Science KS4 Curriculum Map

YEAR	Biology	Chemistry	Physics
	Working Scientifically How do scientists develop ideas into questions? How do you write a plan for an investigation and consider precision and accuracy? How should data be collected and recorded? How can data be presented and analysed? How do scientists evaluate investigations and data collected to make improvements to any investigation or study? How do scientists use mathematical and statistical skills to make judgements about the outcome they discover in science investigations and studies. The concepts for working scientifically are then embedded across all years in a variety of contexts. **Making connections:** Working Scientifically is the very foundation of 'How Science Works'. The concepts learned here will be embedded across every single topic in KS4. From Year 9 onwards, students will also begin to practice and apply higher levels of numeracy that will cross over from Maths and that are transferable to many other subjects too.		
Year 9	**B1 Cells** What are the differences between plant, animal and microbial cells? How are cells highly specialised? How do substances move in and out of cells? Making connections: ● Eukaryotic and prokaryotic cells have evolved over time and are classified in B15. **B2 Cell Division** How do cells grow and divide and what medical problems can this lead to? Making connections: ● Cell division in reproductive cells is covered in B13. Comparisons are made between mitosis and meiosis. Making connections: ● Lifestyle factors such as smoking, alcohol and exercise levels affect the health of your heart, lungs and organs as covered in B7.	**C1 Atomic Structure** How do atoms differ from one another? Making connections: ● Periodic table data and patterns of reactivity in C2 and C5. ● Chemical calculations and use of periodic table data throughout the whole of Chemistry. **C2 The Periodic Table** Why was the periodic table such an important scientific breakthrough? Making connections: ● Atomic structure and reactivity series. ● Allows students to use patterns in structure and bonding. **C3 Structure and Bonding (Potential Separate Science Groups Only)** How do different atoms bond together and how does this affect their properties and uses for everyday materials? Making connections: ● Chemical calculations. ● Redox reactions including electrolysis. ● Uses of all materials based on their structure and properties. ● Structure of organic compounds. ● Testing for ions.	**P1 Energy Conservation and Dissipation** How is energy stored and transferred? Making connections: ● Energy transfers from one store to another in P2. ● How energy needs to be conserved in P3. **P2 Energy Transfer** How is energy transferred from one form to another? How can we calculate the energy needed to heat an object? What is meant by thermal conductivity? Making connections: ● Energy generated in power stations is provided by the flick of a switch and via circuits in P4.. Energy reaches us via national grid making links to P4, P5 and P15.
Year 10	**B3 Organisation and the Digestive System** What factors affect how an enzyme works? Making connections: ● Rates of reaction in chemistry C8 covers the catalysis of all chemical reactions. **B4 Organising Plants and Animals** How can stents prevent a heart attack? **B5 Communicable Disease** What are communicable diseases and how can we prevent them? Making connections: ● Genetic diseases, which are not infectious but can be passed parent to offspring in B13.	**C3 Structure and Bonding (Combined Science Groups Only)** How do different atoms bond together and how does this affect their properties and uses for everyday materials? Making connections: ● Chemical calculations. ● Redox reactions including electrolysis. ● Uses of all materials based on their structure and properties. ● Structure of organic compounds. ● Testing for ions. **C4 Chemical Calculations** How do we use chemical equations to predict reacting quantities? Making connections: ● C1 Atomic structure and a variety of calculations used later in the course.	**P3 Energy Resources** How can we compare different energy sources? Making connections: ● Nuclear power stations provide us with energy without burning fossils fuels. Nuclear power generation generates large amounts of electricity. Nuclear reactions are covered in P7. **P4 Electric Circuits** What is electric current? How do series and parallel circuits differ? Making connections: ● How electricity generators work in P15. **P5 Electricity in the Home** How is electricity made and how energy is used in our homes. How can energy be saved in the home? How is electrical energy used calculated?

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	B6 Preventing and Treating Disease What are the most effective ways of treating infectious disease? Making connections: ● Lifestyle factors such as diet, exercise, smoking and hygiene. **B7 Non-Communicable Disease** How can your lifestyle affect your risk of developing many non-communicable diseases, such as Type II Diabetes? Making connections: ● Prevention of disease B6. ● Healthy lifestyle in KS3. **B8 Photosynthesis** How do plants use glucose they make during photosynthesis? Making connections: ● Plant transport and the cross section of the leat in specialised cells B1. **B9 Respiration** What is the difference between aerobic and anaerobic respiration? Making connections: ● Pollution of a waterway by fertilisers or sewage can make it impossible for plants and animals to respire in B16-B17. **B10 The Nervous System** What are reflexes and how do they aid survival? How does our body detect and respond to changes around us in our environment? Making connections: ● The structure of specialised cells in B1. ● Chemicals properties of lipids in B3.	**C5 Chemical Changes** How can we extract metals from their ores? How can we make and prepare pure, dry samples of salts? Making connections: ● Displacement reactions and the use of electrolysis will be applied in C14. **C6 Electrolysis** How can we decompose ionic compounds to get useful products? Making connections: ● Displacement reactions and the use of electrolysis will be applied in C14. ● Redox reactions already learned in C5. **C7 Energy Changes** Why do chemical reactions always involve transfer of energy? Making connections: ● Reaction profile diagrams will be used to explain the effect of catalyst of reaction rates in C8. ● Bond energy calculations relies on students drawing 2D structures from C3. **C8 Rates and Equilibrium** How are reaction rates and reversible reactions affected by changing conditions? Making connections: ● Big emphasis on 'Working scientifically' from any previous topic. ● Chemical changes between reactants in C5. **C9 Crude Oil and Fuels** How is a range of useful products obtained from crude oil? Making connections: ● Pollutants from combustion of fuels have been examined in C13. ● The structure of hydrocarbons and related organic compounds to in C10.	Making connections: ● Use of some equations used in P1. ● Calculating energy supplied to a device in P1. ● Calculating efficiency and power in P1. **P6 Molecules and Matter** What do we mean by density and elasticity? Making connections: ● Particles models and changes of state in C3 Chemistry. ● Density of water in P11. ● Atmospheric pressure in P11. ● Specific heat capacity in P2. **P7 Radioactivity** What is the half-life of a radioactive isotope? Making connections: ● Chemistry C1 atomic structure to understand concept of isotopes. ● Applications of x-rays in P13. ● Medical image systems and ultrasounding in P12. **P8 Forces in Balance** How do we present a force and what is meant by a resultant force? How do we work out resultant forces? Making connections: ● Newton's Second Law in P10. ● Calculating forces at KS3. ● Investigating and measuring forces with motion and pressure. **P9 Motion** What is momentum? Making connections: ● Rearranging equations (H tier only). ● Velocity and displacement as vector quantities. ● Speed is a scalar quantity.
Year 11	**B11 Hormonal Coordination** How do hormones control responses such as the way plants bend towards light, and the release of a mature egg in the human menstrual cycle? Making connections: ● Development and differentiation of specialised cells in B1. **B12 Homeostasis** Why is homeostasis important for survival? What is the process involved in temperature control in animals? Making connections: ● The importance of heart and breathing control in exercise B4. ● Adaptations of organisms to maintain homeostasis in challenging environmental conditions B16. **B13 Reproduction** How do plants and animals reproduce? What is DNA? What is a genome?	**C10 Organic Reactions (Separate Science Only)** How do the functional groups affect the reactions of organic compounds? Making connections: ● Understanding of the basic structure of organic compounds and hydrocarbons from C9. ● Fermentation is revisited here as well in respiration and Biology. **C11 Polymers (Separate Science Only)** How does the structure of a polymer affect its properties? Making connections: ● The ethics of waste disposal in Geography and PHSE/MSC. **C12 Chemical Analysis** How can we use chemical tests to identify unknown substances? Making connections:	**P10 Force and Motion** What is meant by elasticity? How do different materials stretch? Making connections: ● Calculating acceleration in P9. ● Friction has been learned in P8. ● Momentum is a vector quantity in P8. ● Maths skills for inverse proportion. **P11 Forces and Pressure** How do we measure forces and pressure? Making connections: ● Backlinks to P1 energy transfer. **P12 Wave Properties** How do we measure waves and how fast do they travel? What happens when waves meet boundaries between two different substances?

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Making connections:
- Meristem cells in plants are involved in tropic responses.

B14 Variation and Evolution
How are characteristics passed from parents to offspring? What are the benefits of genetic engineering?

Making connections:
- The causes of natural selection in B15.

B15 Genetics and Evolution
How does evolution by natural selection take place and why are mutations important?

Making connections:
- How sexual reproduction causes genetic variation learned in B13.

B16 Adaptations
What adaptations do animals and plants have that enables them to survive and in some cases in extreme conditions?
Making connections:
- Living organisms have adaptations to survive certain ecosystem conditions and the impact from human activity in B17-18.

B17 Ecosystems
How do living and non-living components in ecosystems interact and what affect can humans have on ecosystems?
Making connections:
- The effects of human activity on ecosystems is covered in Geography.
- Backlinks to living things and their adaptations to survive abiotic and biotic components in ecosystems.

B18 Biodiversity
What is the range of living species around the world and in different ecosystems?
Making connections:
- The effects of population dynamics on the world's resources and biodiversity will link into Geography.

- Analysis of chromatograms and carrying out chromatography in C1.

C13 Earth and the Atmosphere
How is human activity affecting the Earth's atmosphere?

Making connections:
- Atmospheric pollution and trends may be covered in Geography, and particularly the impact of human activity.

C14 The Earth's Resources
How are we seeking to make sustainable use of the Earth's limited resources?

Making connections:
- How population dynamics affect the demands on Earth's resources in Geography.

C15 Using Our Resources
How are we seeking to make sustainable use of the Earth's limited resources?

Making connections:
- Understanding of polymers allows us to understand materials choices and demands.

Making connections:
- Wavelength depends on speed and frequency.
- Measuring speed in P8.
- Uses of oscilloscopes covered in P5.

P13 Electromagnetic Waves
What are electromagnetic waves and how do they differ from sound waves?

Making connections:
- Previous knowledge of sound at KS3.
- Energy transfer backlink to P1-3.
- Infrared radiation covered in P2.
- Alternating currents covered in P5.
- Radioactive isotopes in P7.

P14 Light
How do waves carry information and how they can form images?

Making connections:
- Astronomers use non-optical telescopes to obtain images of objects in space P16.

P15 Electromagnetism
How is the strength of an electromagnetic field measured and what a solenoid is?

Making connections:
- Power stations generate alternating currents not direct currents. Alternating currents and transformers will link back to P5.

P16 Space
How do satellites orbit the Earth and what are geostationary satellites?

Making connections:
- Heavier elements and half-life in P7.