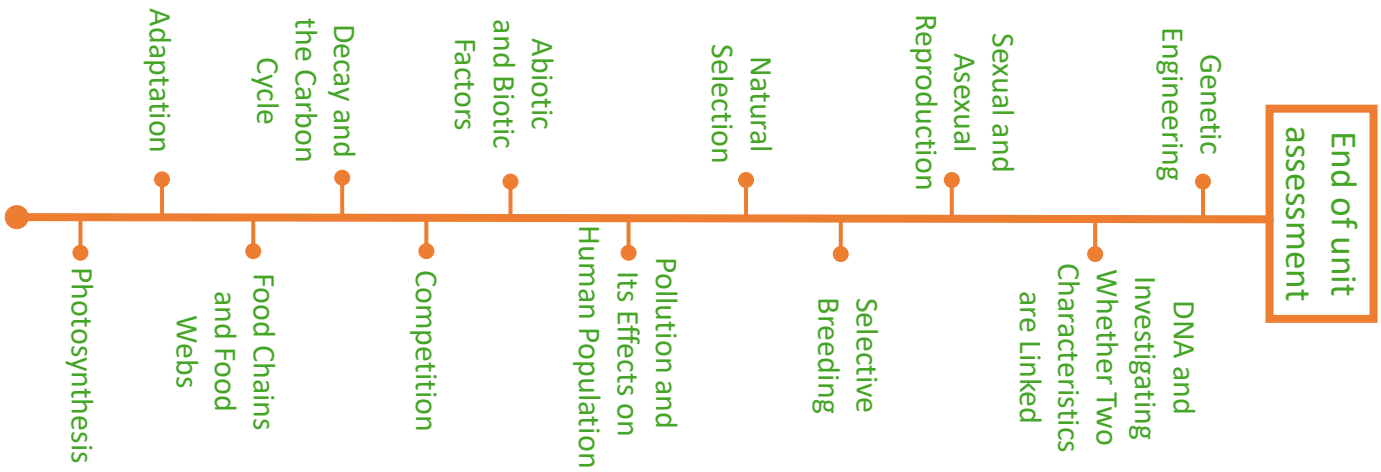
Key Vocabulary:

Acids, Aluminium, Activation energy, Alkalis, Aqueous Solution, Covserved, Carbonates, Displacement, Endothermic, Extraction, Energy, Hydrogen, Crystallisation, Current, Exothermic, Metal oxides, Evaporation, Aerobic biological treatment, Agriculture, Anaerobic digestion, Chlorine, Disposal, Distillation, Effluent, Environment, Environmental impact, Extraction, Finite resources, Industrial, Life Cycle Assessment (LCA), Manufacturing, Microbes, Mining, Ozone, Pollutant, Potable water, Processing, Pure water, Purification, Quarrying, Reduce, reuse, recycle, Renewable resources, Sedimentation, Sewage, Screening, Sterilising, Sustainable, Ultraviolet light

Skills:

How Science Works	Maths	Literacy
Planning experiments, analysing results, making conclusions	Using melting points, graphs, percentages, fractions, significant figures	Using scientific vocabulary, discussion, extended writing

Environment, Evolution and Inheritance



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Big idea:

ECOSYSTEM

GENES

TIMELINE

Overarching context:

- Life on Earth is dependent on photosynthesis to fix carbon dioxide and produce the organic molecules used as the fuels for respiration.
- Living organisms interact with one another and their environment in many different ways. Human behaviours may have beneficial or detrimental effects on natural populations and the environment. The chemicals in the environment are continually cycling.
- Life on Earth has evolved over time by natural selection, which accounts for biodiversity and how organisms are related. The characteristics of living things depend on both their environment and their genome.
- Humans can now use genetic engineering to modify organisms.

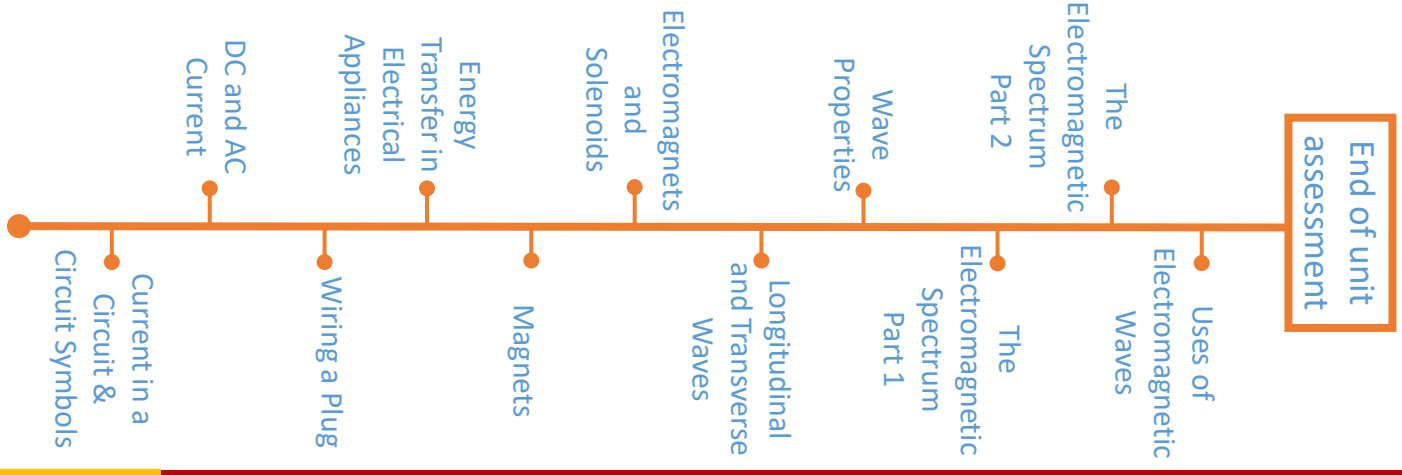
Key Vocabulary:

Abiotic, Abundance, Adaptations, Agricultural, Biodiversity, Biofuels, Biomass, Biotic, Carbon Cycle, Climate, Competition, Deforestation, Disease, Distribution, Ecosystem, Endangered, Evaporation, Extremophiles, Habitat, Intensive farming, Interdependence, Landfill, Microorganisms, Organism, Photosynthetic, Pollutants, Population, Predators, Prey, Primary consumers, Producers, Secondary consumers, Species, Stable community, Tertiary consumers, Transects, Water cycle, DNA, Gene, Allele, Characteristic

Skills:

How Science Works	Maths	Literacy
Using apparatus, planning variables, presenting data, drawing conclusions	Estimation, correlation, unit conversion, analysing correlation, significant figures	Using articles, comprehension, discussion, debate, organising information

Electricity, magnetism and waves



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Big idea:

ELECTROMAGNETS WAVES

TIMELINE

Overarching context:

- Electricity is used in domestic and industrial situations to supply energy. Electric current is a flow of electrical charge and measured in amps. Direct current (d.c.) is supplied by cells and alternating current (a.c.) is supplied by the mains, but in both cases the size of the current depends on the resistance in the circuit. When a current flows through a coil of wire an electromagnet is formed, which like permanent magnets, can exert a force over a distance.
- Electric currents can also be used to produce electromagnetic waves, which have many uses including the transmission of information and the transfer of energy from one place to another.

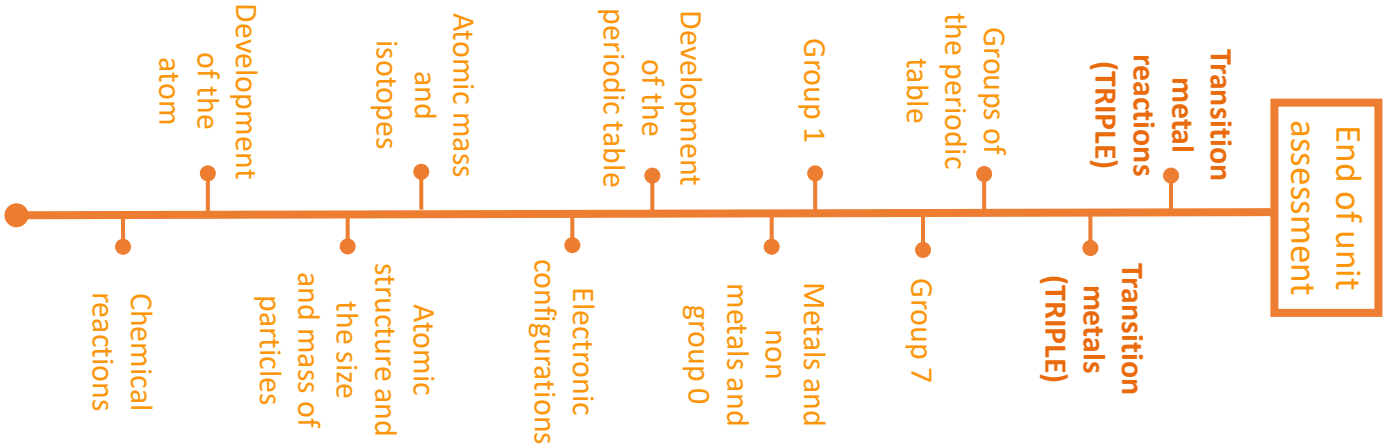
Key Vocabulary:

Attract, Coil, Compass, Conducting wire, Current, Earth's core, Electromagnet, Electromagnetism, Induce magnet, Iron core, Magnet, Magnetic field, Non-contact force, Permanent magnet, Pole, Repel, Solenoid, Steel, Cell, Circuit, Coulombs, Connection, Battery, Domestic appliance, Earth wire, Electrical charge, Electrocution, Fault, Filament lamp, Fuse, Joules, Lamp, Live wire, Mains electricity, Neutral wire, Parallel, Potential difference, Power, Power supply, Power station, Resistance, Resistor, Series, Longitudinal, Peak, Refraction, Reflection, Transverse, Vibrations, Wave, Wavelength

Skills:

How Science Works	Maths	Literacy
Experimental skills and strategies	Arithmetic and numerical computation; Algebra	Written equations, Comprehension, extended writing

Atomic Structure and the Periodic Table



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Big idea:

MATTER

TIMELINE

Overarching context:

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

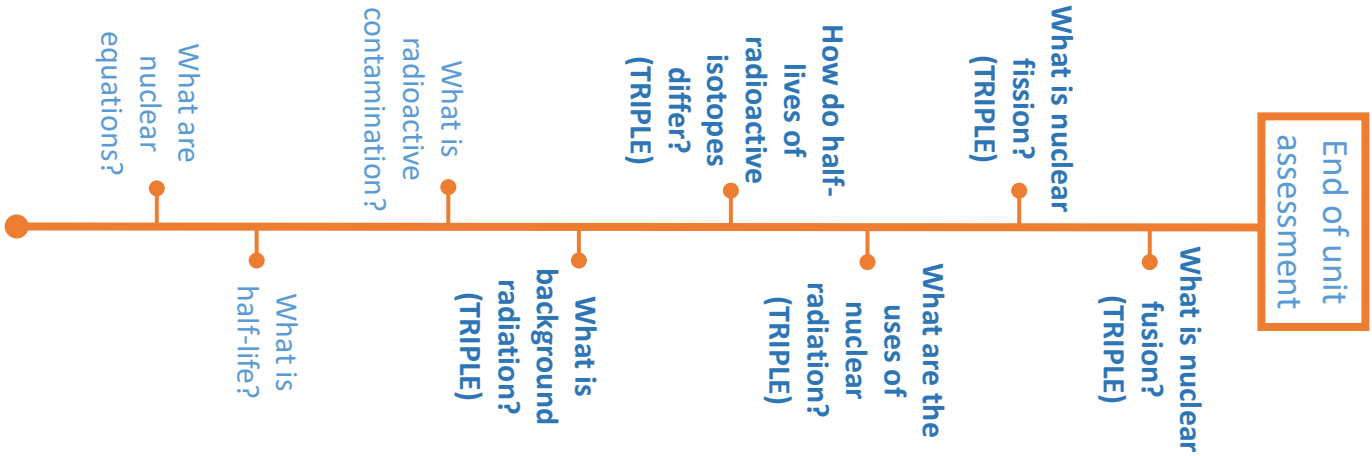
Key Vocabulary:

Atom, Balanced equation, Bond, Chromatography, Compound, Diatomic, Displacement, Element, Electron, Electron shell, Filtration, Formulae, Group, Ions, Isotope, Mass number, Metals, Mixture, Negative charge, Neutron, Nuclear model, Non-metals, Particle, Period, Periodic table of elements, Plum pudding model, Positive charge, Polymers, Products, Proton, Purification, Reactants, Relative formula mass (Mr), Simple molecule, Separation **(TRIPLE):** Catalyst, Compounds density, Halogens, Hardness, Melting point, Oxygen, Reactivity, Transition metals, Water

Skills:

How Science Works	Maths	Literacy
Predicting reactions and properties, using models, separating mixtures	Balancing equations, percentages, fractions, SI units and orders of magnitude	Discussion, extended writing, historical timelines

Atomic Structure



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Big idea:

MATTER

TIMELINE

Overarching context:

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

Key Vocabulary:

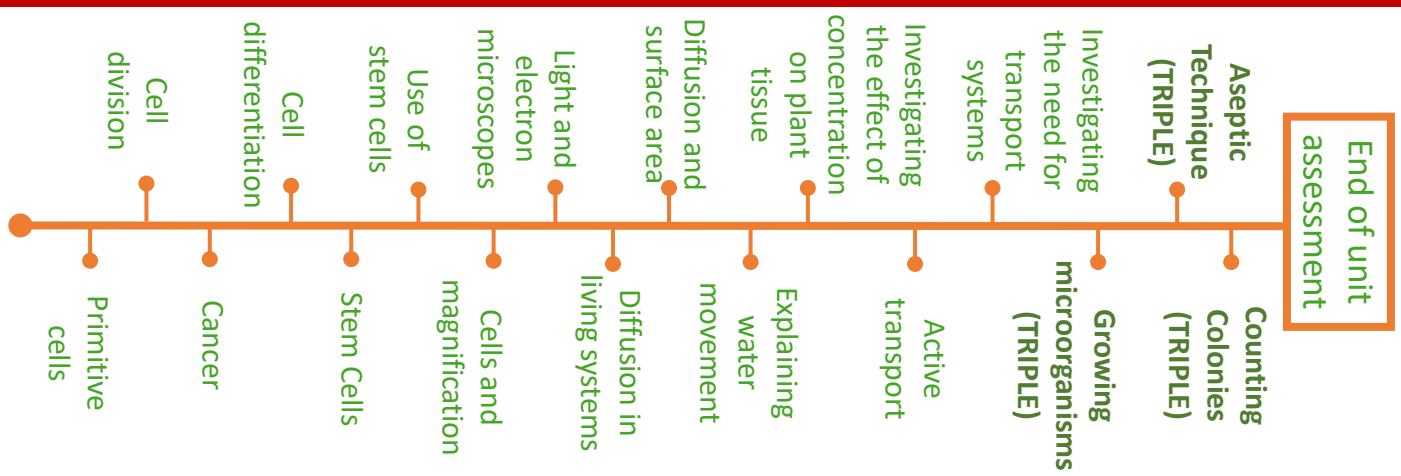
Absorbtion, Alpha decay, Alpha particle, Atom, Atomic model, Atomic nuclei, Atomic number, Bacquerel (Bq), Beta decay, Beta particle, Contamination, Count-rate, Electrical charge, Electromagnetic radiation, Electron, Emission, Energy levels, Evidence, Gamma ray, Geiger-Muller tube, Half-life, Hazard, Ionising power, Irradiation, Isotope, James Chadwick, Mass, Mass number, Negative charge, Neutron, Niels Bohr, Nuclear model, Nucleus, Orbit, Plum pudding model, Positive charge, Positive ions, Precaution, Proton, Proton, Radiation, Radioactive decay, Radius, Unstable

(TRIPLE): Joining nuclei, Kinetic energy, Nuclear reactor, Nuclear weapons, Radiation dose, Sieverts (Sv), Splitting nculei, Spontaneous

Skills:

How Science Works	Maths	Literacy
Development of scientific thinking; Scientific vocabulary	Arithmetic and numerical computation; Algebra; Graphs	Understanding key vocabulary; evaluating , extended writing, written equations

Cell Biology



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Big idea:

ORGANISMS

TIMELINE

Overarching context:

- Cells are the basic unit of all forms of life. Structural differences between types of cells are controlled by genes in the nucleus and enable them to perform specific functions within the organism.
- For an organism to grow, cells must divide by mitosis producing two new identical cells.
- If cells are isolated at an early stage of growth before they have become too specialised, they can retain their ability to grow into a range of different types of cells.

Key Vocabulary:

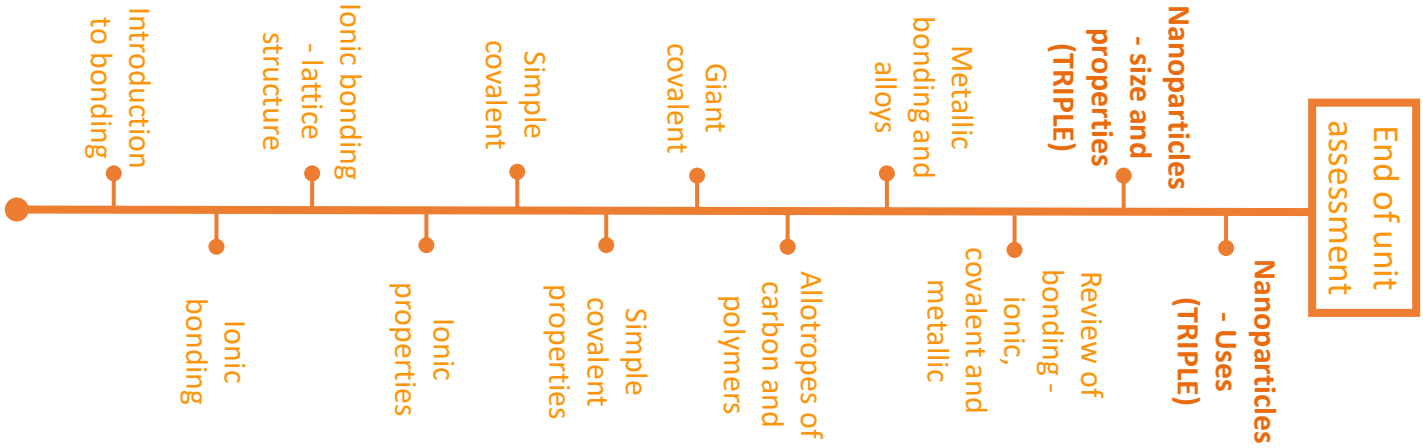
Algae, Active transport, Bacteria, Bone marrow, Chromosomes, ATP, Clone, Cellulose, Chloroplast, Cytoplasm, Embryo, Concentration gradient, Diffusion, Differentiation, DNA, Eukaryote, Meristem, Equilibrium, Gene, Hypertonic, Hypotonic, Isotonic, Magnification, Membrane, Microscope, Mitochondria, Mitosis, Nucleus, Osmosis, Organelle, Organism, Respiration, Plasmids, Stem cell, Permeable, Prokaryote, Undifferentiated, Ribosome
(TRIPLE): Aseptic technique, Binary fission, Colony, Incubate, Inoculation loop

Skills:

How Science Works	Maths	Literacy
Analysing patterns, drawing conclusions, collecting data, comparing equipment, using apparatus, biological drawings	Calculations, rearranging equations, standard form, orders of magnitude, standard units and conversions	Labeling diagrams, comprehension, discussion, debate, long answer questions, using articles, extended writing

Additional topics for Triple Science students only.

Bonding, Structure & Properties of Matter



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Homework and revision platforms:

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Big idea:

MATTER

TIMELINE

Overarching context:

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

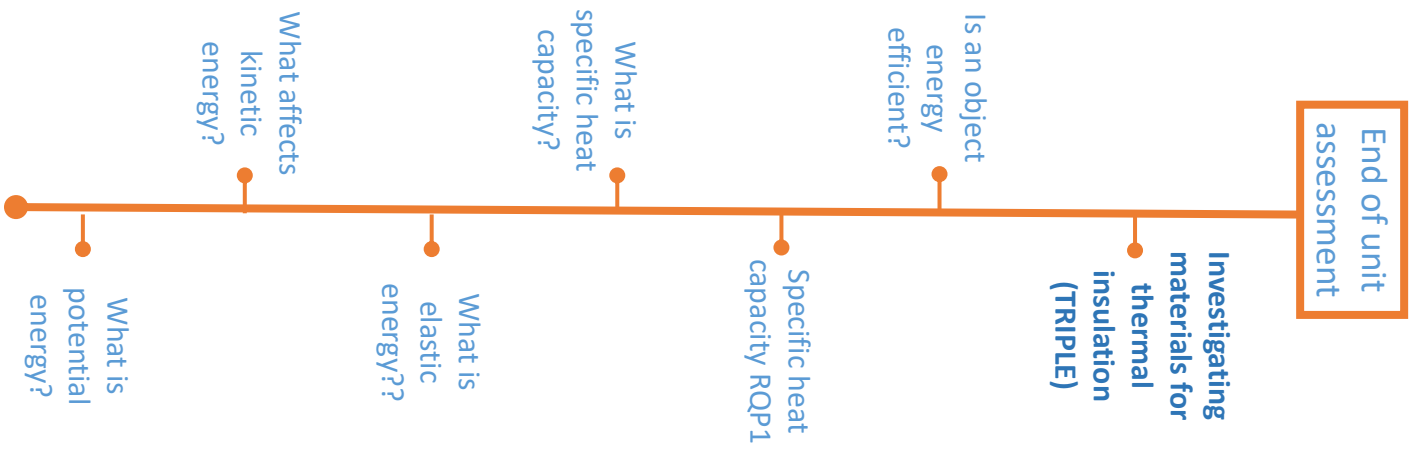
Key Vocabulary:

Alloys, Aqueous (aq), Atoms, Carbon, Compounds, Conduct, Covalent bond, Charged ions, Boiling point, Bond, Delocalised, Diamond, Diatomic, Electrical charge, Electron, Electrostatic forces, Elements, Fullerenes, Gas (g), Giant structure, Graphene, Graphite, Hexagonal rings, Ionic bond, Intermolecular forces, Lattice, Liquid (l), Macromolecule, Metallic bond, Materials, Metals, Melting point, Molecules, Molecular formula, Nanotechnology, Nanotubes, Negatively charged, Non-metals, Properties, Polymers, Particles, Positively charged, Silica, Simple molecule, Solid (s), States of matter, Strong forces, Silicon dioxide, Sodium chloride, Temperature, Weak forces
(TRIPLE): Coarse, Cosmetics, Electronics, Fine, Medicine, Nanometre (nm), Nanoparticles

Skills:

How Science Works	Maths	Literacy
Models and analogies, model drawings	3D models, equations	Extended writing, using articles, researching uses of substances

Energy



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Homework and revision platforms:

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Big idea:

ENERGY

TIMELINE

Overarching context:

- The concept of energy emerged in the 19th century. The idea was used to explain the work output of steam engines and then generalised to understand other heat engines. It also became a key tool for understanding chemical reactions and biological systems.
- Limits to the use of fossil fuels and global warming are critical problems for this century.
- Physicists and engineers are working hard to identify ways to reduce our energy usage

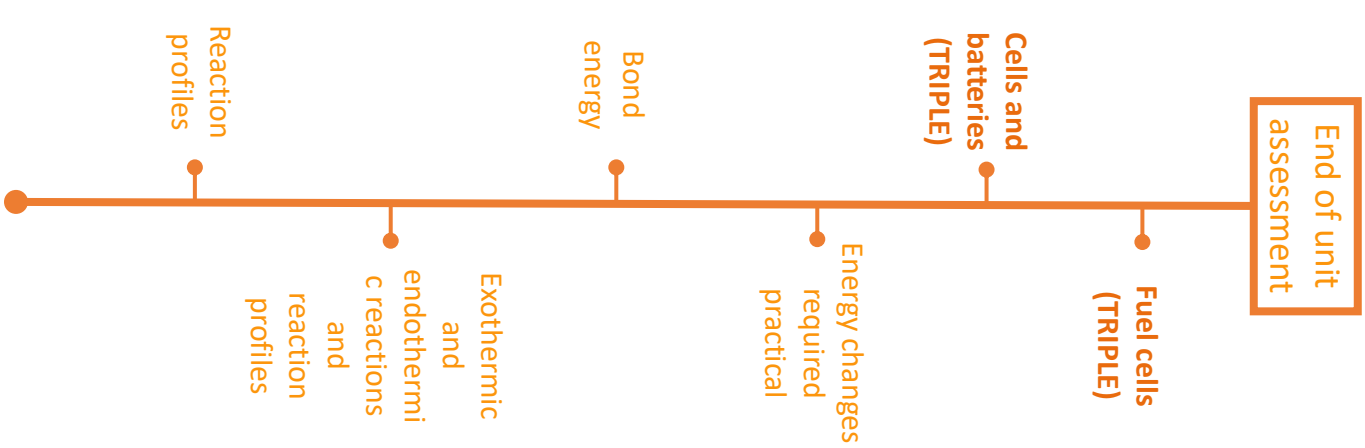
Key Vocabulary:

Acceleration, Closed system, Biofuel, Deceleration, Conduction, Energy resources, Elastic potential energy, Efficiency, Force, Fossil fuels, Gravitational field strength, Energy store, Geothermal, Gravitational potential energy, Lubrication, Hydroelectric, Heating, Power, Non-renewable, Joules, Thermal conductivity, Nuclear fuel, Kinetic, Thermal insulation, Renewable, Mass, Solar, Newton, Series, Tidal, Specific heat capacity, Speed, Spring constant, System, Temperature, Thermal, Transfer, Volts

Skills:

How Science Works	Maths	Literacy
Scientific thinking, analysis and evaluation' using scientific vocabulary, quantities, units, symbols, and nomenclature	Arithmetic and numerical computation, handling data, algebra	Discussion, evaluating; understanding key vocabulary, written equations, extended writing

Energy Changes



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Homework and revision platforms:

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Big idea:

REACTIONS

TIMELINE

Overarching context:

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

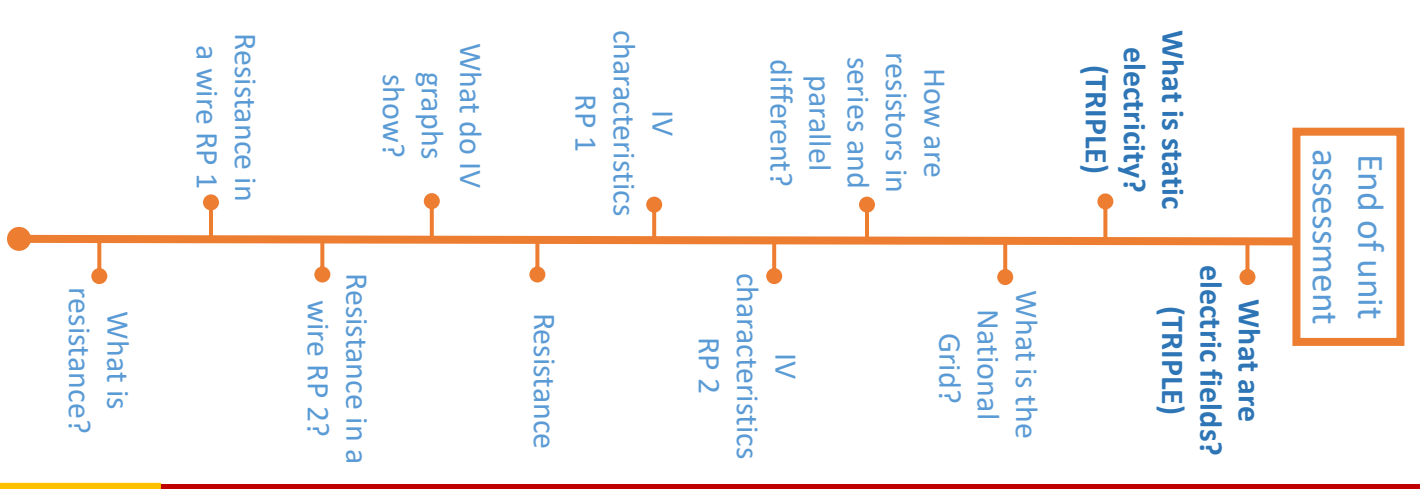
Key Vocabulary:

Activation energy, Conserved, Endothermic, Energy, Exothermic, Neutralisation, Oxidiation, Reaction, Surroundings, Thermal decomposition
***Higher only*:** Bond energies, Bonds
(TRIPLE): Alkaline, Batteries, Cells, Chemicals, Electricity, Electrode, Electrolyte, Fuel cells, Hydrogen, Non-rechargable, Oxidation, React, Relative reactivity, Series, Voltage

Skills:

How Science Works	Maths	Literacy
Temperature changes experiment, drawing energy profiles	Thermometer readings, calculating means, measuring differences	Using chemistry in everyday life work

Electricity



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Homework and revision platforms:

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Big idea:

ELECTROMAGNETS

TIMELINE

Overarching context:

- The concept of energy emerged in the 19th century. The idea was used to explain the work output of steam engines and then generalised to understand other heat engines. It also became a key tool for understanding chemical reactions and biological systems.
- Limits to the use of fossil fuels and global warming are critical problems for this century. Physicists and engineers are working hard to identify ways to reduce our energy usage

Key Vocabulary:

Appliance, Cell, Circuit, Coulombs, Connection, Current, Battery, Direct current, Direct potential difference, Diode, Domestic appliance, Earth wire, Electrical charge, Electrocution, Fault, Filament lamp, Fuse, Joules, Lamp, LED, LDR, Light intensity, Linear, Live wire, Mains electricity, National Grid, Neutral wire, Ohmic conductor, Ohms, Parallel, Potential difference, Power, Power supply, Power station, Resistance, Resistor, Series, Step-down transformer, Step-up transformer, Switch, Transformers, Transmission cable, Temperature, Thermistor, Thermostat, Variable resistor, Voltage, Voltmeter, Volts, Watts **(TRIPLE):** Attraction, charged, Electric field, Electrons, Electrostatic, Force, Friction, Isolated charge sphere, Negative charge, Repulsion, Static electricity

Skills:

How Science Works	Maths	Literacy
Scientific thinking, analysis and evaluation' using scientific vocabulary	Arithmetic and numerical computation, algebra, graphs	Written equations, extended writing, sequencing information