Year 11: Curriculum Intent

The intent of the Year 11 curriculum is to learn the final parts of their science curriculum and consolidate this and prepare them for the next stage of education. They will continue to increase the depth and breadth of their knowledge and build strong links in learning to consolidate prior learning and secure the knowledge and skills required to excel in GCSE Science. Pupils will continue to study the different areas of science:

- in Biology - Homeostasis and Inheritance, Variation & Evolution.
- in Chemistry - Chemical Analysis, Chemistry of the Atmosphere and Using Resources.
- in Physics - Forces, Magnets & Electromagnets and, in triple science only, Space Physics..
- and across all three sciences - how to Work Scientifically.

Pupils will be taught key knowledge and skills in both theory and practical science. They will learn about the scientific method, how to keep safe and how to draw valid conclusions from data.

Year 11 Biology Essential Knowledge Summary

Schemata 1: B5 Homeostasis and Response

Composite Knowledge: Pupils will gain an understanding of both the endocrine and nervous system. With a particular focus on glucose control and the negative feedback systems involved in thyroxine release and the female menstrual cycle.

Component Knowledge:
Foundational Knowledge:
Declarative Knowledge:

Recall what homeostasis is and why it is important.

Recall examples of conditions that need to be controlled.

Recall the roles of the nervous system and the endocrine system in homeostasis.

Recall the main components of a control system and their functions.

Recall the functions of the main structures in the nervous system.

Recall the differences between voluntary and reflex actions.

Recall the stages of a reflex action

Describe the endocrine system

Recall the term hormone.

Recall the locations of organs in the endocrine system.

Recall why the pituitary gland is often called the master gland.

Recall how blood glucose concentration is monitored and controlled.

Recall when insulin is produced and how it helps to control blood glucose levels.

Recall glycogen as a stored carbohydrate.

Recall the cause, treatment and problems associated with Type 2 diabetes.

Recall the terms hormonal and non-hormonal methods of contraception.

Recall the use of fertility drugs in women with low FSH levels.

Recall where and when adrenaline is released and its target organs.

Recall the effects of adrenaline on the body.

Recall where thyroxine is produced and its effects on the body.

Biology Only

Identify the cerebral cortex, cerebellum and medulla on a diagram and recall the function of each.

Label a diagram of the eye and describe the function of each structure.

Define the term 'accommodation'.

Recall different methods to measure body temperature.

Recall how body temperature is monitored and controlled.

Describe where water, ions and urea are lost from the body.

Label a diagram of the excretory system.

Recall the advantages and disadvantages of a kidney transplant.

Schemata 2: B6: Inheritance, Variation and Evolution

Composite Knowledge: Pupils will gain an understanding of how the information in your genetic code controls the chemicals that make up your cells, tissues and organs. Students will consider some of the new gene technologies that scientists are using. Students will gain an understanding of how knowledge of the genome allows us to classify organisms in different ways and make sense of global diversity.

Component Knowledge:
Foundational Knowledge:
Declarative Knowledge:

Recall sexual reproduction produces variation in the offspring, but asexual reproduction does not.

Recall sexual reproduction in animals and plants.

Recall the term clone.

Recall cuttings as clones of plants.

Define meiosis.

Describe the process of meiosis to include the number of chromosomes at each stage.

Define fertilisation.

Describe using a Punnett square and genetic diagram how sex is determined in humans.

Define the term gametes and describe their genetic material.

Draw diagrams to explain how gametes are formed in meiosis.

Recall the number of chromosomes in the gametes during meiosis and fertilisation.

Recall that plants can reproduce sexually to produce seeds and asexually by runners.

Recall the structure of chromosomes, DNA and genes.

Recall that a gene is a small section of DNA that codes for a particular sequence of amino acids to make a specific protein**.**

Define the term genome.

Recall what a mutation is.

Give examples of characteristics controlled by a single gene and describe their alleles.

Give examples of characteristics controlled by multiple genes.

Define and use the terms: gametes, genotype, phenotype, dominant recessive, homozygous and heterozygous.

Describe the inherited disorders polydactyly and cystic fibrosis.

Define the term genetic engineering.

Recall the process of genetic engineering and its advantages.

Recall plant cloning techniques to include:

- taking plant cuttings
- tissue culture.

Explain why identical twins are clones.

Recall how a kidney machine works.

Recall how plant shoots and roots respond to light and gravity.

Recall the role of auxin in plant responses in terms of unequal distribution in shoots and roots.

Recall how auxins are used as weedkillers and rooting powders, and to promote growth in tissue culture.

Procedural Knowledge:

Explain the importance of being able to respond to environmental changes and coordinate behaviour.

Explain how the nervous system is adapted for its functions.

Explain the role of chemicals at synapses.

Describe and use different methods to measure reaction time.

Explain the importance of reflex actions and give examples.

Compare the actions of the nervous and endocrine systems.

Compare the causes, and treatments of Type 1 and Type 2 diabetes.

Recall secondary sexual characteristics of boys and girls.

Recall the cause of these changes in boys and girls and their relevance in reproduction.

Describe the menstrual cycle and fertility including the role of hormones.

Explain how hormonal and non-hormonal contraceptives work.

Explain the process of In Vitro Fertilisation (IVF).

Explain how levels of adrenaline are controlled by a negative feedback system.

Explain how its release is stimulated by thyroid stimulating hormone and the levels of these two hormones are controlled by a negative feedback system.

Biology Only

Describe how the eye changes to focus on near and distant objects.

Complete simple ray diagrams to show normal vision, long-sightedness and short-sightedness

Describe and explain the changes that happen when body temperature is too high or too low.

Explain why we drink more fluid during hot weather.

Explain why there is no control over water, ion and urea loss by the lungs and skin.

Explain when cells might gain or lose too much water, in terms of osmosis (links to B1)).

Describe the effect of too much or too little water on cells.

Explain how the body responds to different temperature and osmotic challenges in terms of sweat and urine release.

Describe how urine is produced.

Describe the absorption of glucose and ions by diffusion and active transport (link to B1).

Explain why dialysis fluid contains sugar and ions at the same concentration as normal blood, but no urea.

Evaluate the use of kidney transplants and dialysis to treat kidney failure.

Explain the role of auxin in plant responses in terms of unequal distribution in shoots and roots.

Describe the use of ethene to control the ripening of fruit during storage and transport.

Describe the use of gibberellins to end seed dormancy, promote flowering and to increase fruit size.

Describe animal cloning techniques to include:

- embryo transplants
- adult cell cloning.

Recall classification of characteristics as being due to genetic, environmental or a combination of these causes.

Recall examples of continuous and discontinuous variation.

Recall why humans selectively breed plants and animals.

Recall selective breeding as a type of sexual reproduction.

Describe the process of selective breeding and give examples.

Describe evolution by Darwin's theory of natural selection, recalling the main stages of natural selection.

Recall why mutation may lead to more rapid change in a species.

Define the term species.

Identify organisms that are of different species.

Recall the work of Alfred Russel Wallace on natural selection.

Recall the work of Jean-Baptiste Lamarck.

Define the terms inherited and acquired characteristics.

Recall types of evidence for the theory of evolution by natural selection.

Define the term 'fossil'.

Recall how fossils may be formed.

Define the term extinction.

Explain how extinction may be caused.

Biology Only

Recall advantages and disadvantages of asexual and sexual reproduction.

Explain the structure of DNA using diagrams and models.

Recall how the bases on the two strands link together.

Describe some of the experiments carried out by Mendel using pea plants.

Recall a timeline showing the main developments in the understanding of inheritance

Recall the work of Wallace.

Procedural Knowledge:

Explain why sexual reproduction produces variation in the offspring, but asexual reproduction does not.

Explain why sexual reproduction results in variety.

Compare mitosis and meiosis

Describe advantages and disadvantages of sexual and asexual reproduction.

Describe some organisms that can reproduce by both methods (Malarial parasite and types of fungi).

Explain using a Punnett square and genetic diagram how sex is determined in humans.

Explain the probability of having a child that is a boy or a girl.

Explain how knowledge of the human genome will help medicine in the future.

Upper Hierarchical Knowledge

Explain when glucagon is produced by the pancreas and its effect on blood glucose levels.

Explain how insulin and glucagon work together to control blood glucose levels.

Explain the cause, effects, treatment and problems associated with Type 1 diabetes.

Evaluate modern methods of treating diabetes.

Explain the interaction between these hormones in the control of the menstrual cycle.

Evaluate hormonal and non-hormonal contraceptives.

Evaluate the use of fertility treatments.

Biology Only

- Describe the techniques used to map areas of the brain to their functions.
- Evaluate the benefits and risks of procedures carried out on the brain and nervous system.
- Describe how amino acids are deaminated in the liver to form ammonia, which is converted to urea for excretion.
- Recall the site of production and target organs for ADH.
- Describe the effects of ADH on kidney tubules.
- Explain, with the aid of a diagram, how ADH controls the concentration of the blood using a negative feedback mechanism.
- Explain the interaction between these hormones in the control of the menstrual cycle.
- Describe the functions of gibberellins and ethene in plants.

Working Scientifically

Testing samples of urine for glucose:

- **WSAN 1** make and record observations and measurements and present data using appropriate methods including tables with repeat measurements

Required practical- Plan and carry out an investigation into the effect of a factor on human reaction time:

- WS8 make and record observations and measurements using a range of methods for different investigations; and evaluate the reliability of methods and suggest possible improvements.

Biology Only:

Eye Dissection:

- **WSAN 1** make and record observations and measurements and present data using appropriate methods including tables with repeat measurements.

Plot cooling curves:

- **WSAN 2** use basic data analysis to calculate means, plot graphs with line of best fit and use this data to draw conclusions

Kidney Dissection:

- **WSAN 1** make and record observations and measurements and present data using appropriate methods including tables with repeat measurements.

Required practical-Plan and carry out an investigation into the effect of light on plant shoots:

- WS6 select, plan and carry out the most appropriate types of scientific enquiries to test predictions, including identifying independent, dependent and control variables, where appropriate.

Explain the ethical issues related to DNA sequencing.

Use genetic cross diagrams to explain inheritance and carriers.

Make informed judgements about the economic, social and ethical issues concerning embryo screening.

Describe the use of genetic modification to treat genetic disorders.

Explain why Mendel proposed the idea of separately inherited factors and why the importance of this discovery was not recognised until after his death.

Predict and explain the outcome of crosses using genetic diagrams based on Mendel's experiments and using unfamiliar information.

Evaluate the use of genetic engineering in medicine, eg in gene therapy and production of hormones and some vaccines.

Interpret information about genetic engineering techniques.

Make informed judgements about the economic, social and ethical issues concerning genetic engineering and GM crops.

Explain the importance of cloning to plant growers.

Interpret information about plant cloning techniques.

Explain advantages and disadvantages of plant cloning techniques.

Evaluate arguments for and against human cloning.

Make informed judgements about the economic, social and ethical issues concerning cloning.

Explain the benefits and risks of selective breeding in plants and animals.

Interpret evolutionary trees

Identify differences between Darwin's theory of evolution and conflicting theories.

Suggest reasons for the different theories.

Explain why scientists cannot be certain how life began on Earth.

Explain how fossils provide evidence for evolution.

Explain what we should do to slow down the rate of development of resistant strains of bacteria (Link to B3).

Explain that organisms become extinct because something changes and the species cannot adapt quickly enough to the new circumstances.

Biology Only

Describe in simple terms how a protein is synthesised.

Describe how a mutation could affect the formation of a protein, including enzymes and how the shape of the protein links to enzyme action (link to B2).

Explain how new species arise using the terms:

- isolation
- genetic variation
- natural selection
- speciation.

Upper Hierarchical Knowledge

Describe how an embryo is formed.

Describe the function of non-coding parts of DNA and the possible effect of a mutation in a non-coding section of DNA.

Construct genetic cross diagrams.

Describe in detail the process of genetic engineering.

Describe the impact of antibiotic resistance.

Working Scientifically

Observing under slides under a micrsocope- Observe mitosis and meiosis slides. Making observational drawings.

- **WSAN 1** make and record observations and measurements and present data using appropriate methods including tables with repeat measurements.

DNA Extraction: The extraction of DNA from a kiwi:

- **WSAT 2** identify hazards and risks and suggest appropriate ways to reduce the risks.

Appreciate how scientific developments can be used to control reproduction:

WSAT 1 explain how scientific methods and theories have developed, as new evidence and ideas are taken into account by the scientific community (e.g. the development of the periodic table)

Appreciate the power and limitations of science and consider any ethical issues:

- WS2 understand that scientific methods and theories develop as earlier explanations are modified to take account of new evidence and ideas, together with the importance of publishing results and peer review

Model DNA structure.

Produce cauliflower clones using aseptic technique. Evaluate the method and results:

- **WSAN 1** make and record observations and measurements and present data using appropriate methods including tables with repeat measurements

Model how a fossil can be formed.

<u>Year 10 (biology) Final Composite Knowledge End Point</u>

Schemata 1 B7 Ecology

- Recall the terms ecosystem, community, competition, habitat, interdependence.
- Recall the definition of a stable community.
- Recall the resources that plants and animals compete for in a given habitat.
- Recall structural, behavioural and functional adaptations, in a range of organisms.
- Recall the Linnaean classification system.
- Recall Carl Woese's system of classification and classify organisms into the three domains.
- Recall biotic factors in a habitat.
- Recall abiotic factors in a habitat.
- Define biodiversity
- Recall the types of water pollution.
- Recall examples of air pollutants and where they come from.
- Recall what global warming is
- Recall the gases responsible for global warming.

Schemata 2 B6 Inheritance, Variation and Evolution

- Recall sexual and asexual reproduction in animals and plants.
- Recall the term clone.
- Define a cutting from a plant.
- Define meiosis.
- Describe the process of meiosis.
- Define fertilisation.
- Define the term gametes.
- Recall the number of chromosomes in the gametes during meiosis and fertilisation.
- Recall the structure of chromosomes, DNA and genes.
- Define the term genome.
- Recall what a mutation is.
- Give examples of characteristics controlled by a single gene and describe their alleles.
- Give examples of characteristics controlled by multiple genes.
- Define and use the terms: gametes, genotype, phenotype, dominant recessive, homozygous and heterozygous.
- Describe the inherited disorders polydactyly and cystic fibrosis.
- Define the term genetic engineering.
- Recall the process of genetic engineering and its advantages.
- Recall plant cloning techniques to include:
- Explain why identical twins are clones.
- Describe animal cloning techniques.
- Recall examples of continuous and discontinuous variation.
- Recall why humans selectively breed plants and animals.
- Describe the process of selective breeding and give examples.
- Recall the main stages of Darwin's theory of natural selection.
- Define the term species.
- Recall the work of Alfred Russel Wallace on natural selection.
- Recall the work of Jean-Baptiste Lamarck.
- Define the terms inherited and acquired characteristics.
- Recall types of evidence for the theory of evolution by natural selection.

- Define the term ‘fossil’.
- Define the term extinction.
- Explain how extinction may be caused.

Biology Only

- Recall advantages and disadvantages of asexual and sexual reproduction.
- Recall the structure of DNA and how the bases on the two strands link together.
- Describe some of the experiments carried out by Mendel using pea plants.
- Recall a timeline showing the main developments in the understanding of inheritance
- Recall the work of Wallace.

Year 11 Chemistry Essential Knowledge Summary			
Schemata 1: C7 Organic Chemistry	**Schemata 2: C8 Chemical Analysis**	**Schemata 3: C9 Chemistry of the Atmosphere**	**Schemata 4: C10 Using Resources**
Composite Knowledge: Pct. **Component Knowledge:** **Foundational Knowledge:** **Declarative Knowledge:** ● Be able to recognise substances as alkanes given their formulae in these forms. ● Describe the formation of crude oil. ● Describe the composition of crude oil. ● Define a hydrocarbon. ● Explain what is meant by the formula ● C_nH_{2n+2} ● Make molecular models and work out general formula for the alkanes. ● Draw the covalent bonding in: ● methane ● ethane ● propane ● butane. ● Define the term saturated ● Describe how fractional distillation works in terms of evaporation and condensation. ● Describe in general terms the conditions used for catalytic cracking and steam cracking. ● Recall the colour change when bromine water reacts with an alkene. ● Recall how boiling point, viscosity and flammability change with increasing molecular size. ● Write balanced equations for the complete combustion of hydrocarbons with a given formula.	**Composite Knowledge:** Pues. **Component Knowledge:** **Foundational Knowledge:** **Declarative Knowledge:** ● Define the terms: ● pure substance ● compound. ● Use data to identify pure and impure substances. ● Identify the contents of mineral waters sold as ‘pure’. Discuss the meaning of ‘pure’. ● Define the terms: ● mixture ● formulation. ● Describe a method for paper chromatography. ● Describe what the R_f value is and instructions on how to calculate the R_f value. ● Devise a method for distinguishing between pure and impure substances using chromatography. ● Describe the tests for hydrogen, oxygen, chlorine and carbon dioxide. ● Describe the flame tests for identifying cations to another student. ● Describe how sodium hydroxide can be used to identify some cations to another student. ● Describe how dilute acids can be used to identify carbonates. ● Describe how silver nitrate can be used to identify halides. ● Describe how barium chloride in the presence of dilute hydrochloric acid can be used to identify sulfate ions. ● Describe the process of flame emission spectroscopy. ●	**Composite Knowledge:** Pues. **Component Knowledge:** **Foundational Knowledge:** **Declarative Knowledge:** ● Describe the composition of the atmosphere. ● Describe the approximate levels of gases in Earth’s early atmosphere. ● Draw accurate pie charts for the composition of the atmosphere. ● Describe how sedimentary rocks formed and locked up carbon dioxide. ● Describe the main changes in the atmosphere over time and some of the likely causes of these changes. ● Describe and explain the formation of deposits of limestone, coal, crude oil and natural gas. ● Describe how sedimentary rocks formed and locked up carbon dioxide. ● Describe the greenhouse effect in terms of the interaction of short and long wavelength radiation with matter. ● Recall two human activities that increase the amounts of each of the greenhouse gases carbon dioxide and methane. ● Evaluate the quality of evidence in a report about global climate change given appropriate information. ● Describe uncertainties in the evidence base. ● Describe how greenhouse gases are produced ● Describe briefly four potential effects of global climate change	**Composite Knowledge:** Pues. **Component Knowledge:** **Foundational Knowledge:** **Declarative Knowledge:** ● State examples of natural products that are supplemented or replaced by agricultural and synthetic products. ● Distinguish between finite and renewable resources given appropriate information. ● Define the terms: ● finite ● renewable. ● Distinguish between potable water and pure water. ● Describe the differences in treatment of ground water and salty water. ● Give reasons for the steps used to produce potable water. ● Define the terms: ● potable water ● pure water. ● Describe what a LCA is using a suitable example. ● Discuss the negative issues relating to LCAs and why caution should be used when using them ● Define the following terms using suitable examples: ● corrosion ● rusting ● sacrificial protection. ● Describe how to prevent corrosion using the examples: ● oxide coating on aluminium ● zinc on iron ● magnesium on steel. ● Use suitable examples to explain why corrosion can be prevented using barriers and the

- Knowledge of trends in properties of hydrocarbons is limited to:
  - boiling points
  - viscosity
  - flammability.
- Describe the balanced symbol equation including moles present, reactants and products.
- Describe the reaction including moles present, reactants and products.
- Describe what happens when any of the first four alcohols react with sodium, burn in air, are added to water, react with an oxidising agent.
- Recall the main uses of these alcohols.
- Know the conditions used for fermentation of sugar using yeast.
- Be able to recognise alcohols from their names or from given formulae.
- Describe what happens when any of the first four carboxylic acids react with carbonates, dissolve in water, react with alcohols.
- (HT only)
- Recognise carboxylic acids from their names or from given formulae.
- Students do not need to know the names of individual carboxylic acids other than methanoic acid.
- Recognise addition polymers and monomers from diagrams in the forms shown and from the presence of the functional group -C=C- in the monomers.
- Draw diagrams to represent the formation of a polymer from a given alkene monomer.
- Relate the repeating unit to the monomer.
- Explain the basic principles of condensation polymerisation by reference to the functional groups in the monomers and the repeating units in the polymers.
- Be able to name the types of monomers from which these naturally occurring polymers are made.
- Describe the structure of DNA in terms of two polymer chains and nucleotides.

Procedural Knowledge:

- Plot boiling points of alkanes against number of carbons.
- Explain how fractional distillation works in terms of evaporation and condensation.
- Balance chemical equations as examples of cracking given the formulae of the reactants and products.
- Research uses of common alkenes.
- Give examples to illustrate the usefulness of cracking.
- Be able to explain how modern life depends on the uses of hydrocarbons.
- Explain what is meant by the formula C_nH_{2n}
- Write balanced symbol equations for the combustion of alkenes in oxygen.
- Write the reaction between an alkene and hydrogen, giving suitable examples.
- Write the reaction between an alkene and water, giving suitable examples.
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- Discuss the advantages and disadvantages of instrumental analysis versus test tube analysis.
- State advantages of instrumental methods compared with the chemical tests in this specification.

Procedural Knowledge:

- Be able to use melting point data to distinguish pure from impure substances.
- Interpret chromatograms and determine R_f values from chromatograms.
- Provide answers to an appropriate number of significant figures.
- Research how chemical analysis has been used to detect and solve crimes especially in forgery and murder by poisoning.
- Research how robotic spacecraft sent to investigate other planets analyse their atmospheres and surface materials using instrumentation.
- Research instrumental methods for detecting elements and compounds.
- Suggest advantages of the instrumental methods compared with the chemical tests.
-

Upper Hierarchical Knowledge

Explain, in terms of intermolecular forces, the terms:

- melting point
- boiling point.
  - Explain what happens to substances during the process of chromatograph.
  - Suggest how chromatographic methods can be used for distinguishing pure substances from impure substances.
  - Be able to write balanced equations for the reactions to produce the insoluble hydroxides.
  - Explain what happens to a sample throughout the process of flame emission spectroscopy.
  - Interpret instrumental results for flame emission spectroscopy.
  - Compare these to chemical tests carried out in this specification.
  -

Working Scientifically

- Research the melting and boiling points of common pure substances and compounds.
- Suggest reasons for differences in data available on the internet.
- Investigate how paper chromatography can be used to separate and tell the difference between coloured substances. Students should calculate Rf values.
- Carry out tests for hydrogen, oxygen. carbon dioxide and chlorine.
- Carry out flame tests on the following cations:

- lithium
- sodium
- potassium
- calcium
- copper.
  - Use sodium hydroxide to test for the following cations:

- aluminium
- calcium
- magnesium
- copper(II)
- iron(II)
- iron(III).
  - Use dilute acid to test for the following carbonates:

- sodium carbonate
- potassium carbonate.

  - Analyse the composition of an egg shell, testing for the presence of various ions using acids and other

- Identify the effects of global warming.
- Explain the effects of climate change.
- Describe what a carbon footprint is.
- Describe how emissions can be reduced. Suggest the consequences of the reductions on the Earth, atmosphere and everyday life.
- Describe how carbon monoxide, soot (carbon particles), sulfur dioxide and oxides of nitrogen are produced by burning fuels
- Predict the products of combustion of a fuel given appropriate information about the composition of the fuel and the conditions in which it is used.
- Write word equations for complete and incomplete combustion.
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Procedural Knowledge:

- Given appropriate information, interpret evidence and evaluate different theories about the Earth's early atmosphere
- Describe the effect of greenhouse gases on wavelength.
- Compare the Earth's atmosphere to that of Mars and Venus.
- Discuss the scale, risk and environmental implications of global climate change.
- Use the internet to obtain numerical predictions for the effects of climate change. Using these predictions, suggest the possible effects on the Earth and atmosphere should the predictions become reality.
- Suggest the consequences of the reductions on the Earth, atmosphere and everyday life.
- Predict the products of combustion of a fuel given appropriate information about the composition of the fuel and the conditions in which it is used.
- Describe the effect of the following products:

- Carbon monoxide on the human body.
- Sulfur dioxide and oxides of nitrogen on acidity of rain water.
- Sulfur dioxide and oxides of nitrogen on respiratory system.
- Particulates on global dimming.
- Particulates on human health problems.

Upper Hierarchical Knowledge

- Extended writing: describe the theory of the evolution of the Earth's early atmosphere.
- Extended writing: explain why the composition of the atmosphere has changed over billions of years.
- Compare the Earth's atmosphere to that of Mars and Venus.
- Extended writing: explain how algae and plants have caused the concentrations of oxygen in the atmosphere to increase.
- Extended writing: explain how algae and plants have caused the concentrations of carbon dioxide in the atmosphere to decrease.
- Grade 9: explain why the wavelength changes due to greenhouse gases.
- Evaluate the quality of evidence in a report about global climate change given appropriate information.
- Describe how greenhouse gases are produced.
- Evaluate the use of models for predicting climate change.
- Use these equations to describe the reactions in terms of reactants, products made and number of each present.
- Explain why the following can be produced in combustion:

role of sacrificial barriers if appropriate to the example used.

- Describe experiments and interpret results to show that both air and water are necessary for rusting.
- Recall a use of each of the alloys specified
- Interpret and evaluate the composition and uses of alloys other than those specified, given appropriate information.
- Define the terms:

- alloy
- high carbon steel
- low carbon steel.
  - Explain how low density and high density poly(ethene) are both produced from ethene.
  - Explain the difference between thermosoftening and thermosetting polymers in terms of their structures.
  - Compare quantitatively the physical properties of glass and clay ceramics, polymers, composites and metals.
  - Recall a source for the nitrogen and a source for the hydrogen used in the Haber process.
  - State where the raw materials in the Haber process come from.
  - Describe the process for manufacturing ammonia.
  - Recall the names of the salts produced when phosphate rock is treated with nitric acid, sulfuric acid and phosphoric acid
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  - Compare the industrial production of fertilisers with laboratory preparations of the same compounds, given appropriate information.

Procedural Knowledge:

- Extract and interpret information about resources from charts, graphs and tables.
- Use orders of magnitude to evaluate the significance of data.
- Evaluate the impacts and benefits of biological methods of extracting meta
- Research information for the processes of:

- phytomining
- bioleaching.
  - Include percentage of metal extracted, concentration of global warming gases released, amount of electricity used etc.

Use this data in an evaluation.

- Use information to interpret the LCA of a given material or product.
- Explain sacrificial protection in terms of relative reactivity.
- Using diagrams, describe the difference between metals and their alloys
- Research the first alloy to include the history of it and its uses.
- Model an alloy using different size marbles. Use this model to discuss the properties of alloys.
- Describe how the following are produced and give uses for each:

- soda-lime glass
- borosilicate glass
- clay ceramics
- low-density poly(ethene)
- high density poly(ethene)
- composites.
  - Using diagrams, describe the structure of the following polymers:

- thermosoftening
- thermosetting.

Upper Hierarchical Knowledge

- Make predictions of the boiling points of other alkanes.
- Suggest the impact on fuels, feedstocks and petrochemicals of the depleting stocks of crude oil.
- Explain the properties of hydrocarbons in relation to intermolecular forces.
- Write balanced symbol equations for the combustion of hydrocarbon fuels.
- Describe the balanced symbol equation including moles present, long alkane reactant, specific reaction conditions, and alkene and short alkane products.
- Draw the covalent bonding in:

● ethene
● propene
● butene
● pentene.

- Explain why carboxylic acids are weak acids in terms of ionisation and pH.

Draw the covalent bonding in:

● methanoic acid
● ethanoic acids
● propanoic acid
● butanoic acid.

Describe what happens to one of the first four acids during the reactions:

● dissolving in water to produce acidic solutions
● reacting with carbonates to produce carbon dioxide
● not ionising completely when dissolved in water (they are weak acids)
● reacting with alcohols in the presence of an acid catalyst to produce esters, for example ethanoic acid reacts with ethanol to produce ethyl ethanoate and water.

- Describe what takes place during condensation polymerisation.
- Identify monomers, polymers and repeating units.
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- Describe the polymerisation of ethane-1,2-diol and hexanedioic acid.

Working Scientifically

- Investigate the properties of different hydrocarbons in terms of boiling point, viscosity and flammability with increasing molecular size.
- Identify the products of combustion of alkanes.
- Demo or practical: crack paraffin over porous clay pot.
- Use bromine water to identify alkenes.
- Test for unsaturation in other compounds.
- Research uses of the first four carboxylic acids.
- Research some of the uses of esters and try to work out the alcohols and carboxylic acids used to make them.
- Opportunities within investigation of the reactions of carboxylic acids.
- Use models to represent condensation polymerisation.
- Research common polyesters and their uses.
- Research common amino acids and polypeptides, and polypeptide uses
- Research the history of the discovery of DNA as a polymer chain.

test tube reactions and flame tests.

- Interpret an instrumental result given appropriate data in chart or tabular form, when accompanied by a reference set in the same form.
- Use of chemical tests to identify the ions in unknown single ionic compounds.

● carbon dioxide
● carbon monoxide
● soot
● water vapour
● sulfur dioxide
● oxides of nitrogen.

Working Scientifically

- Show that aquatic plants (eg Elodea) produce oxygen in daylight.
- Use the internet to obtain data for concentrations of greenhouse gases.
- Evaluate the reliability of the data available on the internet.
- Research the process of peer review in reporting results/data.
- Use data to calculate your own carbon footprint over a period/holiday. Suggest the effects on Earth and atmosphere of the calculated carbon footprint.
- Use shells and acid to show how pollution can cause shells to corrode.

- Use these diagrams and descriptions to explain why the following happens when heated:

● thermosoftening polymers melt
● thermosetting polymers do not melt.

- Extended writing: compare how fertilisers are produced in industry and in the laboratory.
- Investigate what was used as fertilizer before the industrial preparation of fertilisers was invented.
-

Upper Hierarchical Knowledge

- Explain the differences between the two terms using suitable examples.
- Explain the differences between the two terms.
- Extended writing: describe the process of desalination.
- Extended writing: describe the process of distillation
- Extended writing: explain why distillation separates substances.
- Explain what happens to substances during the process of distillation in terms of intermolecular forces of attraction.
- Extended writing: describe the processes of

● phytomining
● bioleaching.

- Evaluate ways of reducing the use of limited resources, given appropriate information.
- Extended writing: describe the environmental impacts of obtaining raw materials from the Earth.
- Describe how to prevent corrosion using the examples:

● oxide coating on aluminium
● zinc on iron
● magnesium on steel.

- Use suitable examples to explain why corrosion can be prevented using barriers and the role of sacrificial barriers if appropriate to the example used.
- State properties of examples of alloys. Explain, in relation to the structure, why these alloys have these properties.

Research the physical properties of:

● soda-lime glass
● borosilicate glass
● clay ceramics
● low-density poly(ethene)
● high density poly(ethene)
● composites

Use these properties to explain how the materials are related to their use.
Compare the properties of thermosetting and thermosoftening polymers.

- Using diagrams, describe the structure of the following polymers:

● thermosoftening
● thermosetting.

- Use these diagrams and descriptions to explain why the following happens when heated:

● thermosoftening polymers melt
● thermosetting polymers do not melt.

- (HT only) Interpret graphs of reaction conditions versus rate.
- (HT only) Apply the principles of dynamic equilibrium to the Haber process.
- (HT only) Explain the trade-off between rate of production and position of equilibrium.
- (HT only) Explain how the commercially used conditions for the Haber process are related to the availability and cost of raw materials and energy

● Research naturally occurring polymers and their uses			supplies, control of equilibrium position and rate. ● Write a balanced symbol equation for the manufacture of ammonia. Use this to describe the reaction in terms of reactants, products, conditions and number of moles. ● Recall the following topics: ● dynamic equilibrium ● temperature affecting the rate of a reaction ● pressure. ● Explain how each of these affects the Haber process reaction. ● Discuss the effect of the following conditions on the reaction: ● a high temperature ● a low temperature ● a high pressure ● a low pressure ● use of a catalyst ● no catalyst. ● Discuss the pros and cons of these varying conditions. ● Explain the trade-off between the rate of the reaction and the position of the equilibrium. ● Explain how the conditions used in industry affect the equilibrium position, rate and costs of the reaction. **<u>Working Scientifically</u>** ● Research examples of natural products that are supplemented or replaced by agricultural and synthetic products. ● Analysis and purification of water samples from different sources, including pH, dissolved solids and distillation. ● Research how water is treated. ● Model phytomining in the laboratory by watering geraniums with dilute copper sulphate for a period of time. The leaves can be burnt and copper can be extracted from the ash by rinsing in dilute hydrochloric acid and electrolysing the solution. ● Use the internet to carry out simple comparative LCAs for shopping bags made from plastic and paper. ● Use the internet to carry out simple comparative LCAs for shopping bags made from plastic and paper. ● Research methods of producing/obtaining metal/glass/building materials/clay ceramics/plastics. Identify in these methods the limited resources that are used to generate the energy. ● Research how glass is recycled. ● Research how metal is recycled and alternatives for use of scrap metals ie in obtaining iron in a blast furnace. ● Investigate the conditions for rusting of iron nails in test tubes. ● Research the physical properties of: ● soda-lime glass ● borosilicate glass ● clay ceramics ● low-density poly(ethene) ● high density poly(ethene) ● composites ● Research the availability and cost of the raw materials and energy supplies in the Haber process. Explain how these relate to the conditions used for the Haber process in industry.

			• Research compositions of NPK and their uses. • Research how fertilisers can be prepared: • industrially • in a laboratory.

Year 11 Physics Essential Knowledge Summary		
Schemate 1: P5 Forces	**Schemata 2: P7 Magnets & Electromagnets**	**Schemate 3: P8 Space (triple only)**
Composite Knowledge: Pupils will learn the difference between, and examples of, vector and scalar quantities. Pupils will learn about forces: examples of contact and non-contact force &, how to represent them. Pupils will learn about Newton's laws of motion, how to interpret motion graphs and how to calculate unknown quantities and manipulate the equation of motion. Pupils understand the concept of momentum and the principle of conservation of momentum. They will apply the conservation of energy to moments, levers & gears. Pupils will experimentally prove Hooke's law and understand elastic and inelastic deformation. **Component Knowledge:** **Foundational Knowledge:** Declarative Knowledge: • State the units of: weight, mass, gravitational field strength, work done, distance, spring constant, extension, moment, pressure, area, speed, acceleration, velocity, momentum, • Define scalar and vector • Give examples of scalar and vector quantities • Draw arrows to scale to represent a vector quantity • Define a contact and non-contact force • Give examples of contact and non-contact forces • State the difference between weight and mass • Recall the equation that links: weight, mass and gravity • Define centre of mass • Define resultant force • Recall the equation that links: work done, force, and distance • Know that work done is equivalent to the energy transferred • Describe the difference between elastic and inelastic deformation • Describe how to stretch, compress or bend an object • Recall the equation that links: force, spring constant, and extension. • Describe the difference between linear and non-linear relationships • Know what is meant by the term moment (triple only) • Give examples of simple levers (triple only) • Know what is meant by a fluid (triple only) • Define pressure (triple only) • Describe how the density of a fluid changes with height (triple only) • Describe how pressure of the atmosphere changes with altitude (triple only) • Describe what is meant by upthrust (triple only) • Describe why some objects float and others sink (triple only) • Define displacement • Define velocity • Know the typical speed for: walking, running, cycling, sound in air • Recall the equation that links: distance travelled, speed, and time. • Recognise how the gradient of a of a d-t graph describes motion • Recall the equation that links: acceleration, change in velocity, and time. • Recognise how the gradient of a of a v-t graph describes motion • State what happens to an object if the resultant force is zero • State what is meant by inertia (higher tier)	**Composite Knowledge:** Pupils will understand how we represent magnetic fields and the properties of magnetic fields. They will be able to define and differentiate between permanent magnets, magnetic materials and electromagnets. Pupils will learn about how electromagnets are made and controlled. They will learn about the motor effect and generator effects and their applications. Pupils will be able to make predictions about the properties of motors and generators. **Component Knowledge:** **Foundational Knowledge:** Declarative Knowledge: • State where the magnetic forces are strongest relative to a magnet • Know how magnets behave • Know the difference between permanent magnets, magnetic materials and electromagnets • Know what is meant by the term 'magnetic field' • State which materials are magnetic • Sketch the diagram of the magnetic field around: a bar magnet, the Earth, a straight wire and a solenoid. • Describe how to plot the magnetic field using a magnet and compass • State that a current carrying wire produces a magnetic field around it. • Describe how to increase the strength of an electromagnet • Recall the corkscrew rule Procedural Knowledge: • Describe how to plot the magnetic field using a magnet and compass • Use an equation to find an unknown variable • Write methods for experiments. • Accurately plot axes & graphs • Draw lines of best fit and use them to find tangents and gradients. **Upper Hierarchical Knowledge** • Interpret diagrams of electromagnetic devices • Define the motor effect • Recall Fleming's left-hand rule and be able to identify either the direction of the force, the current flow or the magnetic field. • Use and manipulate the equations • Recall the units of magnetic flux density • Describe how a simple electric motor works and how to change the speed or direction of rotation • Describe how loudspeakers / headphones can use the motor effect to create sound waves • Understand and describe the generator effect • Understand that an induced current produces a magnetic field that opposes the change • Recall the factors that affect the size or direction of an induced potential difference or current • Apply the principles of the generator effect in other contexts • Explain how an alternator and dynamo works • Draw and interpret potential difference graphs produced by an alternator or dynamo • Explain how a microphone works	**Composite Knowledge:** Pupils will learn about the formation and composition of the Solar System, they will learn about the movement of objects in the Solar System. Pupils will be able to describe and explain the formation and life cycle of stars. They will be able to understand the formation and potential future of the Universe and why there is doubt about this. **Component Knowledge:** **Foundational Knowledge:** Declarative Knowledge: • Name the celestial objects found in the Solar System • Describe how the Sun and planets in our SOlar System formed • Describe and explain the life cycle of stars • Know that gravity is the force that maintains the motion of celestial objects • Describe red-shift and understand how this provides evidence of the Big Bang • Explain the evidence for the Big Bang • State what is meant by 'dark energy' and 'dark matter' Procedural Knowledge: **Upper Hierarchical Knowledge** • Explain circular motion **Working Scientifically** Big Bang theory • WS 1.2 Use a variety of models such as representational, spatial, descriptive, computational and mathematical to solve problems, make predictions and to develop scientific explanations and understanding of familiar and unfamiliar facts. ○ Use models in explanations, or match features of a model to the data from experiments or observations that the model describes or explains. ○ Give examples of ways in which a model can be tested by observation or experiment.

- Recall the equation that links: force, mass, and acceleration.
- State Newton's 2nd law
- State Newton's 3rd law
- Recall the equation for stopping distance
- Recall and describe factors that affect thinking distance
- Recall and describe factors that affect braking distance
- Recall typical reaction times
- Recall the equation that links: momentum, mass, and velocity (higher tier).
- State the law of conservation of momentum (high tier)
- Recall the equation that links: force, change in momentum, and time (higher tier & triple-only)

Procedural Knowledge:

- Use an equation to find an unknown variable
- Draw scale diagrams
- Calculate the resultant of parallel forces
- Calculate the extension of a linear object
- Use primary data and a graph to calculate the spring constant
- Calculate the resultant of non-parallel forces (higher tier only)
- Write methods for experiments
- Resolve a force into two perpendicular components (higher tier only)
- Draw free body diagrams

Upper Hierarchical Knowledge

- Manipulate equations to find unknown variables
- Draw scale diagrams to find the resultant of non-parallel forces
- Draw scale diagrams to resolve a force into two perpendicular components
- Describe and explain the effect on motion for changing forces on an object
- Describe and explain how an object reaches a terminal velocity
- Using primary or secondary data to find the spring constant of an elastic object
- Use primary or secondary data to show the relationship in Newton's 2nd law
- Apply the law of moments
- Explain the causes of pressure and changes in pressure
- Interpet d-t & v-t graphs to find speed, acceleration & distance travelled for both linear and non-linear relationships.
- Apply the law of conservation of momentum

Working Scientifically

Moments practical

- WS 3.3 Carrying out and represent mathematical and statistical analysis.
    - change the subject of an equation substitute numerical values into algebraic
    - equations using appropriate

Hooke's law (RP 6)

- WS 3.3 Carrying out and represent mathematical and statistical analysis.
    - determine the slope and intercept of a linear graph

Centre of mass of an irregular 2D shape

- WS 2.2 Plan experiments or devise procedures to make observations, produce or characterise a substance, test hypotheses, check data or explore phenomena.
    - Describe a practical procedure for a specified purpose.

Newton's 2nd law (RP7)

- WS 2.2 Plan experiments or devise procedures to make observations, produce or characterise a substance, test hypotheses, check data or explore phenomena.
    - Identify in a given context:
      • the independent variable as the one that is changed or selected by the investigator

- Describe and explain the structure of a transformer
- Explain how a transformer works

Working Scientifically

Demo shape of magnetic fields (bar magnet, straight wire, solenoid)

- WS 1.2 Use a variety of models such as representational, spatial, descriptive, computational and mathematical to solve problems, make predictions and to develop scientific explanations and understanding of familiar and unfamiliar facts.
    - Recognise/draw/interpret diagrams.

Investigate electromagnet strength

- WS 2.2 Plan experiments or devise procedures to make observations, produce or characterise a substance, test hypotheses, check data or explore phenomena.
    - Identify in a given context:
        - the independent variable as the one that is changed or selected by the investigator
        - the dependent variable that is measured for each change in the independent variable
        - control variables and be able to explain why they are kept the same.

Demo motor effect and generator effect

- WS 1.4 Explain everyday and technological applications of science; evaluate associated personal, social, economic and environmental implications; and make decisions based on the evaluation of evidence and arguments.
    - Describe and explain specified examples of the technological applications of science.

• the dependent variable that is measured for each change in the independent variable • control variables and be able to explain why they are kept the same.		

Year 11 (physics) Final Composite Knowledge End Point

- Learn about longitudinal and transverse, mechanical and electromagnetic waves.
- Learn about the electromagnetic spectrum, the different waves and their uses and dangers.
- All pupils will learn about reflection and refraction, in triple science they will learn about wave fronts and how we use lenses to form images.
- In triple science pupils will learn about sound waves and seismic waves.
- Draw and describe the shape of magnetic fields caused by permanent and temporary magnets.
- Explain how electromagnets are made and controlled.
- In triple science they will be able to define both the motor effect and generator effect. They will be able to describe how to use the motor and generator effects in different contexts.
- Space physics is only learnt by triple science pupils, they will describe the contents of our Solar System and how it was formed.
- Describe and explain the life cycle of a star similar to and much more massive than our Sun.
- They will learn how the Universe formed and explain the evidence for this.
- Pupils will able learn about what we know we don't know about the Universe and areas of current research.