

## KS4 Curriculum Map – Physics:

<b>Topic</b>	<b>Substantive Knowledge</b>  This is the specific, factual content for the topic, which should be connected into a careful sequence of learning.	<b>Disciplinary Knowledge (Skills)</b>  This is the action taken within a particular topic in order to gain substantive knowledge.	<b>Assessment Opportunities</b>  What assessments will be used to measure student progress?
Energy and Energy Resources	<ul style="list-style-type: none"> <li>• State all energy stores, Describe how energy can be transferred,</li> <li>• Define "Conservation of Energy", Define "Closed System"</li> <li>• Define "Work Done",</li> <li>• Define "GPE" and give factors that affect it,</li> <li>• Give factors that affect kinetic and elastic energy,</li> <li>• Define "Useful" and "Wasted" energy</li> <li>• Define "Efficiency",</li> <li>• Identify where our electricity comes from, Write energy transfers for common electrical appliances,</li> <li>• Define "Power"</li> </ul>	<ul style="list-style-type: none"> <li>• Write energy transfers</li> <li>• Write energy transfers and apply conservation of energy</li> <li>• Use the formulae <math>KE=1/2mv^2</math> and <math>E=1/2ke^2</math> to solve problems</li> <li>• Use the formula <math>GPE=mgh</math> to solve problems</li> <li>• Use <math>P=E/t</math> to calculate power, Link power to useful and wasted energy</li> <li>• Use the formula <math>W=Fs</math> to calculate work</li> <li>• Explain how work is done to overcome friction</li> <li>• Use the formula to calculate efficiency</li> <li>• Suggest how machines could be made more efficient</li> <li>• State what happens to wasted energy</li> <li>• Discuss whether energy is ever really "lost"</li> <li>• Identify useful and waste energy types in electrical transfers</li> </ul>	<ul style="list-style-type: none"> <li>• Kerboodle Review Questions</li> <li>• Summative End of Unit Test</li> <li>• Practice Calculations</li> <li>• Interactive kerboodle resources:</li> </ul>

<p>Energy Transfer by Heating</p>	<ul style="list-style-type: none"> <li>• Define "Conductors" and "Insulators" and give examples,</li> <li>• State and explain what factors affect the rate of conduction</li> <li>• Define "Infrared Radiation"</li> <li>• Explain what is meant by black body radiation</li> <li>• State factors that affect the rate of infrared transfer</li> <li>• Explain how the rate of infrared transfer affects temperature,</li> <li>• Define "Specific Heat Capacity"</li> <li>• State factors that affect the rate of temperature change of an object</li> <li>• State ways in which homes are heated,</li> </ul>	<ul style="list-style-type: none"> <li>• Use the particle model to explain how conduction works</li> <li>• Model how global warming is caused in terms of infrared radiation</li> <li>• Use the formula <math>E=mc\theta</math> to solve problems</li> <li>• Identify methods to reduce heat loss</li> <li>• explain how each method works in terms of conduction, convection, and radiation</li> </ul>	<ul style="list-style-type: none"> <li>• Kerboodle Review Questions</li> <li>• Summative End of Unit Test</li> <li>• Practice Calculations</li> <li>• Investigative Practical Work – Specific Heat Capacity</li> <li>• Home Heating Project</li> <li>• Interactive Kerboodle Resources:</li> </ul>
<p>Energy Resources</p>	<ul style="list-style-type: none"> <li>• Identify which fuels are used to generate electricity,</li> <li>• Describe how nuclear powerplants work</li> <li>• Describe how a power plant produces electricity,</li> <li>• Identify different types of power plant,</li> <li>• Define "Renewable Energy" Give examples of renewable sources of energy,</li> <li>• Identify the main causes of environmental concern when producing electricity,</li> <li>• Define "Supply" and "Demand"</li> </ul>	<ul style="list-style-type: none"> <li>• Compare uses of different fuels,</li> <li>• Identify advantages and disadvantages of power plants</li> <li>• Identify advantages and disadvantages of renewable sources of energy</li> <li>• Compare power stations to one another in terms of advantages and disadvantages for the environment</li> <li>• Identify how best to use different power stations to adapt to changes in demand</li> </ul>	<ul style="list-style-type: none"> <li>• Kerboodle Review Questions</li> <li>• Summative End of Unit Test</li> <li>• Power Plant Project</li> <li>• Presentations</li> <li>• Interactive Kerboodle Resources:</li> </ul>
<p>Electricity</p>	<ul style="list-style-type: none"> <li>• Define an electric field</li> <li>• State how charges affect one another,</li> <li>• Describe how a static charge is formed and discharged</li> <li>• Define what is meant by current</li> <li>• Define what is meant by potential difference</li> <li>• Define "Series Circuit"</li> </ul>	<ul style="list-style-type: none"> <li>• Drawing circuits and symbols</li> <li>• Building circuits</li> <li>• Give the relationship between current and charge</li> <li>• Use the formula <math>Q=It</math> to solve problems</li> <li>• Measure potential difference in a circuit</li> <li>• Perform a practical to investigate how resistance changes with length</li> </ul>	<ul style="list-style-type: none"> <li>• Kerboodle Review Questions</li> <li>• Summative End of Unit Test</li> <li>• Practice Calculations</li> <li>• Investigative Practical Work – Circuits</li> <li>• Circuit Building Simulation Kits (PhET)</li> <li>• Interactive Kerboodle Resources:</li> </ul>

	<ul style="list-style-type: none"> <li>• State how current and potential difference changes in series circuits</li> <li>• State and explain what happens when you place resistors in series,</li> <li>• Define "Parallel Circuits"</li> <li>• State what happens to current and potential difference in parallel circuits</li> <li>• State and explain what happens to resistors in parallel</li> </ul>	<ul style="list-style-type: none"> <li>• Sketch IV graphs for an ohmic resistor, a filament lamp, and a diode</li> <li>• Explain the shapes of these graphs, Calculate the resistance of the components from the graphs</li> <li>• Perform required practical to test the current and pd of a component</li> <li>• Perform a practical to test resistors in series</li> <li>• Perform a practical to test resistors in parallel</li> </ul>	
Mains Electricity	<ul style="list-style-type: none"> <li>• Define AC and DC</li> <li>• State what is meant by the live wire and neutral wire in mains electricity</li> <li>• Describe the national grid</li> <li>• Describe the parts of a UK plug and explain the materials used</li> <li>• Describe energy transfers through a resistor</li> <li>• Describe the energy transfer in a circuit</li> </ul>	<ul style="list-style-type: none"> <li>• Describe how to use an oscilloscope to measure frequency and peak pd</li> <li>• Identify the wires in a UK cable</li> <li>• Explain the function of the earth pin</li> <li>• Calculate the current drawn by a device from its power rating,</li> <li>• Be able to correctly identify which fuse should be used in a device from its power rating</li> <li>• Use the formula <math>Q=It</math> and <math>P=IV</math> to solve problems</li> <li>• Relate energy transfer to potential difference using <math>E=QV</math></li> <li>• Calculate the total energy supplied using <math>P=IV</math> and <math>E=Pt</math></li> <li>• Calculate the useful and wasted energy from an appliance's efficiency</li> <li>• Compare different appliances based on their efficiencies</li> </ul>	<ul style="list-style-type: none"> <li>• Kerboodle Review Questions</li> <li>• Summative End of Unit Test</li> <li>• Use of an oscilloscope</li> <li>• Practice Calculations</li> </ul>
Molecules and Matter	<ul style="list-style-type: none"> <li>• Define density including units</li> <li>• State properties of solids, liquids and gases, particle arrangement of solids, liquids and gases</li> <li>• Define melting and boiling point</li> <li>• Describe requirements to melt solids or boil liquids</li> </ul>	<ul style="list-style-type: none"> <li>• Measure density of solids and liquids</li> <li>• Use density equation to calculate mass or volume</li> <li>• Determine from density whether object will float</li> <li>• Explain why gases are less dense</li> <li>• Explain why mass stays the same after state changes</li> </ul>	<ul style="list-style-type: none"> <li>• Kerboodle Review Questions</li> <li>• Summative End of Unit Test</li> <li>• Investigative Practical Work – Latent Heat and Density</li> <li>• Practice Calculations</li> <li>• Interactive Kerboodle Resources:</li> </ul>

	<ul style="list-style-type: none"> <li>• Explain how temperature changes affect internal energy, explain properties of solid, liquid and gas</li> <li>• Describe how particle energy changes with heating</li> <li>• Define latent heat, specific latent heat of fusion and of vaporisation</li> <li>• Explain how gases exert pressure on a surface</li> </ul>	<ul style="list-style-type: none"> <li>• Explain difference between boiling and evaporation</li> <li>• Determine melting or boiling point from temp/time graph</li> <li>• Explain gas pressure in terms of particles</li> <li>• Use specific latent heat in calculations</li> <li>• Measure specific latent heat of ice and water</li> <li>• Relate gas pressure to temperature</li> <li>• Describe observable evidence of random motion</li> <li>• Relate changes in gas pressure to changes in volume</li> <li>• Explain why changing gas volume changes pressure</li> <li>• Use <math>pV = \text{constant}</math> in calculations</li> <li>• Explain why gas temperature increases when compressed rapidly</li> </ul>	
Radioactivity	<ul style="list-style-type: none"> <li>• Define isotope</li> <li>• State how far each type of radiation travels in air</li> <li>• State how materials absorb alpha/beta/gamma radiation</li> <li>• State ionising power of radiation,</li> <li>• Define half life and count rate</li> <li>• Describe effect of radioactive decay on count rate</li> <li>• Describe use of radioisotopes in medicine</li> <li>• Define nuclear fission</li> <li>• Define chain reaction</li> <li>• Define nuclear fusion</li> <li>• Describe radon gas</li> </ul>	<ul style="list-style-type: none"> <li>• describe how alpha/beta emission changes nucleus</li> <li>• Represent alpha/beta emission as a diagram</li> <li>• Explain why ionising radiation is dangerous</li> <li>• Calculate count rate after given number of half lives</li> <li>• Choose appropriate radioisotope for a job,</li> <li>• Explain types of nuclear radiation used in medical imaging</li> <li>• Explain how to use radioactivity to destroy cancer cells</li> <li>• Describe difference between spontaneous and induced fission</li> <li>• Explain how chain reaction is controlled in a reactor</li> <li>• Describe how nuclei can be fused</li> <li>• Explain where the sun's energy comes from</li> </ul>	<ul style="list-style-type: none"> <li>• Kerboodle Review Questions</li> <li>• Summative End of Unit Test</li> <li>• Interpret/plot half-life graphs</li> <li>• Practice Calculations</li> <li>• Interactive Kerboodle Resources:</li> </ul>

		<ul style="list-style-type: none"> <li>• Explain why fusion reactors are difficult to make</li> <li>• Discuss how safe nuclear reactors are</li> <li>• Explain: why radon gas is dangerous, why nuclear waste is dangerous, what happens to nuclear waste</li> </ul>	
<p>Forces in Balance</p>	<ul style="list-style-type: none"> <li>• Define "scalar" and "vector"</li> <li>• Give examples of scalars and vectors,</li> <li>• State Newton's Laws of Motion,</li> <li>• Define "Resultant Force"</li> <li>• State what happens to an object when resultant force is zero or not</li> <li>• Define moment, lever, effort, and load</li> <li>• Define "moment" and give examples of levers</li> <li>• Identify when gears/levers change the force or moment of a system</li> <li>• Define "centre of mass"</li> <li>• Define "counterweight"</li> </ul>	<ul style="list-style-type: none"> <li>• Find a resultant vector for parallel and perpendicular vectors</li> <li>• Use Newton's laws to explain motion</li> <li>• Use <math>F=ma</math> formula to solve problems</li> <li>• Draw a free body diagram</li> <li>• Calculate resultant force</li> <li>• Label a diagram of a lever</li> <li>• State the formula for moments and use it to solve problems involving levers and gears</li> <li>• Use the formula to calculate increases/decreases in forces/moments</li> <li>• Describe and carry out a practical to determine the centre of mass of a 2D shape</li> <li>• Give examples of practical uses of moments in everyday life</li> <li>• Use the idea of centre of mass and moments to explain stability/toppling over</li> <li>• Draw a parallelogram of forces</li> <li>• Use the parallelogram of forces to calculate a resultant force</li> <li>• Find vertical and horizontal components of forces at an angle</li> <li>• Combine two vectors that are not at right angles</li> <li>• Use SOHCAHTOA and graphical methods to find solutions to vector problems</li> </ul>	<ul style="list-style-type: none"> <li>• Kerboodle Review Questions</li> <li>• Summative End of Unit Test</li> <li>• Investigative Practical Work – Centre of Mass</li> <li>• Practice Calculations</li> <li>• Interactive Kerboodle Resources:</li> </ul>

<p>Motion</p>	<ul style="list-style-type: none"> <li>• Define acceleration</li> <li>• Define displacement</li> <li>• Define distance</li> <li>• Define speed</li> <li>• Define velocity</li> </ul>	<ul style="list-style-type: none"> <li>• Plot and distance-time graphs</li> <li>• Describe an objects motion from its motion graph</li> <li>• Calculate speed from the graph</li> <li>• Use the formula <math>a=(v-u)t/2</math> to solve problems</li> <li>• Explain the meaning of negative acceleration</li> <li>• Plot speed-time graphs</li> <li>• Describe an object's motion from its motion graph</li> <li>• Plot a speed-time graph from a distance-time graph</li> <li>• Calculate acceleration and distance travelled from the graph</li> <li>• Interpret motion graphs to find meaningful values from gradients or areas</li> <li>• Use motion time graphs to accurately describe an object's journey</li> <li>• Making reference to key calculated values</li> </ul>	<ul style="list-style-type: none"> <li>• Kerboodle Review Questions</li> <li>• Summative End of Unit Test</li> <li>• Practice Calculations</li> <li>• Graph plotting/interpreting</li> <li>• Interactive Kerboodle Resources:</li> </ul>
<p>Forces and Motion</p>	<ul style="list-style-type: none"> <li>• Relate acceleration to force and mass</li> <li>• Define inertia</li> <li>• State difference between mass and weight</li> <li>• Describe motion of a falling object</li> <li>• Define terminal velocity</li> <li>• Describe resultant force for terminal velocity</li> <li>• State forces opposing forward motion of a vehicle</li> <li>• Define momentum</li> <li>• Describe conservation of momentum</li> <li>• Describe momentum of objects pushing each other apart</li> <li>• State factors that affect impact force,</li> <li>• Define elasticity</li> <li>• Describe how spring extension relates to force applies</li> </ul>	<ul style="list-style-type: none"> <li>• Calculate resultant force from acceleration and mass</li> <li>• Describe and explain factors affecting stopping distance</li> <li>• Calculate momentum including units</li> <li>• Solve problems involving the conservation of momentum</li> <li>• Describe how impact time affects force</li> <li>• Explain why increasing the impact time reduces the force</li> <li>• Explain: why helmets and cushioned surfaces reduce impact forces, why seatbelts and airbags reduce force in an accident, how side impact bars and crumple zones work; work out if a car in a collision was speeding</li> <li>• Measure extension of a stretched object,</li> </ul>	<ul style="list-style-type: none"> <li>• Kerboodle Review Questions</li> <li>• Summative End of Unit Test</li> <li>• Practice Calculations</li> <li>• Investigative Practical Work: Hooke's Law</li> <li>• Interactive Kerboodle Resources:</li> </ul>

	<ul style="list-style-type: none"> <li>Define limit of proportionality</li> </ul>		
Forces and Pressure	<ul style="list-style-type: none"> <li>Define pressure</li> <li>State unit of pressure,</li> <li>Explain how liquid pressure increases with depth</li> <li>Relate atmospheric density to altitude,</li> <li>Define upthrust in a fluid, explain causes of upthrust</li> </ul>	<ul style="list-style-type: none"> <li>Use <math>P=F/A</math> to solve problems</li> <li>Explain significance of contact area for pressure</li> <li>Explain why liquid pressure is constant along a horizontal line</li> <li>Describe factors affecting liquid pressure</li> <li>Calculate pressure caused by a liquid column</li> <li>Explain why atmospheric pressure exists and changes with altitude</li> <li>calculate force on flat objects due to pressure difference</li> <li>Explain factors affecting pressure in fluid</li> <li>Explain whether objects float or sink</li> </ul>	<ul style="list-style-type: none"> <li>Kerboodle Review Questions</li> <li>Summative End of Unit Test</li> <li>Practice Calculations</li> <li>Interactive Kerboodle resources:</li> </ul>
Wave Properties	<ul style="list-style-type: none"> <li>Give examples of uses of waves</li> <li>Describe reflection and refraction</li> <li>State when reflection and refraction of plane waves will happen</li> <li>Describe sound waves</li> <li>Describe how the loudness and pitch of a soundwave are affected</li> <li>State limits of human hearing</li> <li>Define ultrasound</li> <li>Describe how ultrasound is used in SONAR and medicine</li> <li>Define seismic waves</li> </ul>	<ul style="list-style-type: none"> <li>Identify types of waves</li> <li>Label key features of waves</li> <li>Relate wave speed to frequency and wavelength</li> <li>Use the formula <math>v=f\lambda</math></li> <li>Explain why reflection and refraction occur</li> <li>Investigate waves propagating on a string</li> <li>Identify sound waves from oscilloscope traces</li> <li>Give advantages of using ultrasound</li> <li>Identify different types and state how they are produced, Explain how seismic waves tell us about the structure of the earth</li> </ul>	<ul style="list-style-type: none"> <li>Kerboodle Review Questions</li> <li>Summative End of Unit Test</li> <li>Practice Calculations</li> <li>Investigative Practical Work: Waves on a String</li> <li>Interactive Kerboodle Resources:</li> </ul>

<p>Electromagnetic Waves</p>	<ul style="list-style-type: none"> <li>• Identify parts of the EM spectrum</li> <li>• Identify wavelengths of visible light</li> <li>• Define white light</li> <li>• Identify different radio waves for different purposes</li> <li>• Describe fibre optics</li> <li>• Define ionising radiation</li> <li>• State why some EM waves are dangerous</li> <li>• State which materials will absorb X-Rays</li> </ul>	<ul style="list-style-type: none"> <li>• Calculate the wavelength or frequency of EM waves</li> <li>• Identify uses for microwaves, radio waves, and infrared</li> <li>• Complete IR required practical</li> <li>• Explain which waves are used for satellite communications</li> <li>• Explain what a carrier wave is</li> <li>• Identify uses of UV, Gamma, and X-Rays</li> <li>• Identify medical uses of X-Rays,</li> </ul>	<ul style="list-style-type: none"> <li>• Kerboodle Review Questions</li> <li>• Summative End of Unit Test</li> <li>• Investigative Practical Work: Infrared Radiation</li> <li>• Practice Calculations</li> <li>• Interactive Kerboodle resources:</li> </ul>
<p>Light</p>	<ul style="list-style-type: none"> <li>• State the law of reflection for light waves,</li> <li>• State where refraction of light waves happens</li> <li>• Explain the difference between colours of light and state the primary and secondary colours</li> <li>• Define convex and concave lenses</li> </ul>	<ul style="list-style-type: none"> <li>• Draw and label a reflection diagram</li> <li>• Explain the difference between diffuse and specular reflection</li> <li>• Use diagrams to determine an image formed in a plane mirror</li> <li>• Draw and label diagrams of refraction</li> <li>• Explain why refraction happens</li> <li>• Explain what determines the colour of a surface</li> <li>• Explain how light filters work</li> <li>• Draw diagrams of lenses</li> <li>• Calculate the magnification of a lens</li> <li>• Draw ray diagrams for images formed by lenses</li> <li>• State and explain the nature of the images formed from lenses when the object is at various distances from the lens</li> </ul>	<ul style="list-style-type: none"> <li>• Kerboodle Review Questions</li> <li>• Summative End of Unit Test</li> <li>• Practice Calculations</li> <li>• Graphical Scaled Diagrams</li> <li>• Interactive Kerboodle Resources:</li> </ul>
<p>Electromagnetism</p>	<ul style="list-style-type: none"> <li>• State the force rule for magnets near each other</li> <li>• Explain induced magnetism</li> <li>• State how the strength and direction of the field can be varied</li> <li>• State devices that use electromagnets</li> <li>• Define the motor effect</li> <li>• Label a diagram of a simple motor and explain how it works</li> <li>• Define the generator effect</li> </ul>	<ul style="list-style-type: none"> <li>• Draw field lines around a fixed magnet</li> <li>• Draw magnetic field lines around a current carrying wire</li> <li>• Define an electromagnet and label a diagram</li> <li>• Explain how electromagnets allow their devices to work</li> <li>• Use the Left Hand Rule to determine the force on a wire in a magnetic field</li> </ul>	<ul style="list-style-type: none"> <li>• Kerboodle Review Questions</li> <li>• Summative End of Unit Test</li> <li>• Practice Calculations</li> <li>• Interactive Kerboodle Resources:</li> </ul>



	<ul style="list-style-type: none"> <li>• Explain what is meant by induced potential</li> <li>• Describe a transformer and what it does</li> <li>• State where transformers are used</li> <li>• Explain how transformers work</li> <li>• Use the transformer formula to solve problems</li> <li>• Explain why high voltages are used in overhead power cables</li> </ul>	<ul style="list-style-type: none"> <li>• Use induced potential to explain how current can be induced in a wire and state what affects its size and direction</li> <li>• Label a diagram of a generator and explain how it works</li> <li>• Relate the ratio of coil numbers to ratio of potential differences</li> <li>• Discuss transformer efficiency</li> </ul>	
Space	<ul style="list-style-type: none"> <li>• Describe the solar system</li> <li>• Describe a protostar</li> <li>• Describe energy transfers in the sun</li> <li>• Identify stages of a star's life and describe what is happening at each stage</li> <li>• Describe an orbit and state the forces involved</li> <li>• Describe the direction of forces on a body in orbit</li> <li>• Describe how the velocity of a satellite changes</li> <li>• Describe and explain Red Shift</li> <li>• Relate red shift to an object's speed</li> <li>• Describe the Big Bang Theory</li> <li>• State evidence for the big bang such as Red Shift and CMBR</li> </ul>	<ul style="list-style-type: none"> <li>• Draw a diagram of the solar system</li> <li>• Explain what is meant by a star's stability</li> <li>• Explain why some stars have different endings to their lives</li> <li>• Explain why a satellite needs to move at a particular speed</li> <li>• Describe and explain Red Shift</li> <li>• Explain how red shift is used as evidence for an expanding universe</li> <li>• Explain how the evidence leads to the conclusion of the big bang</li> <li>• Discuss what might possibly happen to the universe in the future</li> </ul>	<ul style="list-style-type: none"> <li>• Kerboodle Review Questions</li> <li>• Summative End of Unit Test</li> <li>• Interactive Kerboodle Resources:</li> </ul>