# Science Year 10 Physics Long Term Map

**Subject Intent/Aims**

Expose all students to a broad range of learning opportunities to deepen their knowledge and understanding of themselves and the world around them and to build a solid foundation of Science knowledge and skills.We believe in developing curiosity and understand that science is an active process with many questions to be answered and still to be asked. We provide an understanding of how knowledge was derived, discovered and came to be accepted by the scientific community. By focusing on thinking, interpreting and evaluating rather than simply memorising scientific fact we intend to enable our students to use the skills that they need to answer their own scientific questions.

Our focus on the scientific process as a way of thinking and working will allow our students to develop their own ideas, attitudes and interpretations.

| **Topic: Electricity** | **Topic: Atomic Structure** | **Topic: Waves and the EM spectrum** |
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| **National Curriculum:**<br>• measuring resistance using p.d. and current measurements<br>• exploring current, resistance and voltage relationships for different circuit elements; including their graphical representations<br>• quantity of charge flowing as the product of current and time<br>• drawing circuit diagrams; exploring equivalent resistance for resistors in series<br>• the domestic a.c. supply; live, neutral and earth mains wires, safety measures<br>• power transfer related to p.d. and current, or current and resistance. | **National Curriculum:**<br>• the nuclear model and its development in the light of changing evidence<br>• masses and sizes of nuclei, atoms and small molecules<br>• differences in numbers of protons, and neutrons related to masses and identities of nuclei, isotope characteristics and equations to represent changes<br>• ionisation; absorption or emission of radiation related to changes in electron orbits<br>• radioactive nuclei: emission of alpha or beta particles, neutrons, or gamma rays, related to changes in the nuclear mass and/or charge<br>• radioactive materials, half-life, irradiation, contamination and their associated hazardous effects, waste disposal<br>• nuclear fission, nuclear fusion and our Sun's energy | **National Curriculum:**<br>• amplitude, wavelength, frequency, relating velocity to frequency and wavelength<br>• transverse and longitudinal waves<br>• electromagnetic waves, velocity in vacuum; waves transferring energy; wavelengths and frequencies from radio to gamma-rays<br>• velocities differing between media: absorption, reflection, refraction effects<br>• production and detection, by electrical circuits, or by changes in atoms and nuclei<br>• uses in the radio, microwave, infra-red, visible, ultra-violet, X-ray and gammaray regions, hazardous effects on bodily tissues |
| **Composition** | **Composition** | **Composition** |
| To understand the basics of electricity how is it supplied to domestic users. | To understand the structure of the atom and how it has changed over time. | To understand the features, properties ad uses of the waves of the electromagnetic spectrum. |
| **Components** | **Components** | **Components** |
| Component 1: To know the different types of circuit and describe some of the key features of each type of circuit.<br>Component 2: Know that electric flows and calculate charge flow.<br>Component 3: Know the features of a series circuit and identify the current, potential difference and resistance rules for a series circuit.<br>Component 4: Know the features of a parallel circuit and identify the current, potential difference and resistance rules for a parallel circuit.<br>Component 5: Know how to set up circuits to investigate the factors affecting the resistance of electrical circuits.<br>Component 6: Know that, for some resistors, the value of R remains constant | Component 1: describe the current model of the atoms, and how ideas about the structure of the atom have changed over the years.<br>Component 2: relate differences between isotopes to differences in conventional representations of their identities, charges and masses.<br>Component 3: describe the three types of ionising radiation and consider hazards related to and uses of each type of radiation.<br>Component 4: apply their knowledge to the uses of radiation and evaluate the best sources of radiation to use in a given situation.<br>Component 5: recall examples of radioactive decay and use the names and symbols of common nuclei and particles to write balanced equations that | Component 1: To know the difference between transverse and longitudinal waves.<br>Component 2: To know the examples of transverse and longitudinal waves.<br>Component 3: To know the parts of the waves.<br>Component 4: To know the wave formula.<br>Component 5: To know how to investigate how the amount of infrared radiation absorbed or radiated by a surface depends on the nature of that surface.<br>Component 6: To know the parts of the EM spectrum, how they are |

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| but that in others it can change as the current changes.<br>Component 7: Know how to design a circuit to measure the resistance of a component by measuring the current through, and potential difference across, the component.<br>Component 8: Know the formula for calculation resistance.<br>Component 9: Know the formula for calculating electrical work done.<br>Component 10: To know the I-V graphs for different components.<br>Component 11: Know how electricity is transmitted to homes and the features of mains electricity and to know the difference between direct and alternating potential difference.<br>Component 12: Know the formula for calculate power and energy transfers.<br>Component 13: Know the features of the national grid and why step-up and step-down transformers are used. | show single alpha (α) and beta (β) decay.<br>Component 6: explain the concept of half-life, determine half-life from given information and calculate the net decline, expressed as a ratio, in a radioactive emission after a given number of half-lives.<br>Component 7: compare the hazards associated with contamination and irradiation and describe suitable safety precautions.<br>Component 8: understand that it is important for the findings of studies into the effects of radiation on humans to be published and shared with other scientists so that the findings can be checked by peer review. | grouped and that what they have in common.<br>Component 7: To know the effects of different EM waves on the body.<br>Component 8: To know the practical uses of the EM spectrum.<br>Component 9: To know that different substances may absorb, transmit, refract or reflect electromagnetic waves in ways that vary with wavelength. |
| **Composites** | **Composites** | **Composites** |
| Composite 1: To be able draw circuit components<br>Composite 2: To be able to connect components to make a circuit.<br>Composite 3: To read values off ammeters, voltmeters and multimeters.<br>Composite 4: To recognize which formula to use and how to rearrange and apply it.<br>Composite 5: To distinguish between current and potential difference and investigate factors that affect resistance in a circuit.<br>Composite 6: Use graphs to explore whether circuit elements are linear or non-linear and relate the curves produced to their function and properties.<br>Composite 7: 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. | Composite 1: To be able to plan different types of scientific enquiries to include different variable investigations including the radiation experiments.<br>Composite 2: To be able to taking becquerel measurements, using a Geiger muller counter, with increasing accuracy and precision, taking repeat readings.<br>Composite 3: To record data and results of increasing complexity using half-life graphs/count charts.<br>Composite 4: To understand and present findings from half-life enquiries, in oral and written forms such as displays and other presentations<br>Composite 5: To know how to use safety precautions to prevent radiation contamination and reduce irradiation. | Composite 1: To be able to identify the parts of a wave on a diagram.<br>Composite 2: To be able to apply the wave formula.<br>Composite 3: To be able to measure the time period for a wave.<br>Composite 4: To be able to measure the frequency of a wave<br>Composite 5: To be able to measure the wavelength of a wave.<br>Composite 6: To be able to measure angle of reflection and refraction PO.<br>Composite 7: PO To be able to construct a ray diagram. |
| **Higher Order Knowledge** | **Higher Order Knowledge** | **Higher Order Knowledge** |
| Component 14: Know how static electricity is produce: sparking, by rubbing surfaces<br>Component 15: Know that charged objects exert forces of attraction or repulsion on one another when not in contact.<br>Component 16: Know how the transfer of electrons between objects can explain the phenomena of static electricity, draw the electric field pattern for an isolated charged sphere. Component 17: Know what an electric field is like and how the concept of an electric field helps to explain the non-contact force between charged objects as well as other electrostatic phenomena such as sparking. | Component 9: explain why the hazards associated with radioactive material differ according to the half-life involved.<br>Component 10: describe and evaluate the uses of nuclear radiations for exploration of internal organs, and for control or destruction of unwanted tissue.<br>Component 11: evaluate the perceived risks of using nuclear radiations in relation to given data and consequences.<br>Component 12: explain the process of nuclear fission and fusion and describe the fusion process in stars and the production of electricity in a power station using nuclear fission | Component 10 HT Explain why each type of electromagnetic wave is suitable for the practical application.<br>Component 11 HT: To know that different substances may absorb, transmit, refract or reflect electromagnetic waves in ways that vary with wavelength and be able to construct ray diagrams.<br>Component 12: Explain what happens to waves at a boundary and be able to draw a ray diagram.<br>Component 13: Know how to investigate the reflection of light by different types of surface and the refraction of light by different substances.<br>Component 14: PO Describe how sound waves travel and are heard.<br>Component 15: HT Explain how the properties of waves can be used both for detection and exploration of hidden structures.eg. ultrasounds, seismic waves, echo sounding. |

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| | | Component 16 PO: To know how lenses form and image and be able to construct ray diagrams to illustrate the similarities and differences between convex and concave lenses.<br>Component 17 PO: Explain what the visible light spectrum is and how it affects colour and interacts with filters.<br>Component 18 PO: Explain what black body radiation is and apply ideas about infrared emission and absorption to Earth's temperature. |
| **Key terms** | **Key terms** | **Key terms** |
| Diode, light-dependent resistor, resistance, current, charge, potential difference, series, parallel, thermistor, direct current, alternating current, transformers, oscilloscope | Radiation, isotopes, alpha, beta, gamma, ionising, Geiger counter, becquerels, half-life, irradiated, contaminated, atomic number, mass number | Longitudinal, transverse, compression, rarefaction, wavelength, frequency, amplitude, period, refraction, diffraction, reflection, oscillation, diverging, converging, |
| **Final Composition/Deliberate Practice** | **Final Composition/Deliberate Practice** | **Final Composition/Deliberate Practice** |
| Planning, carrying out and analysing an investigation<br>Use circuit diagrams to set up and check appropriate circuits to investigate the factors affecting the resistance of electrical circuits including resistors in series and parallel.<br>Use circuit diagrams to construct appropriate circuits to investigate the I–V characteristics of a variety of circuit elements, including a filament lamp | Long answer question on the properties and uses of nuclear radiation. | Make observations to identify the suitability of apparatus to measure the frequency, wavelength and speed of waves in a ripple tank and waves in a solid and take appropriate measurements. |
| **Summative/Formative assessment** | **Summative/Formative assessment** | **Summative/Formative assessment** |
| RRR<br>Static electricity exam questions (PO)<br>Exam questions on current in series sand parallel circuits.<br>Learner check on potential difference and current in series and parallel, components, and formula application.<br>Resistance of a wire exam practice questions.<br>Final assessment covering potential difference and current in series and parallel, components, and formula application, resistance, thermistors, LDRs and diodes. | RRR<br>Structure of atom 6 mark question.<br>Model of the atom assessed question.<br>Learner check on structure of the atom, nuclear decay and isotopes.<br>Half-life graph drawing and processing.<br>Learner check two, exam questions on nuclear decay, uses and half-life.<br>Final assessment on structure of atom, nuclear decay, properties of alpha, beta, gamma radiation, uses of radiation and half-life. | RRR<br>Exam questions on the scientific method and use of technology.<br>Exam questions on the properties of EM waves.<br>Required practical questions.<br>Final assessment on wave formula, transverse and longitudinal waves, uses and properties of the EM spectrum. |

| **Numeracy** | **Literacy** | **Numeracy** | **Literacy** | **Numeracy** | **Literacy** |
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| Numeracy:<br>Use SI units (eg kg, g, mg; km, m, mm; kJ, J) Recognise the importance of scientific quantities and understand how they are determined.<br>Use a scatter diagram to identify a correlation between two variables.<br>Change the subject of an equation. | English – literacy skills – focusing onkeywords, tier 3 vocabulary, connectives, SPAG, synonyms,<br>Science specific definition of the word power.<br>Joule vs Jewel.<br>Use of the word cell in different | Plotting graphs and drawing intersects. Find arithmetic means.<br>Taking measurements, half- life decay equations, half-lives, proportion and fractions.<br>Plot two variables from experimental or other data | focusing on keywords, tier 3 vocabulary, connectives, SPAG, synonyms,<br>Different meaning of decay in biology and physics.<br>iron vs ion<br>Focus on difference in meaning of | Visualise and represent 2D and 3D forms including two dimensional representations of 3D objects.<br>Use angular measures in degrees.<br>Solve simple algebraic equations.<br>Substitute numerical values into algebraic equations using appropriate units for physical quantities.<br>Change the subject of an equation. | focusing on keywords, tier 3 vocabulary, connectives, SPAG, synonyms,<br>Highlight different use of the word period in biology/physics.<br>Reading for meaning and extracting |

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| Substitute numerical values into algebraic equations using appropriate units for physical quantities. Interconvert units. | contexts. Biological cell, physics - chemical energy store, everyday language – prison cell. | | irradiation and contamination. | | information from texts on uses of the EM spectrum. |

| Cross curricular links | Cross curricular links | Cross curricular links |
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| **Engineering:** Symbol recognition and components function and use. How potential difference and current behave in series and parallel circuits.<br>**Computer science:** Use of components in circuits to control systems.<br>**Maths:** Applying formula | **History:** Historical context provides an opportunity for students to show an understanding of why and describe how scientific methods and theories develop over time.<br>**Chemistry:** Revisit and build on the atomic structure from chemistry unit. | **Maths:** Measuring and using angles<br>**Biology:** Structure and function of the lense in the eye. |
| **SMSC** | **British Value** | **RSHE** |
| *There will be multiple opportunities for students develop spiritually; being creative in their learning and a range of activities.*<br>*Pupils to develop a better understand of electrical safety, and how energy is transferred through the national grid.*<br>*Pupils will learn about the environmental impact of pylons and how moral decisions are an important aspect of science.*<br>*Pupils will learn about power of different electrical devices and how advances in technologies can come at a cost.*<br>*Pupils will learn about the benefits and drawbacks of nuclear power. They will discover that using nuclear power is a balance between risk and benefit. Pupils will learn about nuclear disasters and the long-term impact on communities and globally.*<br>*Pupils will learn about the ethics of using something that can cause cancer to treat cancer.*<br>*Pupils will develop and understanding of the peer review process and why it is important to verify evidence before publishing.*<br>*The high expectations placed on the student from the school and department mean that pupils will regularly be made aware of the right and wrong morally.*<br>*Pupils are expected to share the views morally on the different topics but also show respect and appreciate others in the classroom.*<br>*The students have the opportunity to develop their social skills by working in groups to complete the specific latent heat required practical.* | *Democracy: Students work together practically in groups which encourages them to share views and opinions and take instructions from others. Group practicals include, resistance of a wire, thermal emission, I-V characteristics of components, half-life model.*<br>*The rule of law: Students follow laboratory rules for the safety of all. Opportunities to discuss laws relating to safe exposure to radiation.*<br>*Individual liberty;*<br>*There are opportunities for students to work independently and make choices in a safe environment when carrying out investigations.*<br>*Mutual respect and tolerance: Students work together practically in groups which encourages teamwork and respect for others. Students will have the opportunity to explore different roles that have higher than typical exposure to radiation.*<br>*Students are taught how to contribute to life in modern Britain by learning about the history of scientific discovery.* | *They will be taught about the need for tolerance of other people's viewpoints.*<br>*Safe us of the internet when carrying out research.* |

| **Adapted Curriculum Content:** | **Adapted Curriculum Content:** | **Adapted Curriculum Content:** |
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| Electricity<br>Higher tier only application of transformer coil equation.<br>Separate science only. Static charge, Electric fields. | Atomic Structure<br>Separate Science only<br>Hazards and uses of radioactive emissions and of background radiation.<br>Nuclear fission and fusion | Waves and the EM spectrum<br>High tier only explanations why each type of electromagnetic wave is suitable for the practical application.<br>Separate science Reflection of waves<br>Separate science Sound waves (HT only)<br>Separate science Waves for detection and exploration (HT only)<br>Separate science only Lenses, Visible light, Black body radiation, Emission and absorption of infrared radiation, Perfect black bodies and radiation |
| **Adaptive Implementation Practices:** | **Adaptive Implementation Practices:** | **Adaptive Implementation Practices:** |

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| Coloured paper/pens<br>Differentiated worksheets<br>Differentiated tasks<br>Seating plans to maximise concentration allowing for visual/hearing impairments etc<br>Appropriate use of IWB<br>Dual coding<br>Spare equipment<br>Modelling experimental detail<br>Pre drawn tables/graphs/diagrams to be labelled | Coloured paper/pens<br>Differentiated worksheets<br>Differentiated tasks<br>Seating plans to maximise concentration allowing for visual/hearing impairments etc<br>Appropriate use of IWB<br>Dual coding<br>Spare equipment<br>Modelling experimental detail<br>Pre drawn tables/graphs/diagrams to be labelled | Coloured paper/pens<br>Differentiated worksheets<br>Differentiated tasks<br>Seating plans to maximise concentration allowing for visual/hearing impairments etc<br>Appropriate use of IWB<br>Dual coding<br>Spare equipment<br>Modelling experimental detail<br>Pre drawn tables/graphs/diagrams to be labelled |