

LONG TERM PLAN

COMBINED SCIENCE

(Synergy) KS4

(Year 10 & Year 11)

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SCIENCE DEPARTMENT KS4

Vision and Intent

Eastlea's Science Curriculum strives for exceptional student progress, fostering critical thinking, problem-solving, innovation, and teamwork for success beyond the classroom.

To enable all students to achieve, our subject curriculum is underpinned by the following principles:



Ambitious -The Eastlea Combined Science Curriculum is ambitiously designed to integrate scientific inquiry, cross-curricular skills, and diverse explorations, fostering students' curiosity and passion for understanding the natural world.



Sequenced / Spiral - Our science curriculum employs a sequenced/spiral approach, systematically reinforcing fundamental concepts throughout Key Stage 3, thereby laying a robust foundation for Key Stage 4, where students delve deeper into advanced topics, ensuring a deep and interconnected understanding of scientific principles.



Literacy - Literacy forms the cornerstone of our scientific education, empowering students to confidently articulate precise scientific concepts verbally and in writing, fostering fluency in scientific vocabulary and enriching communication across all aspects of our curriculum.



Cultural Capital - The science curriculum empowers students with vital knowledge and skills for their future endeavours, offering immersive experiences like field trips to museums and research institutions, fostering a deeper appreciation for the relevance of science in our modern world.

KS4 SCIENCE CURRICULUM BASED ON:

10 BIG IDEAS

- | | |
|---------------------|---------------|
| 1. Force | 2. Reactions |
| 3. Electromagnetism | 4. Earth |
| 5. Energy | 6. Organisms |
| 7. Waves | 8. Ecosystems |
| 9. Matter | 10. Genes |

Biology

Chemistry

Physics

Year 10

Year 11

1.4 Waves

Teaching GCSE waves to students involves explaining the basic properties and types of waves, their behaviours, and applications. Here's a very brief overview of activities that can be incorporated.

Activities

Experiments and Demonstrations: Observing wave properties using ripple tanks, slinkies, or simulations.

Practical Applications: Exploring how different instruments produce sound waves, or how lenses affect light waves.

Quizzes and Discussions: Testing understanding of wave properties, behaviours, and types.

Incorporating hands-on experiments and real-life applications can help students grasp the concepts of waves and see their relevance in everyday life.

4.10 The Earth's atmosphere**Key Concepts****Composition of the Atmosphere**

Major Gases: Nitrogen (78%), oxygen (21%), argon, and trace gases (including carbon dioxide).

Variable Components: Water vapour, pollutants, and greenhouse gases.

Structure of the Atmosphere**Layers:**

Troposphere: Weather processes occur here.

Stratosphere: Contains the ozone layer.

Mesosphere: Meteors burn up.

Thermosphere: Auroras occur, space shuttles orbit.

Exosphere: Outermost layer, merging into space

Functions of the Atmosphere

Protection: Shields from harmful solar radiation (UV rays).

6.15 Forces and energy changes

Teaching forces and energy changes to GCSE students involves covering the fundamental concepts of forces, types of energy, and how they interact.

Here's a brief overview:**Key Concepts****Forces**

Definition: A push or pull on an object due to its interaction with another object.

Types of Forces: Contact forces (e.g., friction, tension) and non-contact forces (e.g., gravitational, magnetic).

Newton's Laws:

1st Law: An object remains at rest or in uniform motion unless acted upon by an external force.

2nd Law: Force = mass × acceleration.

3rd Law: For every action, there is an equal and opposite reaction.

6.16 Magnetism and electromagnetism

Teaching magnetism and electromagnetism to GCSE students involves hands-on experiments to demonstrate magnetic fields, forces, and electromagnets, alongside clear explanations of key concepts like magnetic domains and electromagnetic induction. Utilising visual aids and interactive simulations helps illustrate how electric currents create magnetic fields and how changing magnetic fields can induce currents.

7.18 Forces and motion

Teaching forces and motion to GCSE students involves using real-life examples and practical experiments to illustrate Newton's laws of motion and concepts like velocity, acceleration, and friction. Visual aids, such as diagrams and simulations, alongside problem-solving exercises, help students understand and apply the mathematical relationships between force, mass, and acceleration.

Climate Regulation: Greenhouse effect maintaining Earth's temperature.

Support for Life: Provides essential gases for respiration and photosynthesis.

Human Impact

Pollution: Emission of pollutants leading to smog, acid rain.

Climate Change: Increasing greenhouse gases leading to global warming.

Ozone Depletion: Impact of CFCs on the ozone layer.

Activities

Diagrams and Models: Visual aids showing the layers and composition of the atmosphere.

Experiments: Demonstrations of greenhouse effects, measuring air quality.

Case Studies: Examination of historical and current data on air pollution and climate change.

Quizzes and Discussions: Testing understanding of atmospheric composition, layers, and human impacts.

Incorporating visual tools, hands-on experiments, and current environmental issues can make the subject engaging and relevant for students.

4.11 Ecosystem and Biodiversity

Activities and Assessments

Field Trips and Outdoor Activities: Observing local ecosystems and biodiversity.

Interactive Models and Simulations: Food web construction, simulations of nutrient cycles.

Case Studies: Examples of conservation efforts and their impact (e.g., reforestation projects, protection of endangered species).

Quizzes and Discussions: Testing knowledge on ecosystem components, energy flow, and the importance of biodiversity.

Using hands-on activities and real-world examples can make the concepts more tangible and engaging for students, helping them understand the interconnectedness and significance of ecosystems and biodiversity.

Start with Real-Life Hooks

Sports examples → sprinting (acceleration), football kicks (force & momentum), F1 racing (drag, air resistance).
Everyday analogies → buses braking suddenly (inertia), seat belts (force & stopping distance), rollercoasters (Newton's laws).
Use short video clips or demos to make abstract ideas tangible.

Active Demonstrations & Mini-Practicals

Newton's 1st law: A toy car on a smooth surface, vs. carpet → show friction's role.

Newton's 2nd law ($F=ma$): Trolley + weights on a pulley system → vary mass/force and plot acceleration.

Newton's 3rd law: Balloon rocket or two pupils on skateboards pushing off each other.
Momentum: Colliding marbles or trolleys with data loggers.

Stopping distance: Toy car ramp → measure thinking vs braking effects (students can simulate reaction times with online reaction timers).
Use low-cost kits like marbles, balloons, spring balances, and toy cars before going to formal experiments.

Visual & Interactive Approaches

Force diagrams: Start with arrows on pupils themselves (standing, sitting, holding books) before abstract objects.
Interactive whiteboard simulations: PhET simulations ("Forces and Motion", "The Moving Man") for acceleration, velocity-time graphs, and collisions.

Motion tracking apps: Students film toy cars or people walking/running and plot displacement-time graphs.
Scaffold Graph Work common hurdle

Teach displacement-time vs. velocity-time step-by-step.

Get pupils to walk the graphs: one pupil moves across the classroom while others plot the position/velocity.
Use mini whiteboards for "quick sketch" practice of graphs after describing scenarios.

Tackle Misconceptions Explicitly

Many pupils think:
"Heavier objects fall faster" → Drop two objects of different mass.
"If something's moving, there must be a force pushing it" → Use frictionless puck on an air track to show motion

4.12 Inheritance, variation and evolution Teaching inheritance, variation, and evolution to GCSE students involves explaining key genetic principles, mechanisms of variation, and the process of evolution. Here's a brief overview of activities to include: Interactive Models and Diagrams: Visual aids for genetic crosses, variation, and evolutionary trees. Experiments and Simulations: Simple genetic crosses with plants or simulations of natural selection. Case Studies: Examples of natural selection (e.g., peppered moths) and evolution in action. Quizzes and Discussions: Testing knowledge on inheritance patterns, sources of variation, and evolutionary theory. 5.13 The periodic table Development of the periodic table Electronic structures and the periodic table Group 1-the alkali metals Group 7-the halogens Explaining trends	continues without force. Use concept cartoons or diagnostic questions** (e.g., BEST Evidence Science Teaching resources). Exam Practice Integrated, Not Bolted-On Use mini hinge questions in lessons (e.g., multiple choice on forces/graphs). Scaffold exam questions → break them into stages (draw diagram → identify equation → rearrange → substitute). Encourage “equation triangles” early, then gradually phase them out for fluency. Retrieval & Spaced Practice Regular quick quizzes mixing forces, motion graphs, and equations with other physics topics. Use flashcards or recall grids for equations: Spiral back to motion when revising energy, momentum, or waves. Stretch & Challenge Analyse elastic collisions and conservation of momentum. Discuss terminal velocity in skydiving with force balance. Explore real-world stopping distances (icy roads, ABS braking).
Assessment: At the end of every unit that varies from 2-3 weeks: Quizzes and tests: Checking understanding with the use of quizzes and topical tests on 4.12-inheritance, variation, evolution and 3.19 Prevention and treatment of diseases.. 5.13 periodic table ; 1.4 waves	ASSESSMENT: At the end of every unit that varies from 2-3 weeks: Quizzes and tests: Checking understanding with the use of quizzes and topical tests on forces and energy changes,magnetism,forces and motion

Biology

Chemistry

Physics

4.14 Chemical quantities

Teaching chemical quantities to GCSE students involves introducing the concepts of moles, molar mass, and stoichiometry in a clear and practical way. Here's a very brief overview of activities:

Key Concepts**Moles**

Definition: Unit used to measure the amount of substance.

Avogadro's Number: 1 mole of any substance contains 6.022×10^{23} particles (atoms, molecules, ions).

Calculations: Calculating moles using mass, volume, and particle number.

Molar Mass

Definition: Mass of one mole of a substance (grams per mole).

Calculation: Sum of atomic masses of all atoms in a molecule.

Stoichiometry

Balanced Equations: Writing and balancing chemical equations.

Mole Ratios: Relating amounts of reactants and products.

Calculations: Using mole ratios to determine quantities of substances involved in a reaction.

Using real-world examples and practical applications can help students grasp the importance and application of chemical quantities in chemistry.

6.15 Energy Changes

Forms of Energy: Kinetic energy (energy of motion), potential energy (stored energy), thermal energy (heat), and others (chemical, electrical, etc.).

Energy Transfer: Conversion between different forms of energy.

7.21 Rate and extent of chemical change

Teaching GCSE rates of reaction involves conducting experiments to measure how various factors like temperature, concentration, surface area, and catalysts affect the speed of chemical reactions, and using graphs to analyse these changes. Visual demonstrations and interactive activities help students understand collision theory and the conditions needed for reactions to occur.

8.23 Carbon chemistry

Teaching carbon chemistry to GCSE students involves exploring the structures, properties, and reactions of different carbon compounds, such as alkanes, alkenes, and alcohols, through hands-on experiments and molecular models. Relating these concepts to real-world applications, like fuels and polymers, helps students understand the significance and versatility of carbon compounds in everyday life.

8.24 Resources of materials and energy

Teaching the resources of materials and energy involves exploring the extraction, use, and sustainability of natural resources, along with their environmental impacts, through practical activities and real-world examples.

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Start with Big Ideas & Context Link to everyday life:

Begin with questions like "Where does your energy come from when you switch on a light?" or "How many litres of water does it take to produce a burger?"

Use current case studies (e.g., UK energy mix, global renewable projects, recent energy crises) so students see relevance.

Use Visual & Interactive Tools

Conservation of Energy:Energy cannot be created or destroyed, only transferred or transformed. Applications and Examples Work and Power: Definition of work (force × distance) and power (work done per unit time). Energy Efficiency: Calculating efficiency and understanding wasted energy (e.g., friction, heat loss). 6.16 Structure and bonding Teaching GCSE structure and bonding involves explaining the arrangement of atoms in substances, including the types of bonds they form (ionic, covalent, metallic). Students learn how these bonds affect the physical and chemical properties of materials, and how to represent them using Lewis diagrams and molecular models. Practical demonstrations and problem-solving exercises help students understand the relationships between structure, bonding, and the properties of substances. 7.19 Electricity Teaching electricity to GCSE students involves using circuit diagrams and hands-on experiments to explore concepts like current, voltage, resistance, and Ohm's Law. Interactive simulations and practical problem-solving tasks help students understand the behaviour of electrical circuits and the relationship between electrical quantities.	Flow diagrams & infographics: Show global energy flows, renewable vs non-renewable, and ecological footprints. GIS & online maps (Google Earth, ArcGIS Story Maps): Explore energy production sites and global consumption patterns. Data interpretation tasks: Give graphs/tables for students to describe and explain trends (preparing for exam-style questions). Active Classroom Strategies Role-play/debates:Example: “Should the UK invest more in nuclear power?” Assign roles (government, environmental groups, local residents). Decision-making exercises: Students weigh costs/benefits of energy strategies in LICs vs HICs. Case study jigsaw: Split groups to research different case studies (e.g., micro-hydro in Nepal vs solar in the UK), then teach peers. Build Exam Skills Early: Use command word drills (describe, explain, evaluate) linked to resource/energy questions. Model structured exam answers using PEEL (Point, Evidence, Explain, Link). Retrieval & Spaced Practice Quick quizzes at the start/end of lessons (e.g., “3 renewable sources in 30 seconds”). Interleaving with other topics (e.g., link energy security with development, population, or climate). Use flashcards for key terms (sustainability, energy mix, food security).
ASSESSMENT: At the end of every unit that varies from 2-3 weeks: Quizzes and Tests: Checking understanding with the use of quizzes and topical tests on energy changes,electricity; 5.14 chemical quantities ; 6.15 forces and energy changes; 6.16 structure and bonding	ASSESSMENT: At the end of every unit that varies from 2-3 weeks: Quizzes and Tests: Checking understanding with the use of quizzes and topical tests on resources of materials and energy.

ASSESSMENT STYLE

Question Types

Short-answer, point-marked questions:

"Outline one impact of energy insecurity." (2 marks)

"Give one advantage of renewable energy." (1 mark)

Longer explain/evaluate questions:

"Explain how energy demand and supply are changing in the UK." (6 marks)

"Evaluate the importance of renewable energy to sustainable economic futures." (9 marks + 3 SPaG)

Use of figures/maps/graphs:

Interpret energy mix pie charts, line graphs of consumption, or flow diagrams.

Command Words

Outline / Suggest → short factual answers.

Explain → cause and effect, with linkage words (because, therefore, as a result).

Evaluate / Assess → balanced arguments with a justified conclusion

Marking & Levels

AO1 (knowledge) – recall facts, definitions, case study details.

AO2 (understanding) – show cause-effect, make links between ideas.

AO3 (application/analysis) – interpret data, evaluate strategies, reach conclusions.

Tips for Students

Learn **case study details**: e.g., UK energy mix, Nepal micro-hydro scheme.

Practice **data response** (interpreting pie charts, graphs, maps).

Use **PEEL structure** for 6–9 mark questions: Point → Evidence → Explain → Link to question.

Revise **key terminology** (energy mix, energy insecurity, sustainability).

Work on **SPaG** in 9-mark questions — spelling, punctuation, grammar are rewarded.

Biology

Chemistry

Physics

7.20 Acids and alkali

Teaching acids and alkalis to GCSE students involves practical experiments with indicators and pH testing to explore the properties, reactions, and real-life applications of acids, bases, and their neutralisation.

7.22 Atoms and ions

Teaching atoms and ions to GCSE students involves explaining atomic structure and electron transfer through visual models and practical examples to illustrate the formation and properties of ions.

Revision

CROSS-CURRICULAR PROJECT		ASSESSMENT
Biology	Chemistry	Physics
ASSESSMENT Formative assessments Exam practice End of units test End of term test End of year test Formative assessments Exam practice End of units test End of term test End of year test All assessments are linked to AQA Assessment Objectives for Science Resources Textbook - Kerboodle Biology for practical equipment Free Science Video Maths skills <u>Extended Learning Opportunity</u> After school clubs, STEM Trips, STEM careers	ASSESSMENT Formative assessments Exam practice End of units test End of term test End of year test Formative assessments Exam practice End of units test End of term test End of year test All assessments are linked to AQA Assessment Objectives for Science Resources Textbook - Kerboodle Physics for practical equipment Free Science Videos Maths skills <u>Extended Learning Opportunity</u> After school clubs, STEM Trips, STEM careers	