KS4 SCIENCE

TEACHING OVERVIW AND TIMELINE

YEAR 10

Biology Chemistry Physics

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:	Atomic Structure			Infection and Response				Chemical Changes				Forces		

Spring	Half Term 3						Half Term 4					
Week:	1	2	3	4	5	6	1	2	3	4	5	6
Topic:	Forces		Energy Changes & Higher Quantitative Chem (Part 2)				Homeostasis and Response				Waves	

Summer	Half Term 5						Half Term 6						
Week:	1	2	3	4	5	6	1	2	3	4	5	6	7
Topic:		Rates and Extent of Chemical Change			Organic Chemistry		Ecology						Review

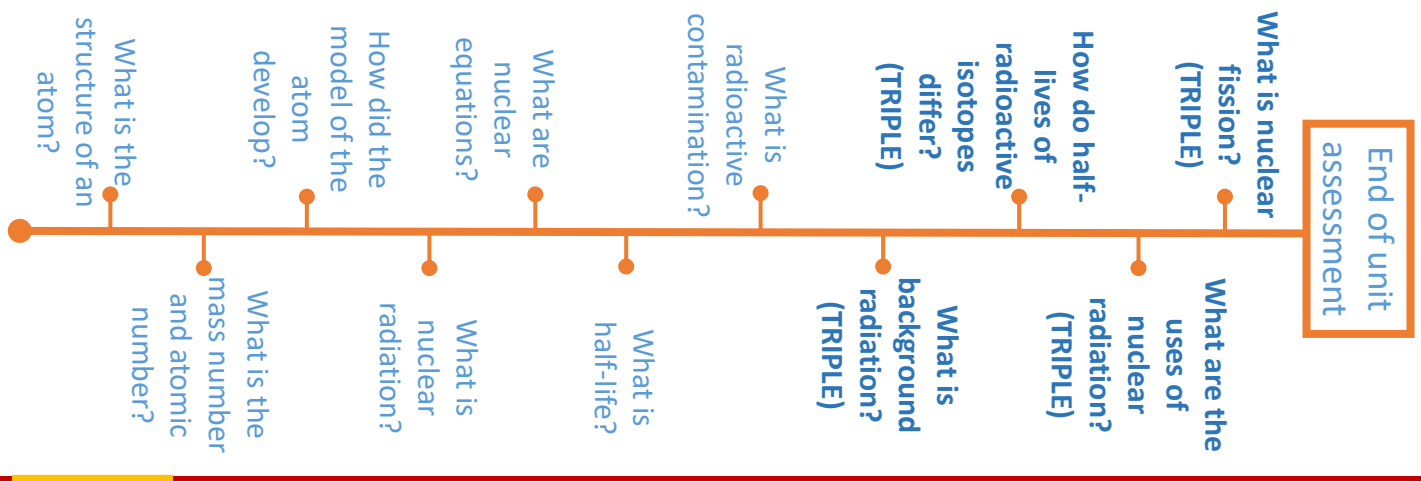
Triple Science:

Autumn	Half Term 1							Half Term 2						
Week:	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Bio:	Infection and Response							Homeostasis and Response						
Chem:	Energy Changes							Quantitative Chem (Part 2)						
Phys:	Atomic Structure							Forces						

Spring	Half Term 3						Half Term 4					
Week:	1	2	3	4	5	6	1	2	3	4	5	6
Bio:	Homeostasis and Response						Ecology					
Chem:	Rate and Extent of Chemical Change						Organic Chemistry					
Phys:	Forces						Waves					

Summer	Half Term 5						Half Term 6						
Week:	1	2	3	4	5	6	1	2	3	4	5	6	7
Bio:	Ecology												
Chem:	Organic Chemistry						Chemical Analysis						
Phys:	Waves											Review	

Atomic Structure



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Homework and revision platforms:

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BBC Bitesize Revision

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:

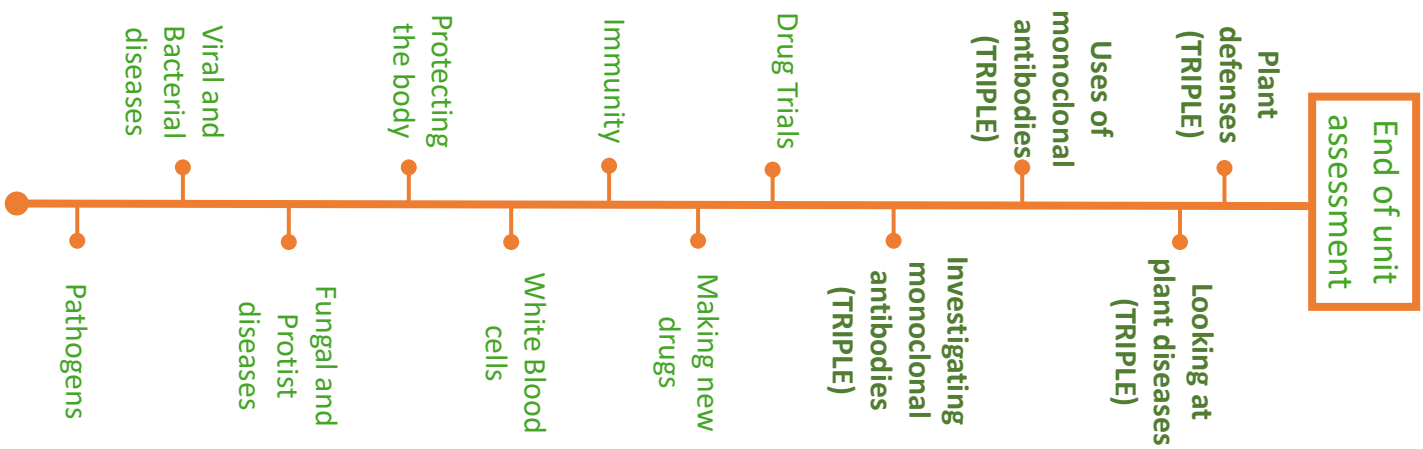
Absorbtion, Alpha decay, Alpha particle, Atom, Atomic model, Atomic nuclei, Atomic number, Bacquerel (Bq), Beta decay, Beta particle, Contamination, Count-rate, Electrical charge, Electromagnetic radiation, Electron, Emission, Energy levels, Evidence, Gamma ray, Geiger-Muller tube, Half-life, Hazard, 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

Infection and Response



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Big idea:

ORGANISMS

TIMELINE

Overarching context:

- Pathogens are microorganisms such as viruses and bacteria that cause infectious diseases in animals and plants. They frequently produce toxins that damage tissues and make us feel ill.
- Once inside the body our immune system is triggered which is usually strong enough to destroy the pathogen and prevent disease.
- When at risk from unusual or dangerous diseases our body's natural system can be enhanced by the use of vaccination.
- Since the 1940s a range of antibiotics have been developed which have proved successful against a number of lethal diseases caused by bacteria.
- Unfortunately many groups of bacteria have now become resistant to these antibiotics. The race is now on to develop a new set of antibiotics.

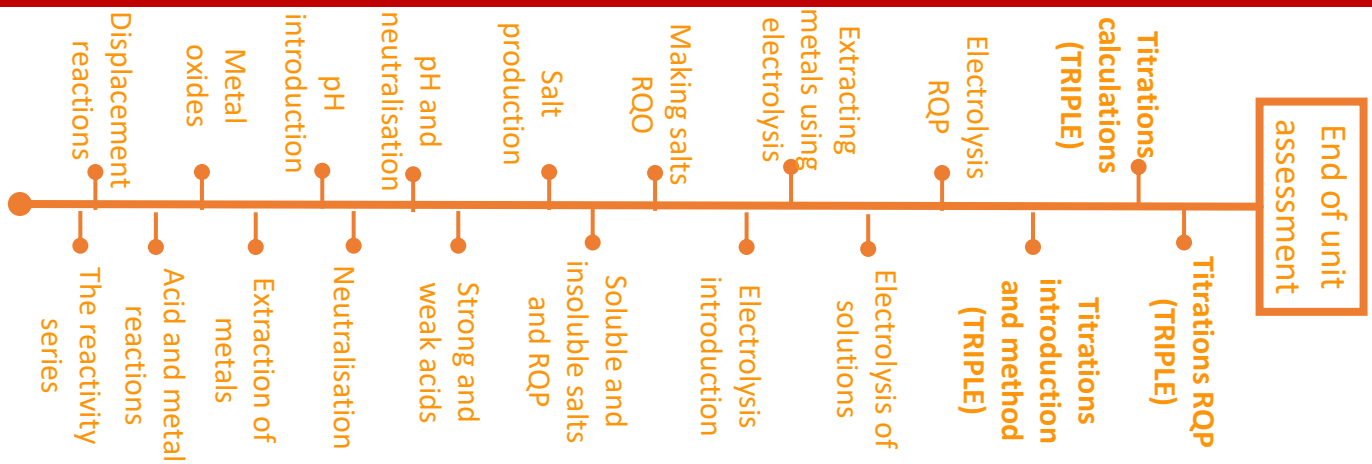
Key Vocabulary:

Alexander Fleming, Antibiotic, Antibodies, Antiretroviral, Antitoxins, Bacteria, Clinical trials, Communicable, Disease, Dose, Double blind trial, Fungi, Fungicides, HIV, Immune, Infection, Malaria, Measles, Painkillers, Pathogen, Penicillin, Phagocytosis, Placebo, Preclinical tests, Protists, Reproduce, Reistant strains, Salmonella, (STD) sexually transmitted disease, Tobacco mosaic virus (TMV), Toxins, Vaccination, Vector, Virus, White blood cells

Skills:

How Science Works	Maths	Literacy
Analyse data from graphs and tables, using models	Interpreting graphs, analysing correlation, standard units and orders of magnitude	Definitions, discussion, extended writing, comprehension, organising information

Chemical Changes



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Big idea:

REACTIONS

TIMELINE

Overarching context:

- Understanding of chemical changes began when people began experimenting with chemical reactions. Knowing about these different chemical changes meant that scientists could begin to predict exactly what new substances would be formed. It also helped biochemists to understand the complex reactions that take place in living organisms.
- The extraction of important resources from the earth makes use of the way that some elements and compounds react with each other and how easily they can be 'pulled apart'.

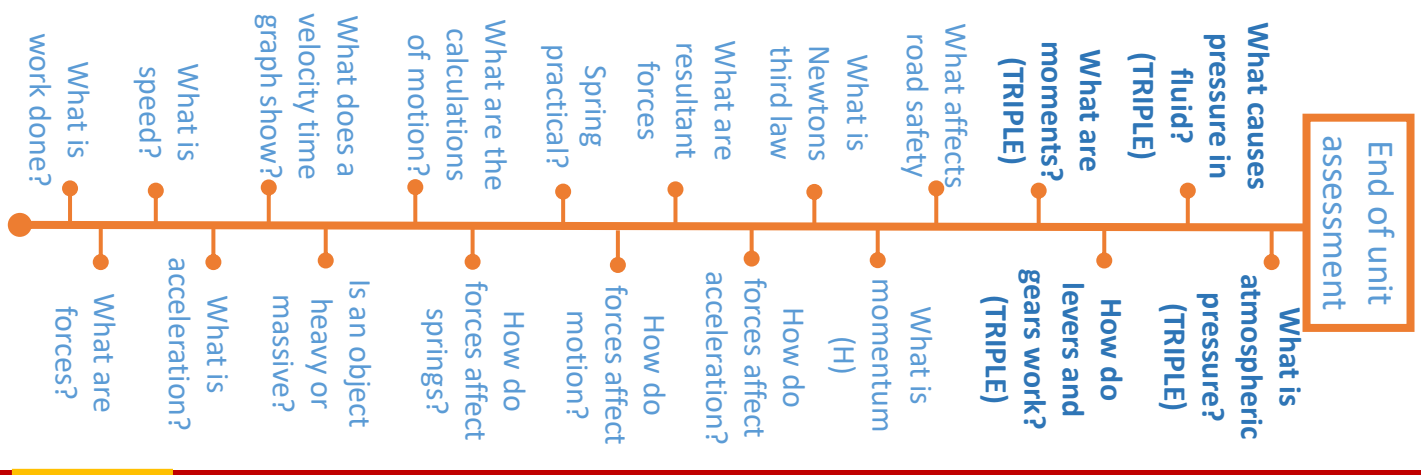
Key Vocabulary:

Acids, Aluminium, Activation energy, Alkalis, Anode, Aqueous Solution, Covserved, Cathode, Carbonates, Displacement, Endothermic, Extraction, Energy, Hydrogen, Crystallisation, Current, Exothermic, Metal oxides, Evaporation, Discharged, Energy, Oxidation, Filtration, Dissolving, Exothermic, Oxygen, Hydrohloric acid, Electrodes, Neutralisation, Positive ions, Hydrogen, Electrolytes, Oxidiation, Reactivity series, Hydrogen ions (H+), Extraction, Reaction, Reduction, Hydroxide, Hydrogen ions, Surroundings, Unreactive, Hydroxide ions (OH-), Hydroxide ions, Temperature, Ionic equation, Insoluble, Ionic Compound, Thermal decomposition

Skills:

How Science Works	Maths	Literacy
Chemical reactions practical's, electrolysis, making salts	pH scales and orders of magnitude, concentrations, equations	Writing chemical equations, deducing products

Forces



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Big idea:

FORCES

TIMELINE

Overarching context:

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

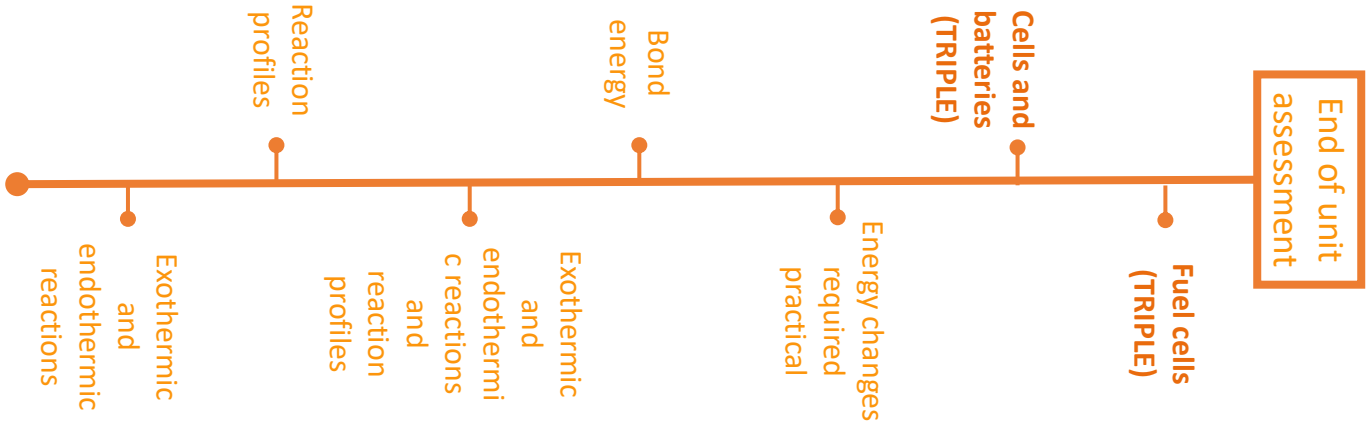
Key Vocabulary:

Air resistance, Displacement, Bending, Centre of mass, Distance, Compressing, Contact forces, Force, Deformation, Direction, Friction, Elastic, Electrostatic force, Joules, Elastic potential energy, Friction, Newtons (N), Extension, Gravitational field strength, Temperature, Force, Gravitational force, Work done, Inelastic, Gravity, Linear, Magnetic force, Spring, Magnitude, Spring constant, Mass, Stationary, Newtonmeter, Stretching, Newtons (N), Non-contact forces, Pull, Push, Resultant force, Scalar, Tension
Higher only: Equillibrium, Free body diagram, Resolution, Vector diagrams
(TRIPLE): Anticlockwise, Balanced, Clockwise, Distance, Force, Gear, Lever, Moment, Newton (N), Perpendicular, Pivot, Rotation

Skills:

How Science Works	Maths	Literacy
Experimental skills and strategies, analysis and evaluation, quantities, units, symbols, and nomenclature	Arithmetic and numerical computation, handling data, algebra; graphs, geometry and trigonometry	Understanding key vocabulary, oracy via discussion

Energy Changes



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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.

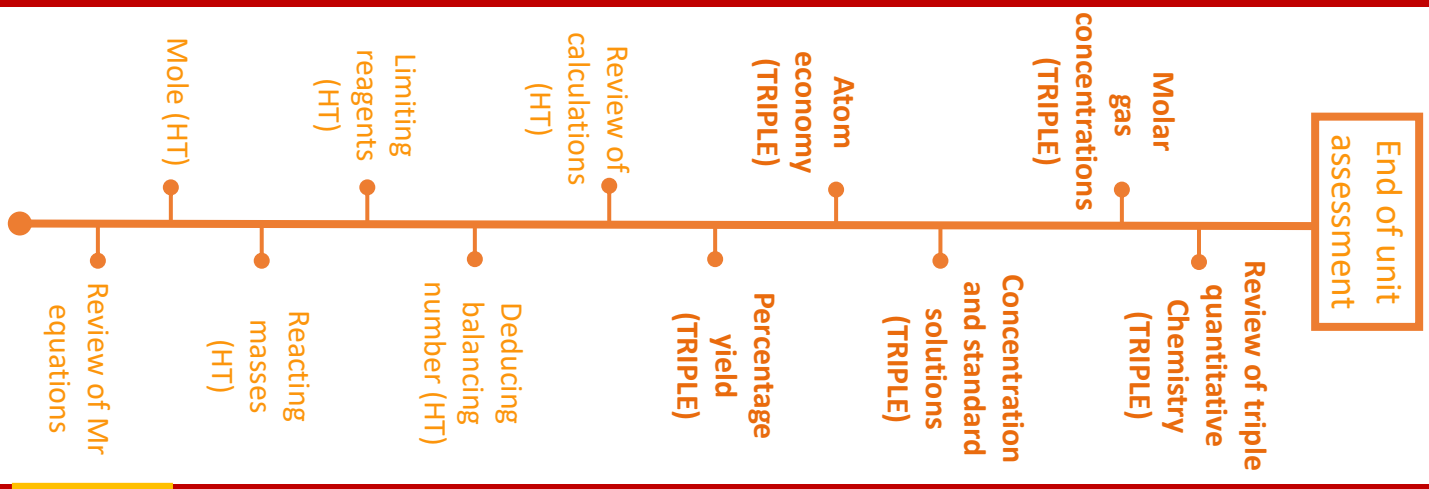
Key Vocabulary:

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

Quantitative Chemistry (Part 2)



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Big idea:

REACTIONS

TIMELINE

Overarching context:

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

Key Vocabulary:

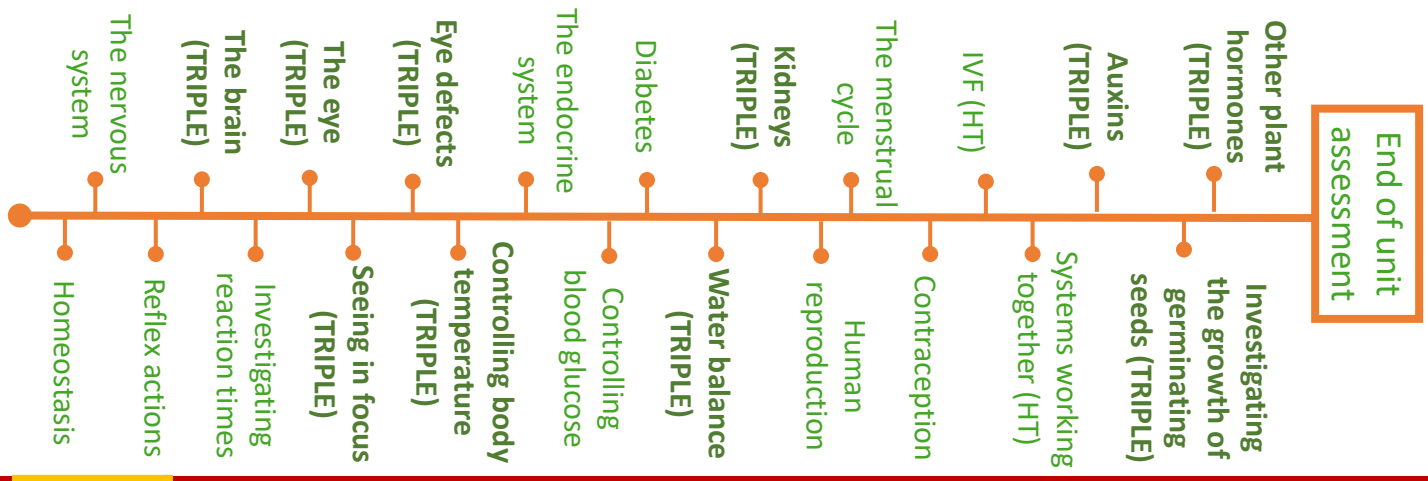
Higher only: Avogadro constant, Balanced equation, Concentration, Excess, Grams, Limiting reactant, Mass, Moles, Relative formula mass (Mr), Simplest ratio, Solute, Volume, Yield

(TRIPLE): Atom utilisation**,** Atom economy, Economic, Mixture, Percentage yield, Reversible, Separation, Sustainability, ***Higher only:*** Atmospheric pressure, Concentration, Gas, Grams, Mass, mol/dm3, Moles, Pressure, Room temperature, temperature Solute, Solution, Volume

Skills:

How Science Works	Maths	Literacy
Scientific definitions, concentrations and moles in everyday language	Percentages, equations, uncertainty, ratios, substituting values, standard form, decimals	Extended writing, scientific vocabulary and definitions

Homeostasis and Response



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Big idea:

ORGANISMS

TIMELINE

Overarching context:

- Cells in the body can only survive within narrow physical and chemical limits. The body requires control systems that constantly monitor and adjust the composition of the blood and tissues.
- The nervous system can bring about fast responses and the hormonal system usually brings about much slower changes.
- Hormonal coordination is important in reproduction since it controls the menstrual cycle. An understanding of the role of these hormones has allowed scientists to develop contraceptive drugs and fertility treatments.

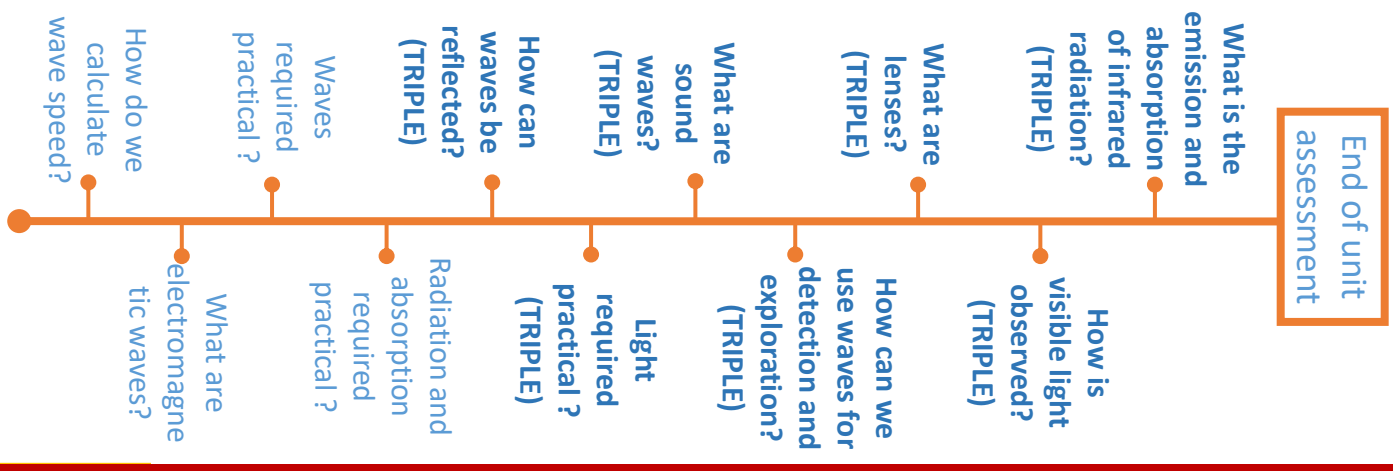
Key Vocabulary:

Adrenal gland, Blood glucose concentration, Brain, Central nervous system (CNS), Contraception, Coordinator, Dialysis, Diaphragm, Effectors, Electrical impulse, Embryo, Endocrine system, Fertility, Follicle stimulation hormone (FSH), Glands, Glucose, Glycogen, Hormones, Implant, Insulin, Intrauterine device, Kidneys, Lutenising hormone (LH), Menstrual cycle, Motor neurone, Nervous system, Neurones, Oestrogen, Ovary, Ovulation, Pancreas, Pituitary gland, Progesterone, Puberty, Receptors, Reflex arc, Relay neurone, Response, Sensory neurone, Spermicidal agents, Spinal cord, Sterilisation, Stimulus, Synapse, Target organ, Testes, Testosterone, Thyroid, Uterus

Skills:

How Science Works	Maths	Literacy
Interpreting data from graphs and tables, discussing limitations, using models	Decimals, interpreting line graphs, making estimations, drawing graphs	Labelling diagrams, discussion, debate, organising information, extended writing

Waves



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Big idea:

WAVES

TIMELINE

Overarching context:

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

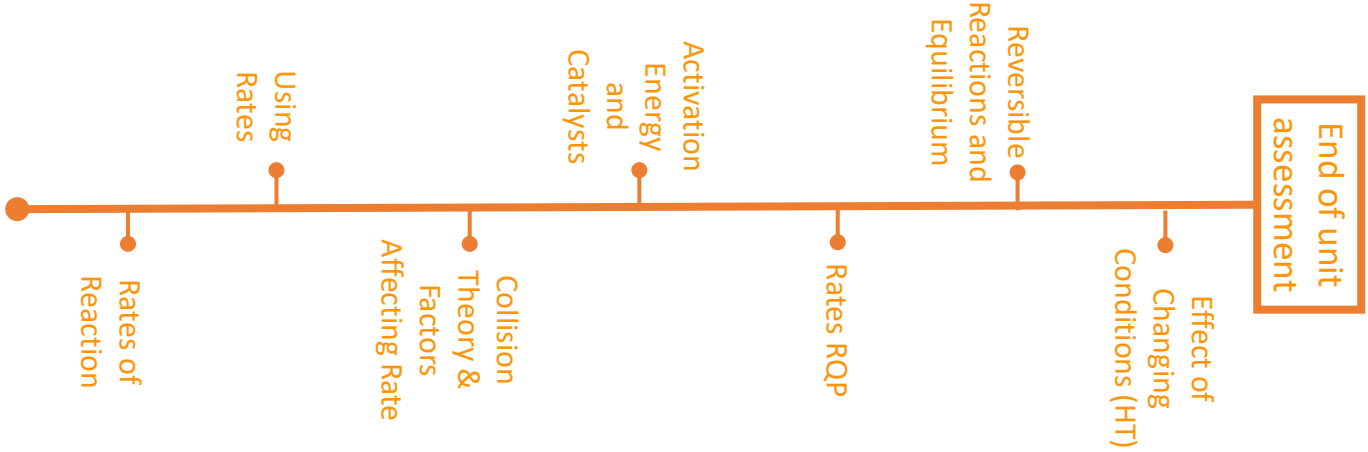
Key Vocabulary:

Amplitude, Absorption, Compression, Emission, Crest, Fibre optics, Radio waves, Displacement, Echo, Frequency, Gamma rays, Infrared, Hertz (Hz), Peak, Visible light, Longitudinal, Microwaves, Opaque, Radiation, Refraction, Reflection, Satellite, Ripple tank, Spectrum, Transverse, Translucent, Transmission, Vibrations, Transparent, Wave speed, Ultraviolet, Wavelength, **(TRIPLE):** X-rays, P-waves, Colour filters, Seismic, Concave lens, S-waves, Convex lens, Diffuse reflection, Velocity, Emitter, Focal length, Magnification, Parallel, Principal focus, Real image, Specular reflection, Virtual image ***Higher only:*** Alternating current, Atoms, Cancer, Hazardous, Ionising, Mutation, Nuclei, Oscillations, Refraction, Siverts (Sv)

Skills:

How Science Works	Maths	Literacy
Experimental skills and strategies, analysis and evaluation	Arithmetic and numerical computation, algebra, geometry and trigonometry	Understanding key vocabulary, dialogic lessons

Rates and Extent of Chemical Change



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Homework and revision platforms:

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Big idea:

REACTIONS

TIMELINE

Overarching context:

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

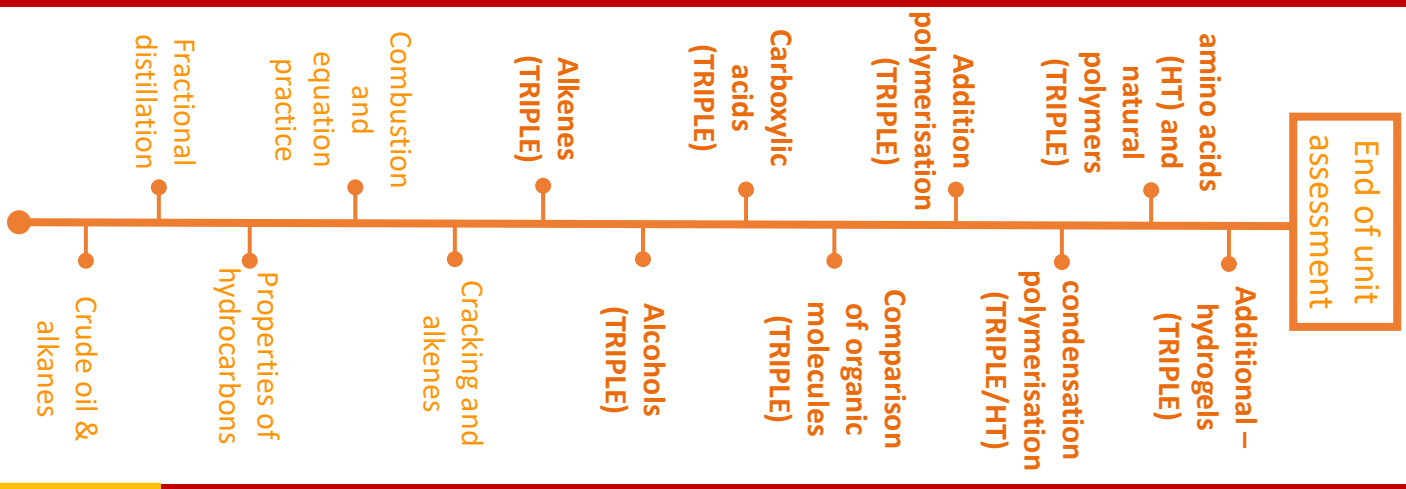
Key Vocabulary:

Activation energy, Endothermic, Catalysts, Equilibrium, Collision theory, Exothermic, Concentration, Product, Enzymes, Reactant, Mass (g), Reversible, Pressure, Surface area, Temperature, Time, Volume (cm3)
Higher only: Product, Concentration, Quantity, Le Chatelier's principle, Reactant, Pressure, Reaction, Temperature, Moles

Skills:

How Science Works	Maths	Literacy
Rates of reaction experiments, using models and analogies	Estimates, graphs, gradients, fractions, writing equations	Using information in everyday contexts, reading, oracy

Organic Chemistry



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Big idea:

MATTER

TIMELINE

Overarching context:

- The chemistry of carbon compounds is so important that it forms a separate branch of chemistry. A great variety of carbon compounds is possible because carbon atoms can form chains and rings linked by C-C bonds. This branch of chemistry gets its name from the fact that the main sources of organic compounds are living, or once-living materials from plants and animals. Chemists are able to take organic molecules and modify them in many ways to make new and useful materials such as polymers, pharmaceuticals, perfumes and flavourings, dyes and detergents.

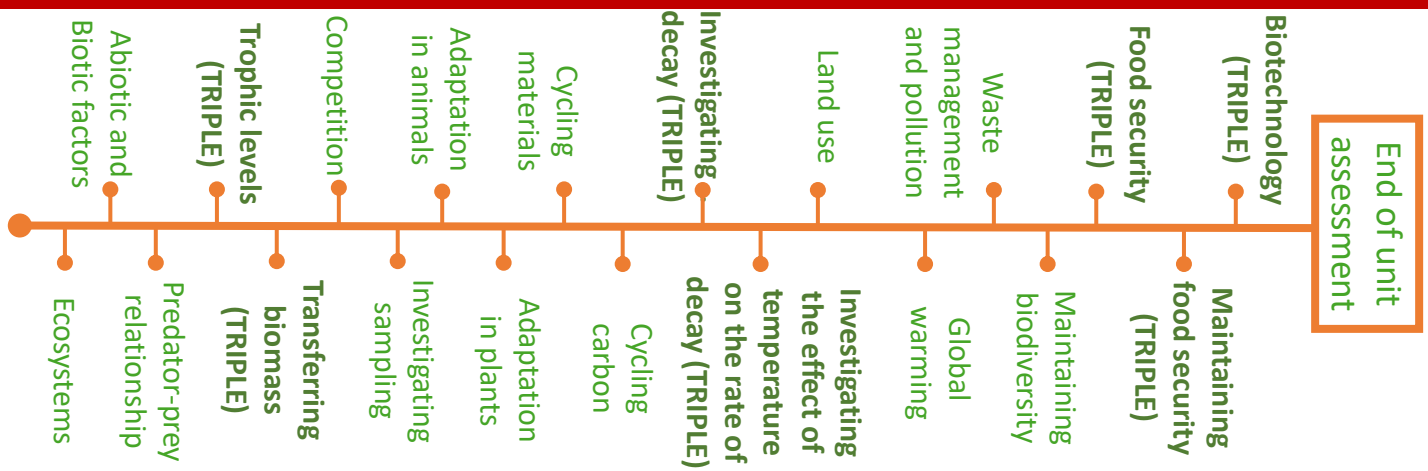
Key Vocabulary:

Alkanes, Alkenes, Biomass, Boiling point, Bromine, Butane, Carbon, Catalytic Cracking, "Alkane formula: CnH2n+2", Combustion, Compounds, Condensation, Crude oil, Diesel, Energy, Ethane, Evaporation, Feedstock, Flammability, Fractional distillation, Fractions, Fules, Hydrocarbons, Hydrogen, Liquid petroleum gas (LPG), Lubricants, Methane, Molecules, Petrol, Polymers, Propane, Solvents, Steam Cracking, Synthetic, Viscosity **(TRIPLE):** Addition polymerisation, Alkenes, Amino acids, Cellulose, DNA, Double helix, Monomer, Nucleotides, Polymer, Polymerisation, Proteins, Starch ***Higher only:*** Condensation polymerisation, Polyester, Polypeptides

Skills:

How Science Works	Maths	Literacy
Using models, making drawings, investigating properties	3D forms, balancing equations	Discussion, extended writing

Ecology



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Homework and revision platforms:

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Big idea:

ECOSYSTEM

TIMELINE

Overarching context:

- The Sun is a source of energy that passes through ecosystems.
- Materials including carbon and water are continually recycled by the living world, being released through respiration of animals, plants and decomposing microorganisms and taken up by plants in photosynthesis.
- All species live in ecosystems composed of complex communities of animals and plants dependent on each other and that are adapted to particular conditions, both abiotic and biotic.
- These ecosystems provide essential services that support human life so it is vital that humans engage with the environment in a sustainable way.

Key Vocabulary:

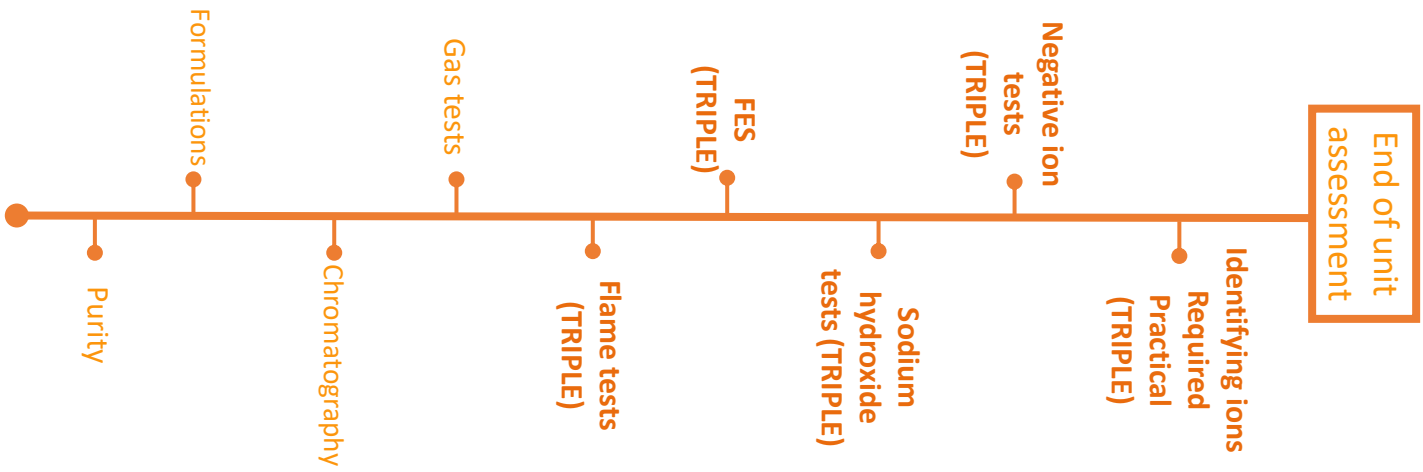
Abiotic, Abundance, Adaptations, Agricultural, Air pollution, Biodiversity, Biofuels, Biomass, Biotic, Carbon Cycle, Climate change, Community, Competition, Deforestation, Disease, Distribution, Ecosystem, Endangered, Evaporation, Extremophiles, Global warming, Habitat, Intensive farming, Interdependence, Landfill, Mean, Median, Microorganisms, Mode, Organism, Peat bog, Photosynthetic, Pollutants, Population, Predation, Predators, Prey, Primary consumers, Producers, Quadrats, Secondary consumers, Species, Stable community, Tertiary consumers, Transects, Water cycle

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

Additional topics for Triple Science students only.

Chemical Analysis



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Homework and revision platforms:

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Big idea:

REACTIONS

TIMELINE

Overarching context:

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

Key Vocabulary:

Alloys, Calcium hydroxide, Boiling point, Carbon dioxide, Chromatogram, Chlorine, Chromatography, Gas test, Fertilisers, Hydrogen, Formulation, Limewater, Impure Litmus Paper, Medicines, Oxygen, Melting point, Splint, Mixture, Squeaky pop, Mobile phase, Pure, Rf value, Separation, Solvent, Solubility, Stationary phase, Temperature

(TRIPLE): Carbonates, Cations, Flame emission spectroscopy, Halides, Line spectrum, Metal hydroxide, Spectroscope, Sulphates, Anion, Carbonate test, FES, Instrumental analysis, Precipitate, Speactator ions

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