



Science curriculum overview SEPARATE SCIENCES KS4

Curriculum intent:

Science is everywhere in today's world. It is part of our daily lives, from cooking and gardening, to recycling and comprehending the daily weather report, to reading a map and using a computer. Advances in technology and science are transforming our world at an incredible pace, and our children's future will surely be filled with leaps in technology we can only imagine. Being "science literate" will no longer be just an advantage but an absolute necessity. We cannot underestimate the significance of science in our world.

We aim to promote a love of science and to equip pupils with the skills necessary to understand the impact of science on their lives and equip them with the skills and knowledge they need to be successful in the future.

IMPLEMENTATION

Core practicals are required to be completed by all students and as such are identified in the lesson order part of the scheme, but also in a specific 'Core practical' session to ensure staff plan and understand the number of core practicals they must carry out in a given period.

Assessments will take place at the end of each topic

Triple Science GCSE students will sit a total of six exams, with each pair of exams for a subject giving them a full GCSE. Students are able to achieve very different grades in each subject, however this is discouraged as colleges find it a cause for concern when students are not similarly skilled.

Triple science specific lessons are highlighted to ensure staff plan ahead to engage students at these times, but also take into account those in the lesson who will need support on these specific topics.

Assessments will take place at the end of each topic

	Autumn Term	Spring Term	Summer term
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Paper 1 – Triple Science

				Paper 1 – Triple Science		
		Biology –	Chemistry –	Physics		
Year 10 and 11	<u>Topic 1 - Cell biology</u>		<u>Topic 1 - Atomic structure and the periodic table</u>		<u>Topic 1 – Energy</u>	
	<ol style="list-style-type: none"> 1. Types of cell 2. Specialised cells 3. Introducing microscopes 4. RP: Using microscopes 5. Types of microscope 6. Mitosis and the cell cycle 7. Multiplying bacteria (T only) 8. Culturing microorganisms (T only) 9. RP: Investigating antiseptics and writing methods 10. RP: Analysing antiseptics practical 11. Mini quiz 12. Stem cells 13. Evaluating stem cells 14. Diffusion 15. Surface area and volume ratio 16. Diffusion in action 17. Osmosis 18. Osmosis in action 19. RP: Osmosis investigation 20. Active transport 		<ol style="list-style-type: none"> 1. Atoms and elements 2. Compounds and formulae 3. Word and symbol equations 4. Balancing equations 5. Separation techniques 6. RP: Chromatography 7. Changing Atomic Theories 8. Protons, Neutrons and Electrons 9. Electron configuration 10. Isotopes and relative atomic mass 11. The periodic table 12. The modern periodic table 13. Metals and non-metals 14. Alkali metals (Group 1) 15. Halogens (Group 7) 16. Noble Gases (Group 0) 		<ol style="list-style-type: none"> 1. Types of energy and energy transfers 2. Open and closed systems 3. Insulation 4. RP: Investigating thermal insulators (T only) 5. Non-renewable resources 6. Renewable resources 7. Comparison of energy resources 8. Work done 9. Power 10. Efficiency calculations 11. Gravitational potential energy 12. Kinetic energy 	

	<p><u>Topic 2 – Organisation</u></p> <ol style="list-style-type: none"> 1. Tissues, organs and systems 2. Plant cells, tissues and organs 3. Enzymes 4. RP: pH and enzymes 5. RP: pH and enzymes 6. Digestion 7. RP: Testing food groups 8. The lungs 9. The heart 10. Blood vessels and heart rate 11. Blood composition 12. Cardiovascular disease 13. Disease data 1 14. Disease data 2 15. Non-communicable diseases 16. Cancer 17. Transpiration and translocation 18. Transpiration experiments 	<p><u>Topic 2 - Bonding, structure, and the properties of matter</u></p> <ol style="list-style-type: none"> 1. Ionic bonding part 1 2. Ionic bonding part 2 3. Properties of ionic bonding 4. Covalent bonding 5. Properties of covalent structures 6. Giant covalent structures 7. Graphene and fullerenes 8. Metallic Bonding 9. Changing states of matter 10. Comparing and contrasting types of bonding 11. Nanoparticles (T only) 	<p><u>Topic 2 – Electricity</u></p> <ol style="list-style-type: none"> 1. Electrical circuits Introduction 2. Calculating current 3. Current in circuits 4. Series and parallel circuits 5. Ohm’s Law 6. Resistance in circuits 7. RP: Factors affecting resistance 8. Light Dependent Resistors 9. Thermistors 10- RP: investigating non-ohmic conductors 12. Mini Quiz 13. Mains electricity and AC & DC 14. Plugs 15. Power calculations 16. Work done calculations 17. Equations practice 18. National Grid and Transformers 19. Transformers structure and equation (T only) Transformers power equation (T only)
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	<p><u>Topic 3 - Infection and response</u></p> <ol style="list-style-type: none"> 1. Health 2. Pathogens 3. Bacterial diseases 4. Viral diseases 5. Fungal and protists 6. Our barriers to diseases 7. White blood cells 8. Vaccinations 9. Antibiotics 10. Antibiotic resistance 11. Developing new drugs 12. Monoclonal antibodies (T only) 13. Data 1 14. Data 2 15. Data 3 16. Plant disease (Triple only) 	<p><u>Topic 3 – Quantitative chemistry</u></p> <ol style="list-style-type: none"> 1. Relative Formula Mass 2. Introducing moles 3. Word equations and conservation of mass (Higher only) 4. Reacting masses 5. Balancing equations using moles (Higher only) 6. Limiting reactants (T only) 7. Calculating volume of a gas (triple only) 8. Introduction to concentration 9. Atom economy (T only) 10. Percentage yield (T only) 11. All calculations for Chemistry 	<p><u>Topic 3 - Particle model of matter</u></p> <ol style="list-style-type: none"> 1. Particle model – density and states 2. RP : Calculating density 3. Change of state 4. Latent heat 5. Heating and cooling graphs 6. Specific heat capacity 7. RP : Investigate the specific heat capacity of a given object 8. Comparing specific heat capacity and latent heat (H only) 9. Pressure in gases 10. Gas pressure part 2 (T only)
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	<u>Topic 4 – Bioenergetics</u> <ol style="list-style-type: none"> 1. Photosynthesis 2-3. RP: Photosynthesis 1. Limiting factors (H only) 2. Aerobic respiration 3. Anaerobic respiration 4. Using glucose and nitrogen in plants 	<u>Topic 4 - Chemical changes</u> <ol style="list-style-type: none"> 1. Acids and bases 2. Acids - weak and strong (H only) 3. Neutralisation 4. RP: Soluble Salts 5. RP: Titrations part 1 (T only) 6. RP Titrations part 2 (T only) 7. Metals and oxygen 8. Metals and acid 9. Metals and water 10. Redox reactions (T only) 11. Reactivity series and extraction methods 12. Electrolysis of molten compounds 13. Electrolysis of aqueous compounds 14. RP: Electrolysis part 1 	<u>Topic 4 -Atomic structure</u> <ol style="list-style-type: none"> 1. Atomic recap 2. Changing atomic theories 3. Atoms, electrons and energy levels 4. Introduction to radioactive decay 5. Alpha, beta and gamma – part 1 6. Alpha, beta and gamma – part 2 7. Half life – part 1 8. Half life - part 2 9. Irradiation and contamination 10. Using radiation in medicine (T only) 11. Background radiation (T only) 12. Evaluating hazards (T only) 13. Radiation – practice exam questions 14. Mini quiz 15. Nuclear fission and fusion – part 1(T only) 16. Fission and fusion – part 2 (T only)
		<u>Topic 5 - Energy changes</u> <ol style="list-style-type: none"> 1. Exothermic and endothermic reactions 2. RP Temperature Changes 3. Reaction profiles 4. Bond energies 5. Chemical cells and voltage (T only) 6. Rechargeable and non-rechargeable batteries (T only) 7. Fuel Cells (T only) 8. Half equations for fuel cells (T only) 	

	<p><u>Core practicals</u></p> <ol style="list-style-type: none"> 1. Preparation of a pure, dry sample of a soluble salt from an insoluble oxide or carbonate, using a Bunsen burner to heat dilute acid and a water bath or electric heater to evaporate the solution. 2. Investigate what happens when aqueous solutions are electrolysed using inert electrodes. 3. Investigate the variables that affect temperature changes in reacting solutions such as, eg acid plus metals, acid plus carbonates, neutralisations, displacement of metals. 	<p><u>Core practicals</u></p> <ol style="list-style-type: none"> 1. Use a light microscope to observe, draw and label a selection of plant and animal cells. A magnification scale must be included. 2. Investigate the effect of a range of concentrations of salt or sugar solutions on the mass of plant tissue 3. Use qualitative reagents to test for a range of carbohydrates, lipids and proteins. To include: Benedict's test for sugars; iodine test for starch; and Biuret reagent for protein. 4. Investigate the effect of pH on the rate of reaction of amylase enzyme <p>Investigate the effect of light intensity on the rate of photosynthesis using an aquatic organism such as pondweed.</p>	<p><u>Core practicals</u></p> <ol style="list-style-type: none"> 5. An investigation to determine the specific heat capacity of one or more materials. The investigation will involve linking the decrease of one energy store (or work done) to the increase in temperature and subsequent increase in thermal energy stored. 6. Use circuit diagrams to set up and check appropriate circuits to investigate the factors affecting the resistance of electrical circuits. This should include: <ul style="list-style-type: none"> • the length of a wire at constant temperature • combinations of resistors in series and parallel. 7. Use circuit diagrams to construct appropriate circuits to investigate the I–V characteristics of variety of circuit elements including a filament lamp, a diode and a resistor at constant temperature. <p>Use appropriate apparatus to make and record the measurements needed to determine the densities of regular and irregular solid objects and liquids. Volume should be determined from the dimensions of regularly shaped objects and by a displacement technique for irregularly shaped objects. Dimensions to be measured using appropriate apparatus such as a ruler, micrometer or Vernier callipers.</p>
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Paper 2 – Triple Science

Biology

Chemistry

Physics

Topic 5 - Homeostasis and response

1. Homeostasis
 2. The nervous system
 3. Synapses
 4. RP Investigating human reaction time
 5. Parts of the brain (T only)
 6. Brain surgery (T only)
 7. The eye (T only)
 8. Myopia and hyperopia (only)
 9. Thermoregulation (T only)
 10. The endocrine system
 11. Controlling blood glucose
 12. Controlling water (T only)
 13. Hormones and the menstrual cycle
 14. IVF (H only)
 15. Contraception
 16. Negative feedback loops (H only)
 17. Comparing nervous and hormonal responses
 18. Tropisms (T only)
 19. Uses of plant hormones (T only)
 20. RP Germination (T only)
- RP Germination part 2 (T only)

Topic 6 - The rate and extent of chemical change

1. Measuring the rate of reaction
2. Factors affecting rates of reaction
3. Drawing rates of reaction graphs
- 4-6. RP: Factors affecting rates of reaction
7. Catalysts
8. Le Chateliers Principle (T only)
9. Reversible reactions

Topic 5 – Forces

1. Scalar and vector quantities
2. Types of forces
3. Centre of mass
4. Weight
5. Resultant force
6. Vector diagrams (HT only)
7. Elastic objects and Hooke's Law
8. Work done
9. RP : Relationship between force and spring
10. Pressure in liquids and hydraulics (T only)
11. Leavers and gears (T only)
12. Leavers and gears (T only)
13. Pressure at different depths (T only)
14. The atmosphere (T only)
15. Floating and sinking (T only)
16. Speed, distance, displacement, velocity
17. Circular motion (H only)
18. Distance time graphs
19. Acceleration
20. Velocity time graphs
21. Mini quiz
22. Falling objects
23. Newton's First Law
24. Newton's Second Law
25. Inertia and inertial mass
26. RP : Investigating Newton's Second Law
27. Newton's Third Law
28. Stopping distance
29. Breaking distance
30. Graphs and forces (T only)
31. Momentum calculations
32. Momentum and safety features (T only)

<u>Topic 6 – Inheritance, variation and evolution</u>	<u>Topic 7 – Organic chemistry</u>	<u>Topic 6 – Waves</u>
<ol style="list-style-type: none"> 1. Introduction to DNA 2. Structure of DNA 3. Protein synthesis (T only) 4. Mutations 5. Sexual reproduction 6. The cell cycle 7. Asexual reproduction 8. Comparing sexual and asexual reproduction 9. Examples of unusual reproduction (T only) 10. Inheritance 11. Family trees 12. Genetic diseases and sex determination 13. Mendel (T only) 14. Variation 15. Natural selection and evolution 16. Genetic engineering modification 17. Selective breeding 18. Cloning (T only) 19. Stem cells 20. Evaluating stem cells 21. Fossils 22. Speciation 23. Antibiotic resistant bacteria 24. Classification <p>Inheritance summary essay</p>	<ol style="list-style-type: none"> 1. Crude Oil 2. Fractional Distillation and the fractions 3. Cracking 1 4. Alkanes and alkenes 5. Properties of alkanes and alkenes 6. Combustion 7. Alkene reactions (T only) 8. Alcohols (T only) 9. Making alcohols by fermentation (T only) 10. Carboxylic acids (T only) 11. Addition polymerisation (T only) 12. Condensation polymerisation (T only) 13. Amino acids (T only) 	<ol style="list-style-type: none"> 1. Introduction to waves 2. Wave equations 3. Measuring speed of sound 4. Measuring period of a wave 5. RP ; Measure the speed of a wave using a ripple tank and speed 6. Using sound waves for detection and exploration (T only) 7. EM spectrum 8. Radios (T only) 9. Sound waves (T only) 10. RP : IR radiation 11. Reflection of light (T only) 12. Refraction of light (T only) 13. RP : Investigating reflection and refractions (T only) 14. Concave and convex ray diagrams (T only) 15. Magnification (T only) 16. Colour (T only) 17. Black bodies and radiation on Earth (T only)

	<p><u>Topic 7 – Ecology</u></p> <ol style="list-style-type: none"> 1. Competition 2. Abiotic and biotic factors 3. Adaptations 4. Food chains 5. RP Quadrats 6. Using transects 7. Water cycle 8. Carbon cycle 9. Decay (T only) 10. RP Decay – part 1 11. RP Decay – part 2 12. Biodiversity & Human impact 13. Reducing Human impact 14. Biogas generators (Triple only) 15. Global warming 16. Deforestation and land use 17. Pyramids of Biomass & tropic levels 18. Biomass transfer 19. Food security (T ONLY) <p>Biotechnology</p>	<p><u>Topic 8 – Chemical analysis</u></p> <ol style="list-style-type: none"> 1. RP Paper chromatography 2. Gas tests 3. Testing for ions (T only) 4. RP Testing for ions (T only) 	<p><u>Topic 7 – Magnetism and electromagnetism</u></p> <ol style="list-style-type: none"> 1. Magnets 2. Electromagnets 3. Electromagnetic fields 4. Uses of electromagnets (T only) 5. Motor effect 6. $F = BIL$ (H only) 7. Applications of the motor effect and generators 8. Generating electricity (T only) 9. Transformers power equation (T only) 10. Transformers structure and equation (T only)
		<p><u>Topic 9 – Chemistry of the atmosphere</u></p> <ol style="list-style-type: none"> 1. The Early Earth's Atmosphere 2. Theories of the atmosphere 3. The Greenhouse Effect 4. Evidence for the greenhouse effect 5. Effects of global warming 6. The Harmful Effects of Combustion <p>Resources used by Humans</p>	<p><u>Topic 8 – Space (T only)</u></p> <ol style="list-style-type: none"> 1. The solar system 2. Life cycle of a star 3. Orbits 4. Orbits 2 5. Red shift and expanding Universe 6. The Big Bang theory <p>Dark mass and dark energy</p>

Topic 10 – Using resources

1. Ceramics and polymers (T only)
2. Uses of metals
3. Corrosion (T only)
4. Corrosion prevention (T only)
5. Transition metals (T only)
6. Typical properties (T only)
7. Alloys
8. Properties and uses of alloys (T only)
9. Potable Water
10. Waste and sewage
11. Evaluating potable water methods
12. RP Analysing water samples
13. Phytomining and bioleaching
14. Life Cycle Assessment
15. Reduce, Reuse, Recycle
16. Important materials
17. Thermosetting and thermos-softening polymers (T only)
18. The Haber process 1 (T only)
19. The Haber process 2 (T only)
20. NPK Fertilisers

	<p><u>Core practicals</u></p> <p>7. Plan and carry out an investigation into the effect of a factor on human reaction time</p> <p>8. Investigate the effect of light or gravity on the growth of newly germinated seedlings. Record results both as length measurements and as accurate, labelled biological drawings to show the effects.(Biology only)</p> <p>9. Measure the population size of a common species in a habitat. Use sampling techniques to investigate the effect of a factor on the distribution of this species.</p> <p>10. Investigate the effect of temperature on the rate of decay of fresh milk by measuring pH change.(Biology only)</p>	<p><u>Core practicals</u></p> <p>5. Investigate how changes in concentration affect the rates of reactions by a method involving measuring the volume of a gas produced and a method involving a change in colour or turbidity.</p> <p>6. Investigate how paper chromatography can be used to separate and tell the difference between coloured substances. Students should calculate R_f values.</p> <p>7. Use of chemical tests to identify the ions in unknown single ionic compounds covering the ions from sections Flame tests through to Sulfates. (Chemistry only)</p> <p>8. Analysis and purification of water samples from different sources, including pH, dissolved solids and distillation.</p>	<p><u>Core practicals</u></p> <p>6. Investigate the relationship between force and extension for a spring.</p> <p>7. Investigate the effect of varying the force on the acceleration of an object of constant mass and the effect of varying the mass of an object on the acceleration produced by a constant force.</p> <p>8. Make observations to identify the suitability of apparatus to measure the frequency, wavelength and speed of waves in a ripple tank and waves in a solid and take appropriate measurements.</p> <p>9. Investigate the reflection of light by different types of surface and the refraction of light by different substances. (Physics only)</p> <p>10. Investigate how the amount of infrared radiation absorbed or radiated by a surface depends on the nature of that surface.</p>
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