

Science KS4 Curriculum Sequence

1. Cell Biology	2. Atomic Structure	3. Energy	4. Bonding & Properties
<ol style="list-style-type: none"> 1. What are cells and what do they consist of? 2. How do you view cells utilising light and electron microscopes? 3. How do you draw cells using a light microscope? 4. How do cells become specialised to a specific function? 5. How do cells divide? 6. How do you culture microorganisms? (Triple) 7. What is a stem cell and what are their uses? 8. How do substances move in and out of cells? 9. How does water move in and out of cells? 10. How does water move in and out of cells? 11. When do cells need energy to move substances? 	<ol style="list-style-type: none"> 1. How do we name and represent elements? 2. How do we name and represent elements? 3. What are the different properties of elements? 4. How was the periodic table discovered? 5. How was our understanding of the atom developed? 6. How is the atom structured? 7. How is the atom structured? 8. What does the electronic structure of an atom show? 9. What are the different states of matter? 10. What is an ion? 11. What makes a Group 1 metal? 12. What makes a Group 7 element? 13. What is a compound? 14. What is a mixture? 15. How do you separate mixtures? 	<ol style="list-style-type: none"> 1. What is an energy store? What is a system? 2. How do you calculate elastic potential energy? 3. How do you calculate kinetic energy? 4. How do you calculate gravitational potential energy? 5. What is specific heat capacity? 6. How can you calculate specific heat capacity? 7. What is power and how do you calculate it? 8. How is energy transferred in a system? 9. What do we mean by energy efficiency? 10. How are different energy resources utilised? 	<ol style="list-style-type: none"> 1. What is covalent bonding and why do molecules do it? 2. What are the main features of giant covalent structures? 3. What is nanoscience? (Triple) 4. What is the difference between a monomer and polymer? 5. How are atoms and molecules arranged in different states of matter? 6. How and why do atoms become ions? Why and how do ionic bonds form? 7. What are the main features of metallic bonding? What are the differences between alloys and pure metals?
5. Electricity	6. Bioenergetics	7. Organisation	8. Chemical Changes
<ol style="list-style-type: none"> 1. What makes up a circuit and how do we represent it? 2. What is the meaning of electrical charge and electrical current? 3. How do you describe the differences between series and parallel circuits? 4. What is electrical resistance? 5. How does length affect the electrical resistance of wire? 6. What are resistors and how do they function? 7. How does resistance change across different circuit components? 8. What happens when you add resistors in series and parallel circuits? 9. How is electricity used in a domestic setting? 10. What is power and how do you calculate it? 11. How do you calculate the energy transferred in an electrical circuit? 12. What is the national grid and how does it work? 13. What is static charge? (Triple) 14. How do electric fields work? (Triple) 	<ol style="list-style-type: none"> 1. What is photosynthesis? How do we represent the reaction? 2. How do plants use glucose that is produced as a result of photosynthesis? 3. What factors affect the speed at which plants photosynthesise? 4. How can we measure the effect of light on the speed of photosynthesis? 5. What is aerobic respiration? 6. How is anaerobic respiration different to aerobic respiration? 7. How does the body react to exercise to ensure it maintains sufficient respiration? 8. What is metabolism and how are enzymes involved? 	<ol style="list-style-type: none"> 1. What are the main structures and systems of the body? 2. How does the digestive system work and what are nutrients for? 3. How do enzymes work and how can they assist digestion? 4. What are the 3 main biological molecules and how do you test for them? 5. How do you test for biological molecules? 6. How are enzymes affected by pH? 7. How are enzymes affected by pH? 8. What is in blood and how is it transported? 9. What are the structures of the heart and how does it assist blood circulation? 10. What are the structural adaptations of plants? 11. What is transpiration in a plant and how can it be affected? 12. What do stomata and guard cells do? 13. What different diseases can affect plants? (Triple) 14. How do plants protect themselves against disease? (Triple) 15. What do plant hormones do? (Triple) 	<ol style="list-style-type: none"> 1. What is meant by the terms oxidation and reduction? 2. How do group 1 metals react with oxygen? 3. How can we rank the reactivity of different metals? 4. What is a displacement reaction and how can we predict their outcomes? 5. What is the difference between acids and alkalis? 6. How do metals react with different acids? 7. What happens when acids react with alkalis or bases? 8. How do you make sodium chloride? 9. What is electrolysis and what happens during it in terms of ion movement? 10. How do we represent what happens during electrolysis in half equations? 11. What happens during the electrolysis of aluminium oxide? 12. What happens during the electrolysis of aqueous solutions? 13. What happens during the electrolysis of copper sulphate?

The above diagram outlines the sequence of topics students learn during Year 9 to Year 11.

Units of study rotate between 3 scientific disciplines, and build sequentially moving from fundamental concepts (i.e. Cells, Atoms, Energy), to their interactions (i.e. Chemical Reactions, Homeostasis & Forces) through to some of their real world applications (i.e. Ecology, Organic Chemistry, Magnetism). The aim being to increase the level of 'desirable difficulties' in recall of information, and to increase the level of 'intrinsic load' in each topic as study progresses through the course

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9. Particle Model of Matter

1. What is the particle model?
2. What is density?
3. How do you calculate density?
4. Can you calculate density in a practical setting?
5. Can you calculate density in a practical setting?
6. What happens during a change in state?
7. What is internal energy and how is it affected?
8. What is specific heat capacity and how do you calculate it?
9. What is specific latent heat and how do you calculate it?
10. How do particles move in a gas?
11. What happens during Brownian Motion? (Triple)
12. What happens during a change in pressure? (Triple)

10. Infection & Response

1. What is health? What is disease? How does lifestyle affect them?
2. What is non-communicable disease? What are the causes and treatments of coronary heart disease?
3. What causes cancer? What are the risk factors involved?
4. What is communicable disease and how are pathogens transmitted?
5. What is a virus and how do they make people ill?
6. What are bacteria and how are they transmitted?
7. What are fungal and protist diseases and how do they spread?
8. How do the body and immune system defend against pathogens?
9. How do vaccinations cause immunity against disease?
10. What is a drug and how can bacteria become resistant to their effects?
11. How do scientists develop drugs for use?
12. What are monoclonal antibodies? (Triple)

11. Energy Changes

1. What is the difference between endothermic and exothermic reactions?
2. How is energy transferred between the bonds of a chemical reaction? (Higher Tier)
3. Can we identify and carry out endothermic and exothermic reactions?
4. What is a battery? (Triple)
5. What is a fuel cell? (Triple)

12. Atomic Structure

1. What is an atom and what is an isotope?
2. How did our understanding of the atom develop?
3. What happens during radioactive decay?
4. How do nuclear equations describe the process of radioactive decay?
5. What is radioactive half-life?
6. What is the difference between radioactive contamination and irradiation?
7. What is background radiation? (Triple)
8. How do you use radiation? (Triple)
9. What is nuclear fission and fusion? (Triple)

13. Homeostasis

1. What is homeostasis and how does negative feedback work?
2. What are the main pathways through the nervous system and how do they transmit information?
3. How does the brain work? (Triple)
4. How does the eye work? (Triple)
5. What are the problems associated with the eye? (Triple)
6. How does the body regulate temperature? (Triple)
7. How can we measure human reaction time and factors that affect it?
8. What are the glands of the endocrine system and what effect do they have on the body?
9. How does the pancreas regulate blood glucose concentration? What is diabetes and how can it be treated?
10. How do the kidneys work? (Triple)
11. What are the hormones involved in the menstrual cycle?
12. How can hormones be used to change fertility?
13. What are the functions of adrenaline and thyroxine in the human body? (Higher Tier)

14. Rates of Chemical Change

1. How do we measure the rate of reaction?
2. How do we measure the rate of reaction?
3. How does concentration affect the rate of reaction?
4. How does temperature affect the rate of reaction?
5. How does surface area affect the rate of reaction?
6. How do pressure and catalysts affect the rate of reaction?
7. What is reversible reaction and equilibrium?

15. Forces 1

1. What is the difference between scalar and vector quantities?
2. How do you define gravity, mass and weight?
3. What is resultant force?
4. How do you define 'work done'?
5. How can you describe the extension of an elastic object?
6. What are the equations for the extension of a spring and elastic potential energy?
7. How do levers and gears work? (Triple)
8. How do you calculate pressure? (Triple)
9. How does pressure act in liquids? (Triple)

16. Inheritance & Variation

1. What is the difference between asexual and sexual reproduction?
2. How are gametes formed by the process of meiosis?
3. What are the advantages/disadvantages of sexual and asexual reproduction? (Triple)
4. What is DNA and the human 'genome'?
5. What is DNA made of? (Triple)
6. How are proteins made? (Triple)
7. What is a mutation and what does it do? (Triple)
8. How do genes determine the sex of offspring and how do we represent this?
9. How do genes control the inheritance of different characteristics?
10. How are genetic diseases inherited and how can we protect against them?
11. What is Mendelian inheritance? (Triple)
12. What do we mean by genetic and environmental variation?
13. How are fossils formed and used as evidence for evolution?
14. How was the theory of evolution developed?
15. What are other ideas about evolution? (Triple)
16. What is antibiotic resistance and how is it an example of evolution?
17. How are organisms selectively bred?
18. What is genetic engineering and what are the pros/cons of it?
19. How does cloning work? (Triple)
20. How are organisms classified?

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17. Waves	18. Magnetism	19. Organic Chemistry	20. Ecology
<ol style="list-style-type: none"> 1. What are transverse and longitudinal waves? 2. What are the properties of waves? 3. What is the wave equation? 4. How do you use a ripple tank to calculate wave speed? 5. How do waves behave at boundaries? 6. What happens during hearing? 7. How are waves used for detection? 8. What are the properties of EM waves? 9. What are the properties of EM waves? 10. How do you investigate infrared radiation given out by different surfaces? 11. What are the properties of EM waves? 12. How do lenses work? (Triple) 13. How is colour related to wavelength? (Triple) 14. How does black body radiation work? (Triple) 	<ol style="list-style-type: none"> 1. What are the rules for magnetic attraction and repulsion? 2. How do you demonstrate the magnetic effect of a current? 3. What is the motor effect and how do you apply it? 4. How does an electric motor and loudspeaker work? 5. What is the generator effect? (Triple/HT) 6. How is the generator effect used? (Triple/HT) 7. What is a transformer and how does it work? (Triple/HT) 8. How do you calculate the efficiency of a transformer? (Triple/HT) 	<ol style="list-style-type: none"> 1. How is crude oil made? What is an alkane? 2. What is a hydrocarbon and what are their key properties? 3. How do we separate out different length hydrocarbons through fractional distillation? 4. What is the process of cracking hydrocarbons and what are the resultant products? 5. What is an alkene and how is it different to an alkane? 6. What is an alkene and how is it different to an alkane? 7. What are alcohols and how they react? (Triple) 8. What are carboxylic acids and how they react? (Triple) 9. What are condensation and addition polymerisation reactions? (Triple) 	<ol style="list-style-type: none"> 1. What is an ecosystem and how is it organised? 2. What is the difference between abiotic and biotic factors and how do changes in them affect ecosystems? 3. How and why are animals adapted to their environments? 4. How do we represent different feeding relationships in an ecosystem? 5. How do we estimate the size and spread of a population in an ecosystem? 6. How and why are water, carbon and waste cycled through an ecosystem? 7. What is biodiversity and why is it important? 8. What environmental problems are being caused by an increasing human population? 9. How can humans reduce their impact on biodiversity?
21. Chemical Analysis	22. Quantitative Chemistry	23. Forces 2	24. Chemistry of the Atmosphere
<ol style="list-style-type: none"> 1. What is the difference between pure and impure substances? How do we separate substance using chromatography? 2. How do we test for the presence of oxygen, hydrogen, chlorine and carbon dioxide gas? 3. How do you test for positive and negative ions? (Triple) 4. How do you test for positive and negative ions? (Triple) 5. What are instrumental methods used for? (Triple) 	<ol style="list-style-type: none"> 1. How do we calculate the relative atomic mass, formula mass and percentage mass of atoms and compounds? 2. What do we mean by 'conservation of mass'? How do we balance equations? 3. What do we mean by a 'mole'? 4. Can we practice calculating mass, moles and percentage mass using experimental data? 5. What is meant by the term 'concentration'? How do you calculate the mass of a solute in a known concentration? (Triple) 6. What is meant by the term 'concentration'? How do you calculate the mass of a solute in a known concentration? (Triple) 7. What is meant by the term 'concentration'? How do you calculate the mass of a solute in a known concentration? (Triple) 8. How do you calculate the volume of gases? (Triple) 9. What are titrations and how do you do them? (Triple) 10. What are titrations and how do you do them? (Triple) 11. How do you calculate percentage yield? (Triple) 	<ol style="list-style-type: none"> 1. What s the difference between distance and displacement? 2. How do you use distance-time graphs? 3. What is acceleration and how do you calculate it? 4. How do you describe terminal velocity and explain the equation of motion? 5. What are Newton's 1st and 2nd Laws? 6. How are force, mass and acceleration related? 7. How do you explain inertial mass and Newton's 3rd law? 8. What affects thinking and braking distances? 9. How do you calculate reaction time? 10. What is momentum and how d you calculate it? 	<ol style="list-style-type: none"> 1. What does the Earth's atmosphere consist of and how did it evolve? 2. What happens during the greenhouse effect? 3. What are the risks associated with climate change? How can carbon emissions be reduced? 4. What problems are associated with increased air pollution?

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25. Using Resources

1. What is the difference between finite and renewable resources?
2. What is potable water and how does desalination occur?
3. Can we practice purifying water ourselves?
4. How is waste water purified?
5. How do phytomining and bioleaching occur? (Higher Tier)
6. What is a lifecycle assessment and how do we conduct one?
7. How do reuse and recycling of materials contribute to sustainable development?
8. What are polymers used for? (Triple)
9. What does the Haber Process do? (Triple)
10. How are fertilisers used and made? (Triple)

26. Space Physics (Triple)

1. What does our Solar System consist of and what is it part of?
2. What are the stages of a life cycle of a star?
3. How does gravity generate orbital motion in natural and artificial satellites?
4. What is Red-shift and what does it tell us?