Year 7: Curriculum Intent

The intent of the Year 7 curriculum is to build on knowledge acquired in Key Stage 2 and introduce pupils to the different areas of science at the Kingsway school:

- in Biology - Cells and Systems, Plants and the Environment, and Variation and Inheritance.
- in Chemistry - Particles and Matter, Chemical reactions, and Earth and Atmosphere.
- in Physics - Forces and Motion, Energy, and Waves.
- 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 7 Physics Essential Knowledge Summary

Schemata 1: Forces & Motion

Composite Knowledge: Pupils will gain fundamental knowledge about forces and forces affect motion. They will be able to use graphs to analyse motion and calculate speed.

Component Knowledge:

Foundational Knowledge:

Declarative Knowledge:

- What does a force cause
- State the difference between mass and weight.
- Examples of contact forces.
- Example of non-contact forces.
- The equation for speed.

Procedural Knowledge:

- Calculate the resultant force on an object
- Calculate speed.
- Calculate weight.
- Draw free body diagrams.
- Describe the motion from free body diagrams.
- Interpret distance/time graphs.

Upper Hierarchical Knowledge

- Analyse motion using a graph.
- Manipulate the equation linking speed, distance, and time.

Working Scientifically

Friction / drag experiment:

- **WSSK 1** develop a line of enquiry based on observations of the real world, and make predictions based on their prior knowledge and scientific understanding

Distance/time graphs:

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

Schemata 2: Energy

Composite Knowledge: Pupils will gain a fundamental understanding of energy stores and transfers and how energy is transferred by heating.

Component Knowledge:

Foundational Knowledge:

Declarative Knowledge:

- Name and describe energy stores.
- Name and describe energy transfers.
- Define conduction.
- Define convection.
- Define thermal radiation.
- State the law of conservation of energy.

Procedural Knowledge:

- Describe changes to energy stores.
- Describe how to increase or decrease the transfer of energy by heating.

Upper Hierarchical Knowledge

- Explain how an object reaches thermal equilibrium.
- Explain energy transfers.

Working Scientifically

Energy in food experiment:

- **WSSK 3** select appropriate apparatus and techniques based on accuracy and precision for an investigation within the laboratory

Conduction (demo – metal rod):

- **WSAN 3** relate results to predictions and hypotheses, giving reasoned explanations, and identify further questions from their results

Convection (demo – convection current):

- **WSAN 3** relate results to predictions and hypotheses, giving reasoned explanations, and identify further questions from their results

Radiation / colour:

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

Schemata 3: Waves

Composite Knowledge: Pupils will gain fundamental knowledge on the different types of waves; how sound waves travel and how sound waves interact with matter.

Component Knowledge:

Foundational Knowledge:

Declarative Knowledge:

- Name the types of waves.
- State how sound travels.
- State the human range of hearing.
- Define ultrasound.
- State uses of ultrasound.

Procedural Knowledge:

- Compare types of waves.
- Use the terms pitch and volume to describe sounds.
- Interpret oscilloscope traces.

Upper Hierarchical Knowledge

- Link the properties of a wave to frequency, wavelength and amplitude.

Working Scientifically

Human range of hearing:

- **WSAN 4** evaluate the reliability of methods and data, suggesting possible improvements for the method to minimize sources of random and systematic error

Year 7 (physics) Final Composite Knowledge End Point

- Describe and give examples of forces and state how forces affect motion.
- Analyse motion graphs and discuss the forces involved and they affect motion.
- Calculate speed, distance or time using the relevant equation.
- Name and give examples of energy stores & transfers and describe simple energy transfers.
- Describe how energy is transferred by heating.
- Name and give examples of different types of waves.
- Describe how sound waves travel and how they interact with matter.

Year 8: Curriculum Intent

The intent of the Year 8 curriculum is to build on knowledge acquired in Year 7 and both broaden and deepen pupil knowledge in the different areas of science at the Kingsway school:

- in Biology - Cells and Systems, Plants and the Environment, and Variation and Inheritance.
- in Chemistry - Particles and Matter, Chemical reactions, and Earth and Atmosphere.
- in Physics - Forces and Motion, Energy, and Waves.
- 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 8 Physics Essential Knowledge Summary

Schemata 1: Energy

Composite Knowledge: Pupils learn the fundamental parts of electricity (current, potential difference, resistance) and how they work together to produce energy changes.

Component Knowledge:

Foundational Knowledge:

Declarative Knowledge:

- Name / draw circuit symbols.
- Define current and state how to measure it.
- Define potential difference and state how to measure it.
- State the difference between series and parallel circuits.

Procedural Knowledge:

- Measure current and potential difference.
- Calculate resistance.
- Predict the current in a circuit.
- Predict the potential difference in a circuit

Upper Hierarchical Knowledge

- Use series and parallel circuit diagrams to predict current and potential difference.

Working Scientifically

Building circuits:

- **WSAN 1** make and record observations and measurements and present data using appropriate methods including tables with repeat measurements.
- Investigating resistance of a wire

Schemata 2: Forces & Motion

Composite Knowledge: Pupils will learn how magnets work and how they are used. Pupils will apply knowledge of particle theory to explain pressure and changes in density. Pupils will be able to calculate pressure and density using both primary and secondary data.

Component Knowledge:

Foundational Knowledge:

Declarative Knowledge:

- Draw magnetic fields.
- Identify magnetic materials.
- State useful features of an electromagnet.
- Define pressure.
- Describe the motion of particles in solids, liquids, and gases.
- State the equation for density.

Procedural Knowledge:

- Describe how to change the strength of an electromagnet.
- Describe how magnets and magnetic materials interact.
- Calculate pressure.
- Describe how the motion and energy of particles changes during changes of state.
- Compare the density of different materials.

Upper Hierarchical Knowledge

- Link the features of an electromagnet to its properties.

Working Scientifically

Shape of magnetic field:

- **WSSK 3** select appropriate apparatus and techniques based on accuracy and precision for an investigation within the laboratory

Strength of an electromagnet:

- **WSSK 2** identify independent, dependent and control variables and use these to plan and carry out a range of investigations to test a prediction, considering repeatability and reproducibility within their plan

Calculate pressure:

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

Measuring density:

- **WSSK 3** select appropriate apparatus and techniques based on accuracy and precision for an investigation within the laboratory

Schemata 3: Waves

Composite Knowledge: Pupils will learn how light waves travel and how light waves interact with matter.

Component Knowledge:

Foundational Knowledge:

Declarative Knowledge:

- Label a ray diagram.
- Measure angles with a protractor.
- State the law of reflection.
- Define the terms: ‘transparent’, ‘translucent’ & ‘opaque’.
- State the seven colours of the visible spectrum.
- State the three primary colours of light.
- State the three secondary colours of light.

Procedural Knowledge:

- Draw ray diagrams to show reflection and refraction.
- Use ray diagrams to show how images are formed.
- Explain why objects appear a particular colour in white light, in coloured light or when using a filter.

Upper Hierarchical Knowledge

- Gain knowledge of refraction to predict how lenses affect light.

Working Scientifically

Reflection & refraction:

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

Year 8 (physics) Final Composite Knowledge End Point

- Use measurements of current and potential difference to find the resistance of a component.
- Explain how the shape of the magnetic field affects forces of attraction or repulsion.
- Describe how magnetic fields interact.
- Link features of an electromagnet to its properties.
- Use knowledge of the arrangement and motion of particles in states of matter and during changes of state to properties of the material including density and pressure.
- Use measurements to find the density of an object.
- Use measurements to find the pressure exerted by an object.
- Predict the current in series and parallel circuits
- Predict the potential difference in series and parallel circuits.
- Explain refraction and predict how lenses affect light using knowledge of refraction.
- Explain the appearance of objects in different coloured light.

Year 9: Curriculum Intent

The intent of the Year 9 curriculum is to build on knowledge acquired in both Year 7 and Year 8 and prepare pupils for the final steps before undertaking GCSE science. They will increase the depth and breadth of their knowledge and build strong links in learning to consolidate prior learning and secure the foundations for GCSE science. Pupils will continue to study the different areas of science:

- in Biology - Variation and Inheritance.
- in Chemistry - Chemical reactions.
- in Physics - Forces and Motion and Energy.
- 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 9 Physics Essential Knowledge Summary

Schemata 1: Energy

Composite Knowledge: Pupils will be able to describe the pros and cons of a variety of energy resources.

Component Knowledge:

Foundational Knowledge:

Declarative Knowledge:

- Can name the eleven different energy resources used to generate electricity.
- Can simply describe how the energy resources can be used to provide electricity.
- Can state pros and cons of each energy resource.

Procedural Knowledge:

- How to write an evaluation of energy resources.

Upper Hierarchical Knowledge

- Compare different energy resources.
- Evaluate the use of energy resources in different contexts.

Working Scientifically

Solar panels:

- **WSSK 2** identify independent, dependent and control variables and use these to plan and carry out a range of investigations to test a prediction, considering repeatability and reproducibility within their plan

Wind turbines::

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

Schemata 2: Forces & Motion

Composite Knowledge: Pupils will gain knowledge on the links between energy and forces. Pupils will understand how forces can cause rotation motion or extension of an object.

Component Knowledge:

Foundational Knowledge:

Declarative Knowledge:

- State the equation that links: force, distance and work done,
- Define the term centre of mass.
- Find the centre of mass of a regularly shaped 2D object.
- Define the term moment.
- State how a force affects the extension of a spring.

Procedural Knowledge:

- Calculate the extension of a spring after a force is applied.
- Describe how to find the centre of mass of an irregularly shaped 2D object.
- Estimate and explain the location of mass in a 3D object.
- Use primary data to find the link between force applied and extension.

Upper Hierarchical Knowledge

- Apply the principle of conservation of energy to work done.
- Manipulate equations.

Working Scientifically

Moments:

- **WSSK 1** develop a line of enquiry based on observations of the real world, and make predictions based on their prior knowledge and scientific understanding

Hooke's law:

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

Schemate 3: P1 Energy

Composite Knowledge: Pupils will understand the different forms of energy and how energy can be transferred between them. They will be able to give examples of energy transfers.

Pupils will gain knowledge of both renewable and non-renewable energy resources and understand their advantages and disadvantages. They will be able to evaluate the use of different energy resources and understand the trends in usage of various energy resources.

Pupils will gain knowledge of the concept of efficiency. They will be able to describe the methods of heat transfer and explain how energy losses can be reduced in buildings. Pupils will be able to calculate changes in multiple energy stores.

Component Knowledge:

Foundational Knowledge:

Declarative Knowledge:

- Name the 5 energy stores
- Name the 4 energy pathways / transfers
- Recall the kinetic energy equation
- Recall the units for energy, mass, velocity, spring constant, extension, height, specific heat capacity, temperature, power, & time.
- Recall the equation for gravitational potential
- Define specific heat capacity
- Recall the equation P=E/t
- Define power
- State that work done = energy transferred
- Recall the law of conservation of energy
- Define closed system
- State how energy can be dissipated
- State how unwanted energy transfers can be reduced
- Define thermal conductivity
- Recall the equations for efficiency
- Name the main energy resources available to use on Earth
- Define renewable resource
- State the uses of energy resources
- Recognise the main energy source available in a given situation
- Name renewable and non-renewable energy resources
- State the environmental impacts of energy resources

Procedural Knowledge:

- Use an equation to find an unknown variable
- Apply the principle of conservation of energy to qualitative descriptions of energy transfers
- Write methods for experiments.
- Accurately plot axes & graphs
- Draw lines of best fit and use them to find tangents and gradients.
- Describe how to experimentally find the specific heat capacity of a substance (RP1)

Upper Hierarchical Knowledge

- Describe how to experimentally find the specific heat capacity of a substance (RP1)
- Describe an experiment to investigate the effectiveness of thermal insulators (RP2)
- Manipulate and use the equations for:
  - kinetic energy
  - elastic potential energy
  - gravitational potential energy
  - specific heat capacity
  - power
  - efficiency

		● Compare and evaluate different energy resources **<u>Working Scientifically</u>** Bungee jump ● WS 2.6 Make and record observations and measurements using a range of apparatus and methods. ○ Read measurements off a scale in a practical context and record appropriately. Specific Heat Capacity (w. joule metres) (RP1) ● WS 3.3 Carrying out and represent mathematical and statistical analysis. ○ use an appropriate number of significant figures ○ change the subject of an equation substitute numerical values into algebraic ○ equations using appropriate units for physical quantities ○ determine the slope and intercept of a linear graph Insulation (RP2) ● 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. ○ 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. Investigating the absorption & radiation of infrared radiation (RP 10) ● WS 3.5 Interpreting observations and other data (presented in verbal, diagrammatic, graphical, symbolic or numerical form), including identifying patterns and trends, making inferences and drawing conclusions. ○ Use data to make predictions. ○ Recognise or describe patterns and trends in data presented in a variety of tabular, graphical and other forms. ○ Draw conclusions from given observations.
<u>Year 9 (physics) Final Composite Knowledge End Point</u>		
KS3 (Term 1) ● Discuss the advantages and disadvantages of the energy resources we use to generate electricity. ● Understand how force and energy are linked. ● Describe how to find the centre of mass of various objects. ● Calculate moment, force or distance using the appropriate equation. ● Calculate force, work done or distance using the appropriate equation. **KS4 (Term 2 & 3)** ● Understand the different forms of energy and how energy can be transferred between them. ● Give examples of energy transfers. ● Knowledge of both renewable and non-renewable energy resources and understand their advantages and disadvantages. ● Evaluate the use of different energy resources and understand the trends in usage of various energy resources. ● Knowledge of the concept of efficiency. ● Describe the methods of heat transfer and explain how energy losses can be reduced in buildings. ● Calculate changes in multiple energy stores.		

Year 10: Curriculum Intent

The intent of the Year 10 curriculum is to build on knowledge acquired in Key Stage 3 and prepare pupils for their GCSEs in science. 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 - Organisation, Infection & Response and Ecology..
- in Chemistry - Chemical Bonding & Structures, Quantitative Chemistry, Chemical Change and Energy Changes.
- in Physics - Particle Model of Matter, Atomic Structure & Radioactivity, Electricity and Forces.
- 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 10 Physics Essential Knowledge Summary

Schemata 1: P3 Particle Model of Matter

Composite Knowledge: Pupils will be able to discuss the changes to particle arrangement, movement, energy and force in relation to states of matter and changes of state.
Pupils will be able to calculate density with both their primary data and secondary data.
Pupils will learn how changes to the internal energy of a substance affect the substance.
Pupils will be able to define and distinguish between specific heat capacity and latent heat.
Pupils will learn about Boyle's law and (Triple only) Charles's Law.

Component Knowledge:

Foundational Knowledge:

Declarative Knowledge:

- Recall the equation that links: density, mass, and volume
- Recall the units for density, mass, volume, energy changes, specific heat capacity, temperature change, latent heat, pressure
- Recall the three states of matter
- Draw simple diagram to represent the three state of matter
- Describe the particle arrangement and particle movement in each state of matter
- Describe how density changes when changing state
- State the law of conservation of mass in relation to changing state
- Name the changes of state
- Describe how the forces between particles and energy of particle changes during changes of state
- Define internal energy
- Apply the equation for specific heat capacity
- Define specific heat capacity
- Define latent heat, latent heat of fusion, and latent heat of vaporisation
- Apply the latent heat equation
- State how particles in a gas move
- Relate the temperature, pressure and volume of a gas
- Apply the equation for gas pV=const (Triple only)
- State how work done on a gas affects pressure / temperature (Triple only)

Procedural Knowledge:

- 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

- Describe how to experimentally find the density of a regular solid, irregular solid, and a liquid (RP5)

Schemata 2: P4 Atomic Structure

Composite Knowledge: Understand and describe the structure of the atom and use evidence to explain how this has changed over time. Understand the concept of the random nature of radioactive decay and the properties of the different types of nuclear radiation. Understand how the penetrating power and ionising ability differentiates the different types of nuclear radiation. Describe the applications and hazards of nuclear radiation. Complete, interpret and balance decay equations. Understand the concept and application of half-life.
(Triple only) Understand and compare the processes of nuclear fission and nuclear fusion. Understand the effect of nuclear radiation on living things and how we take precaution to make ourselves and the environment safe. Understand the difference between contamination and irradiation.

Component Knowledge:

Foundational Knowledge:

Declarative Knowledge:

- State the approximate radius of an atom
- State the approximate size of the nucleus compared to the size of an atom
- Name the three subatomic particles
- State the relative charge and relative mass of the three subatomic particles
- Simply describe the location of the three subatomic particles.
- State what is meant by mass number and atomic number
- Define isotope
- Name historic models of the atoms in chronological order
- Describe different models of the atom
- State the evidence used for changing between atomic models.
- Name the three types of nuclear radiation.
- State what the different types of nuclear decay are made of.
- Name the unit for radioactivity
- Define count-rate and activity
- Know that radioactive decay is random
- State the penetrating power & ionising power of the different types of nuclear decay
- Name the equipment used to detect radioactive decay
- Give uses of nuclear radiation
- Complete decay equation
- State what happens in the nucleus of an atom that undergoes radioactive decay
- Define half-life
- Define radioactive contamination

Schemate 3: P2 Electricity

Composite Knowledge: Pupils will learn about the relationship between current, potential difference, and resistance.
They will learn about circuit components, how to interpret circuit diagrams and how to apply the rules for current, potential difference, and resistance in both series and parallel circuits. Pupils will investigate resistance in various components and circuits.
They will practise and become confident in using and manipulating many equations.
Pupils will learn about our domestic supply, how it is transferred and how we keep ourselves safe when using it.

Component Knowledge:

Foundational Knowledge:

Declarative Knowledge:

- Recall the units for: current, charge, time, resistance, potential difference, power
- Name and draw circuit symbols
- Define electrical current
- Recall the equation that links: charge, current and time
- State Ohm's law
- Recall the Ohm's law equation
- Recognise the V-I graph for a fixed value resistor, filament lamp, diode, thermistor & LDR.
- State how the resistance of thermistors and LDRs change with change in the environment
- State the difference between a series and parallel circuit
- State the rules for current, potential difference and resistance in both series and parallel circuits.
- State the frequency and potential of the UK domestic supply
- State what is meant by both direct and alternating potential differences.
- State the colour of the insulation in a three pin plug
- State the names of the pins in a three pin plug
- State the role of each wire / component in a three pin plug.
- State the expected potential difference between the live and neutral wires in a three pin plug.
- Recall the equation that links: power, current, and potential difference
- Recall the equation that links: power, current, and resistance
- Recall the equation that links: power, energy, and time
- Recall the equation that links: charge, energy, and potential difference
- State the components of the National Grid

Schemate 4: P5 Forces

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 to experimentally find the specific heat capacity of a substance (RP1)
- Manipulate and use the equations for:
  - Density
  - Specific heat capacity
  - Latent heat
- Explain how adding or removing heat from a substance changes the arrangement and movement of particles and the density of the substance.
- Use the concepts of specific heat capacity and latent heat to interpret heating and cooling curves
- Explain the relationship between gas pressure and volume
- Explain the relationship work on a gas and temperature

Working Scientifically

Density (RP5)

- 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.
- Describe a practical procedure for a specified purpose.
  - Assess whether sufficient, precise measurements have been taken in an experiment.

Specific Heat Capacity (w. joule metres) (RP1)

- WS 3.3 Carrying out and represent mathematical and statistical analysis.
  - use an appropriate number of significant figures
  - change the subject of an equation substitute numerical values into algebraic
  - equations using appropriate units for physical quantities
  - determine the slope and intercept of a linear graph

Air pressure / can crush demo

- WS 3.5 Interpreting observations, making inferences and drawing conclusions.
  - Draw conclusions from given observations.

Boyle's law demo

- WS 3.1 Presenting observations and other data using appropriate methods.
  - Plot two variables from experimental or other data.

Charles's Law / Hyman Fire Piston demo

- WS 3.5 Interpreting observations, making inferences and drawing conclusions.
  - Draw conclusions from given observations.

- Define irradiation
- Describe the precautions taken to stay safe in the presence of nuclear radiation
- Define background radiation (triple only)
- Give examples of background radiation (triple only)
- Define nuclear fission (triple only)
- Draw a diagram to represent a nuclear fission chain reaction (triple only)
- State the role of control rods in a chain reaction (triple only)
- Define nuclear fusion

Procedural Knowledge:

- Use mass number and atomic number to state the number of subatomic particles in an atom.
- Complete decay equations
- Determine the half-life of a radioactive source
- Calculate net decline as a ratio (higher tier only)

Upper Hierarchical Knowledge

- Describe how the absorption or emission of EM radiation affects electrons.
- Explain, in depth, the changes to the atomic model.

Working Scientifically

Radioactive source demo

- WS 3.5 Interpreting observations and other data (presented in verbal, diagrammatic, graphical, symbolic or numerical form), including identifying patterns and trends, making inferences and drawing conclusions.
  - Draw conclusions from given observations.

None practical based:

Atomic structure / atoms

- 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.

History of the atom

- WS 1.1 Understand how scientific methods and theories develop over time.
  - Give examples to show how scientific methods and theories have changed over time.
  - Explain, with an example, why new data from experiments or observations led to changes in models or theories.
-

- State how step-up and step-down transformers affect potential difference and current.
- State that objects become charged because of the transfer of electrons (Triple only)
- State that electrons have a negative electrical charge (Triple only)
- Know that like charges repel and unlike charges attract (triple only)

Procedural Knowledge:

- 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

- Describe how to experimentally find the resistance of an electrical component (RP3/4)
- Compare the resistance of electrical components and explain how this changes as potential difference and/or the environment changes
- Manipulate and use the equations for:
  - charge
  - Ohm's law
  - Potential difference
  - Power
  - Energy
  - Resistance
- Compare and evaluate different energy resources

Working Scientifically

Ohm's Law

- WS 3.2 Translating data from one form to another.
  - Translate data between graphical and numeric form.

Resistance of a wire (RP3)

- WS 3.3 Carrying out and represent mathematical and statistical analysis.
  - use an appropriate number of significant figures
  - find the arithmetic mean and range of a set of data
  - substitute numerical values into algebraic equations using appropriate units for physical quantities

Resistors in series & parallel (RP3)

- WS 3.5 Interpreting observations and other data (presented in verbal, diagrammatic, graphical, symbolic or numerical form), including identifying patterns and trends, making inferences and drawing conclusions.
  - Use data to make predictions.
  - Recognise or describe patterns and trends in data
  - Draw conclusions from given observations.

V-I characteristics of filament lamp, diode, and a resistor at constant temperature (RP4)

- WS 3.3 Carrying out and represent mathematical and statistical analysis.

- 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)
- 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

		○ draw and use the slope of a tangent to a curve as a measure of rate of change Series and parallel circuits ● WS 2.1 Use scientific theories and explanations to develop hypotheses. ○ Suggest a hypothesis to explain given observations or data.	● 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 **<u>Working Scientifically</u>** 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 • 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.
<u>Year 10 (physics) Final Composite Knowledge End Point (May ½ term)</u>			
● Learn about electrical circuits and explain the behaviour of components such as filament bulbs, thermistors and LDRs. ● Understand current, potential difference, resistance and their relationships. ● Understand how electricity is transmitted to consumers and the difference between ac/dc. ● Explore ideas of density and pressure, relating this to states of matter and changes of state. ● Understand both specific heat capacity and specific latent heat. ● Describe the structure of an atom and explain how our ideas about atoms have changed. ● Describe the random nature of radioactive decay and the properties of alpha, beta and gamma radiation. ● Understand radioactive decay in terms of isotopes, half-life and decay chains.			

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 - Waves, 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 10 Physics Essential Knowledge Summary

Schemata 1: P6 Waves

Composite Knowledge: Pupils will understand the difference between longitudinal and transverse waves. Pupils will become familiar with the terms amplitude, wavelength, frequency, time period and wave speed. Pupils will learn and be able to use the wave speed equation. They will recognise the waves in the electromagnetic spectrum, their properties, uses and dangers. In triple science pupils will learn about sound waves and seismic waves, their properties and uses. Pupils will learn about light, how it is reflected and refracted. In triple science they will discuss wave fronts and also be able to understand how lenses work.

Component Knowledge:

Foundational Knowledge:

Declarative Knowledge:

- Recall the units of: wave speed, frequency, wavelength, period
- Recognise, define and label transverse and longitudinal waves.
- Define terms: ‘frequency’, ‘wavelength’ & ‘amplitude’.
- Recall and use the wave equation and period-frequency equations.
- Describe how to measure the speed of sound in air
- Recognise that waves can be reflected, transmitted and absorbed at the boundary of different materials (triple only)
- Describe the effect of reflection, transmission or absorption of waves at a boundary (triple only)
- Know how sound waves travel (triple only)
- Describe how the structure of the ear restricts the human range of hearing (triple only)
- State the range of human hearing (triple only)
- Define ultrasound (triple only)
- State the properties of different seismic waves (triple only)
- Describe how echo-sounding is used to measure depth (triple only)
- Define ‘electromagnetic wave’
- State the names of the wave in the electromagnetic spectrum in order (in terms of frequency and wavelength)
- Describe how EM waves can be produced by changes in an atom
- Define ‘radiation dose’
- Recall uses of EM waves
- Recognise a concave and convex lens (triple only)
- Understand the terms: principal focus, focal length, real image and virtual image.
- Name the colours of the visible spectrum in order
- Understand the terms: specular reflection & diffuse scattering (triple only)
- Describe how colour filters work in terms of reflection & transmission (triple only)
- Understand the colour of opaque object in terms of reflection & absorption (triple only)
- Use the terms transparent, translucent and opaque appropriately (triple only)
- Understand the term ‘black body’ and how wavelength and frequency of emission depends on temperature (triple only)

Procedural Knowledge:

- Write methods for experiments
- Construct a ray diagram to show reflection (triple only)

Schemata 2: P7 Magnets & Electromagnets

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

Schemate 3: P8 Space (triple only)

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.

- Construct a ray diagram to show refraction at a boundary
- Construct a ray diagram to show the images formed by concave and convex lenses (triple only)
- Calculate magnification (triple only)
- Write methods for experiments.
- Accurately plot axes & graphs
- Draw lines of best fit and use them to find tangents and gradients.

Upper Hierarchical Knowledge

- Describe how changes in wave speed, frequency & wavelength of sound waves are related as they move from one medium to another.
- Describe how the properties of waves are used for detection & exploration (triple only)
- Use the idea of wave front diagrams to explain refraction
- Describe how radio waves can be produced and transmitted.
- Draw conclusions about the risks of exposure to EM waves
- Explain why a particular EM wave is suitable for a specific application
- Explain temperature of Earth and other bodies in terms of absorption & emission of energy (triple only)

Working Scientifically

Ripple tank & Waves on a string (RP8)

- WS 2.3 Apply a knowledge of a range of techniques, instruments, apparatus, and materials to select those appropriate to the experiment.
    - Describe/suggest/select the technique, instrument, apparatus or material that should be used for a particular purpose, and explain why.

Reflection & refraction of light (RP 9) (triple only)

- 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.

Investigating the absorption & radiation of infrared radiation (RP 10)

- WS 3.5 Interpreting observations and other data (presented in verbal, diagrammatic, graphical, symbolic or numerical form), including identifying patterns and trends, making inferences and drawing conclusions.
    - Use data to make predictions.
    - Recognise or describe patterns and trends in data presented in a variety of tabular, graphical and other forms.
    - Draw conclusions from given observations.

- Explain how a microphone works
- 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.

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.