KS4 Curriculum Map – Physics:

Topic	Substantive Knowledge This is the specific, factual content for the topic, which should be connected into a careful sequence of learning.	Disciplinary Knowledge (Skills) This is the action taken within a particular topic in order to gain substantive knowledge.	Assessment Opportunities What assessments will be used to measure student progress?
Conservation and Dissipation of Energy	• State all energy stores, • Describe how energy can be transferred, • Define "Conservation of Energy", Define "Closed System" • Define "Work Done", • Define "GPE" and give factors that affect it, • Give factors that affect kinetic and elastic energy, • Define "Useful" and "Wasted" energy • Define "Efficiency", • Identify where our electricity comes from, Write energy transfers for common electrical appliances, • Define "Power"	• Write energy transfers • Write energy transfers and apply conservation of energy • Use the formulae $KE=1/2mv^2$ and $E=1/2ke^2$ to solve problems • Use the formula GPE=mgh to solve problems • Use P=E/t to calculate power, Link power to useful and wasted energy • Use the formula W=Fs to calculate work • Explain how work is done to overcome friction • Use the formula to calculate efficiency • Suggest how machines could be made more efficient • State what happens to wasted energy • Discuss whether energy is ever really "lost" • Identify useful and waste energy types in electrical transfers	• Kerboodle Review Questions • Summative End of Unit Test • Practice Calculations • Interactive kerboodle resources:

Energy Transfer by Heating	• Define "Conductors" and "Insulators" and give examples, • State and explain what factors affect the rate of conduction • Define "Infrared Radiation" • Explain what is meant by black body radiation • State factors that affect the rate of infrared transfer • Explain how the rate of infrared transfer affects temperature, • Define "Specific Heat Capacity" • State factors that affect the rate of temperature change of an object • State ways in which homes are heated	• Use the particle model to explain how conduction works • Model how global warming is caused in terms of infrared radiation • Use the formula E=mcθ to solve problems • Identify methods to reduce heat loss • explain how each method works in terms of conduction, convection, and radiation	• Kerboodle Review Questions • Summative End of Unit Test • Practice Calculations • Investigative Practical Work – Specific Heat Capacity • Home Heating Project • Interactive Kerboodle Resources:
Energy Resources	• Identify which fuels are used to generate electricity, • Describe how nuclear powerplants work • Describe how a power plant produces electricity, • Identify different types of power plant, • Define "Renewable Energy" Give examples of renewable sources of energy, • Identify the main causes of environmental concern when producing electricity, • Define "Supply" and "Demand"	• Compare uses of different fuels, • Identify advantages and disadvantages of power plants • Identify advantages and disadvantages of renewable sources of energy • Compare power stations to one another in terms of advantages and disadvantages for the environment • Identify how best to use different power stations to adapt to changes in demand	• Kerboodle Review Questions • Summative End of Unit Test • Power Plant Project • Presentations • Interactive Kerboodle Resources:
Electricity	• Define an electric field • State how charges affect one another, • Describe how a static charge is formed and discharged • Define what is meant by current • Define what is meant by potential difference • Define "Series Circuit" • State how current and potential difference changes in series circuits	• Drawing circuits and symbols • Building circuits • Give the relationship between current and charge • Use the formula Q=It to solve problems • Measure potential difference in a circuit • Perform a practical to investigate how resistance changes with length • Sketch IV graphs for an ohmic resistor, a filament lamp, and a diode	• Kerboodle Review Questions • Summative End of Unit Test • Practice Calculations • Investigative Practical Work – Circuits • Circuit Building Simulation Kits (PhET) • Interactive Kerboodle Resources:

	• State and explain what happens when you place resistors in series, • Define "Parallel Circuits" • State what happens to current and potential difference in parallel circuits • State and explain what happens to resistors in parallel	• Explain the shapes of these graphs, Calculate the resistance of the components from the graphs • Perform required practical to test the current and pd of a component • Perform a practical to test resistors in series • Perform a practical to test resistors in parallel	
Mains Electricity	• Define AC and DC • State what is meant by the live wire and neutral wire in mains electricity • Describe the national grid • Describe the parts of a UK plug and explain the materials used • Describe energy transfers through a resistor • Describe the energy transfer in a circuit	• Describe how to use an oscilloscope to measure frequency and peak pd • Identify the wires in a UK cable • Explain the function of the earth pin • Calculate the current drawn by a device from its power rating, • Be able to correctly identify which fuse should be used in a device from its power rating • Use the formula Q=It and P=IV to solve problems • Relate energy transfer to potential difference using E=QV • Calculate the total energy supplied using P=IV and E=Pt • Calculate the useful and wasted energy from an appliance's efficiency • Compare different appliances based on their efficiencies	• Kerboodle Review Questions • Summative End of Unit Test • Use of an oscilloscope • Practice Calculations
Molecules and Matter	• Define density including units • State properties of solids, liquids and gases, particle arrangement of solids, liquids and gases • Define melting and boiling point • Describe requirements to melt solids or boil liquids • Explain how temperature changes affect internal energy, explain properties of solid, liquid and gas	• Measure density of solids and liquids • Use density equation to calculate mass or volume • Determine from density whether object will float • Explain why gases are less dense • Explain why mass stays the same after state changes • Explain difference between boiling and evaporation	• Kerboodle Review Questions • Summative End of Unit Test • Investigative Practical Work – Latent Heat and Density • Practice Calculations • Interactive Kerboodle Resources:

	• Describe how particle energy changes with heating • Define latent heat, specific latent heat of fusion and of vaporisation • Explain how gases exert pressure on a surface	• Determine melting or boiling point from temp/time graph • Explain gas pressure in terms of particles • Use specific latent heat in calculations • Measure specific latent heat of ice and water • Relate gas pressure to temperature • Describe observable evidence of random motion • Relate changes in gas pressure to changes in volume • Explain why changing gas volume changes pressure • Use pV = constant in calculations • Explain why gas temperature increases when compressed rapidly	
Radioactivity	• Define isotope • State how far each type of radiation travels in air • State how materials absorb alpha/beta/gamma radiation • State ionising power of radiation, • Define half life and count rate • Describe effect of radioactive decay on count rate • Describe use of radioisotopes in medicine • Define nuclear fission • Define chain reaction • Define nuclear fusion • Describe radon gas	• describe how alpha/beta emission changes nucleus • Represent alpha/beta emission as a diagram • Explain why ionising radiation is dangerous • Calculate count rate after given number of half lives • Choose appropriate radioisotope for a job, • Explain types of nuclear radiation used in medical imaging • Explain how to use radioactivity to destroy cancer cells • Describe difference between spontaneous and induced fission • Explain how chain reaction is controlled in a reactor • Describe how nuclei can be fused • Explain where the sun's energy comes from • Explain why fusion reactors are difficult to make • Discuss how safe nuclear reactors are	• Kerboodle Review Questions • Summative End of Unit Test • Interpret/plot half-life graphs • Practice Calculations • Interactive Kerboodle Resources:

		• Explain: why radon gas is dangerous, why nuclear waste is dangerous, what happens to nuclear waste	
Forces in Balance	• Define "scalar" and "vector" • Give examples of scalars and vectors, • State Newton's Laws of Motion, • Define "Resultant Force" • State what happens to an object when resultant force is zero or not • Define moment, lever, effort, and load • Define "moment" and give examples of levers • Identify when gears/levers change the force or moment of a system • Define "centre of mass" • Define "counterweight"	• Find a resultant vector for parallel and perpendicular vectors • Use Newton's laws to explain motion • Use F=ma formula to solve problems • Draw a free body diagram • Calculate resultant force • Label a diagram of a lever • State the formula for moments and use it to solve problems involving levers and gears • Use the formula to calculate increases/decreases in forces/moments • Describe and carry out a practical to determine the centre of mass of a 2D shape • Give examples of practical uses of moments in everyday life • Use the idea of centre of mass and moments to explain stability/toppling over • Draw a parallelogram of forces • Use the parallelogram of forces to calculate a resultant force • Find vertical and horizontal components of forces at an angle • Combine two vectors that are not at right angles • Use SOHCAHTOA and graphical methods to find solutions to vector problems	• Kerboodle Review Questions • Summative End of Unit Test • Investigative Practical Work – Centre of Mass • Practice Calculations • Interactive Kerboodle Resources:
Motion	• Define acceleration • Define displacement • Define distance • Define speed • Define velocity	• Plot and distance-time graphs • Describe an objects motion from its motion graph • Calculate speed from the graph • Use the formula a=(v-u)t/2 to solve problems • Explain the meaning of negative acceleration	• Kerboodle Review Questions • Summative End of Unit Test • Practice Calculations • Graph plotting/interpreting • Interactive Kerboodle Resources:

		• Plot speed-time graphs • Describe an object's motion from its motion graph • Plot a speed-time graph from a distance-time graph • Calculate acceleration and distance travelled from the graph • Interpret motion graphs to find meaningful values from gradients or areas • Use motion time graphs to accurately describe an object's journey • Making reference to key calculated values	
Forces and Motion	• Relate acceleration to force and mass • Define inertia • State difference between mass and weight • Describe motion of a falling object • Define terminal velocity • Describe resultant force for terminal velocity • State forces opposing forward motion of a vehicle • Define momentum • Describe conservation of momentum • Describe momentum of objects pushing each other apart • State factors that affect impact force, • Define elasticity • Describe how spring extension relates to force applies • Define limit of proportionality	• Calculate resultant force from acceleration and mass • Describe and explain factors affecting stopping distance • Calculate momentum including units • Solve problems involving the conservation of momentum • Describe how impact time affects force • Explain why increasing the impact time reduces the force • 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 • Measure extension of a stretched object,	• Kerboodle Review Questions • Summative End of Unit Test • Practice Calculations • Investigative Practical Work: Hooke's Law • Interactive Kerboodle Resources:
Forces and Pressure	• Define pressure • State unit of pressure, • Explain how liquid pressure increases with depth • Relate atmospheric density to altitude, • Define upthrust in a fluid, explain causes of upthrust	• Use P=F/A to solve problems • Explain significance of contact area for pressure • Explain why liquid pressure is constant along a horizontal line • Describe factors affecting liquid pressure	• Kerboodle Review Questions • Summative End of Unit Test • Practice Calculations • Interactive Kerboodle resources:

		• Calculate pressure caused by a liquid column • Explain why atmospheric pressure exists and changes with altitude • calculate force on flat objects due to pressure difference • Explain factors affecting pressure in fluid • Explain whether objects float or sink	
Wave Properties	• Give examples of uses of waves • Describe reflection and refraction • State when reflection and refraction of plane waves will happen • Describe sound waves • Describe how the loudness and pitch of a soundwave are affected • State limits of human hearing • Define ultrasound • Describe how ultrasound is used in SONAR and medicine • Define seismic waves	• Identify types of waves • Label key features of waves • Relate wave speed to frequency and wavelength • Use the formula $v=f\lambda$ • Explain why reflection and refraction occur • Investigate waves propagating on a string • Identify sound waves from oscilloscope traces • Give advantages of using ultrasound • Identify different types and state how they are produced, explain how seismic waves tell us about the structure of the earth	• Kerboodle Review Questions • Summative End of Unit Test • Practice Calculations • Investigative Practical Work: Waves on a String • Interactive Kerboodle Resources:
Electromagnetic Waves	• Identify parts of the EM spectrum • Identify wavelengths of visible light • Define white light • Identify different radio waves for different purposes • Describe fibre optics • Define ionising radiation • State why some EM waves are dangerous • State which materials will absorb X-Rays	• Calculate the wavelength or frequency of EM waves • Identify uses for microwaves, radio waves, and infrared • Complete IR required practical • Explain which waves are used for satellite communications • Explain what a carrier wave is • Identify uses of UV, Gamma, and X-Rays • Identify medical uses of X-Rays,	• Kerboodle Review Questions • Summative End of Unit Test • Investigative Practical Work: Infrared Radiation • Practice Calculations • Interactive Kerboodle resources:
Light	• State the law of reflection for light waves, • State where refraction of light waves happens • Explain the difference between colours of light and state the primary and secondary colours	• Draw and label a reflection diagram • Explain the difference between diffuse and specular reflection • Use diagrams to determine an image formed in a plane mirror • Draw and label diagrams of refraction	• Kerboodle Review Questions • Summative End of Unit Test • Practice Calculations • Graphical Scaled Diagrams • Interactive Kerboodle Resources:

	• Define convex and concave lenses	• Explain why refraction happens • Explain what determines the colour of a surface • Explain how light filters work • Draw diagrams of lenses • Calculate the magnification of a lens • Draw ray diagrams for images formed by lenses • State and explain the nature of the images formed from lenses when the object is at various distances from the lens	
Electromagnetism	• State the force rule for magnets near each other • Explain induced magnetism • State how the strength and direction of the field can be varied • State devices that use electromagnets • Define the motor effect • Label a diagram of a simple motor and explain how it works • Define the generator effect • Explain what is meant by induced potential • Describe a transformer and what it does • State where transformers are used • Explain how transformers work • Use the transformer formula to solve problems • Explain why high voltages are used in overhead power cables	• Draw field lines around a fixed magnet • Draw magnetic field lines around a current carrying wire • Define an electromagnet and label a diagram • Explain how electromagnets allow their devices to work • Use the Left Hand Rule to determine the force on a wire in a magnetic field • Use induced potential to explain how current can be induced in a wire and state what affects its size and direction • Label a diagram of a generator and explain how it works • Relate the ratio of coil numbers to ratio of potential differences • Discuss transformer efficiency	• Kerboodle Review Questions • Summative End of Unit Test • Practice Calculations • Interactive Kerboodle Resources:
Space	• Describe the solar system • Describe a protostar • Describe energy transfers in the sun • Identify stages of a star's life and describe what is happening at each stage • Describe an orbit and state the forces involved	• Draw a diagram of the solar system • Explain what is meant by a star's stability • Explain why some stars have different endings to their lives • Explain why a satellite needs to move at a particular speed • Describe and explain Red Shift	• Kerboodle Review Questions • Summative End of Unit Test • Interactive Kerboodle Resources:

	• Describe the direction of forces on a body in orbit • Describe how the velocity of a satellite changes • Describe and explain Red Shift • Relate red shift to an object's speed • Describe the Big Bang Theory • State evidence for the big bang such as Red Shift and CMBR	• Explain how red shift is used as evidence for an expanding universe • Explain how the evidence leads to the conclusion of the big bang • Discuss what might possibly happen to the universe in the future	