Curriculum Map: Physics year 13 spring term

	Teacher 1	Teacher 2
Content Declarative knowledge 'I Know'	**5.3 – oscillations** Define displacement, amplitude, frequency, time period, angular frequency, phase difference, isochronous, simple harmonic motion, damping, free oscillation, natural frequency, forced oscillation, driving frequency, resonance Draw the graphs of displacement, velocity and acceleration against time To recall the conditions for an object undergoing simple harmonic motion To give the energy transformations when an object undergoes SHM To state what happens to the amplitude of an oscillation when damping takes place To know the difference between damping and critical damping To know the practical uses for resonance To know the effect of damping on the amplitude of the resonant oscillation **5.4 – gravitational fields** Define gravitational field, gravitational field strength, Newton's law of gravitation, kepler's 3rd law, geostationary orbit, gravitational potential energy, gravitational potential, escape velocity To know the rules of gravitational field lines To know the field patterns around a point mass To recall examples of geostationary satellites To know the variation of gravitational field strength with distance To state all 3 of Kepler's laws To know that the acceleration due to gravity is the same as the gravitational field strength To know that gravitational potential is negative as force is an attractive force **6.5 – medical physics** Define x rays, intensity, Compton scattering, attenuation, contract media, CAT scan, gamma camera, collimator, scintillator, photomultiplier tube, PET scan, ultrasound, transducer, piezoelectric effect, acoustic impedance, impedance matching, the doppler effect. To know the variation of intensity of x rays with wavelength To know what contrast media helps with To recall advantages of a CAT scan compared to an x ray To know the function of a tracer and the conditions for choosing the correct tracer To know the functions of a gamma camera and what the gamma camera is used for To state comparisons between a PET scan and a CAT scan To know the uses of a PET scan To know uses of ultrasound and to compare it to other medical techniques To know that there are different types of scan	**6.3 – electromagnetism** Define magnetic field, solenoid, magnetic flux and magnetic flux density, weber, fleming's left hand rule, the motor effect, electromagnetic induction, induced emf, flux linkage, faraday's law, Lenz's law, generator, alternative current, transformer, efficiency To know the fields lines around a bar magnet To know factors that affect the strength of magnetic field of a wire To know the fields lines around the Earth To know the rules of field lines To give the motion of a charged particle in a magnetic field To recall the graphs of how the emf and flux varies with time To know the structure of a generator To know the difference between a step up and step down transformer To know the relationship between the number of turns and the voltage in the transformer **6.4 – nuclear and particle physics** Define proton number, isotope, nucleon number, strong nuclear force, Hadrons, leptons, quarks, neutrinos, weak nuclear force, radioactive decay, activity, half life, decay constant, carbon dating, annihilation, mass defect, binding energy pair production, chain reaction, control rod, moderator To know the alpha particle scattering experiment To recall the nuclear model of the atom To know the connection between nuclear radius and density To know the properties of each of the fundamental particles To recall the differences between alpha, beta and gamma rays including penetration power, ionisation ability, and the nature of particle To state the products of each type of radioactive decay to know that radioactive decay is a random and spontaneous process to know the equipment used to measure the radioactive decay of a radioactive source. To provide the graph for binding energy against nucleon number To know the difference between nuclear fusion and nuclear fission To recall the requirements needed for something to undergo fission and fusion.

Skills Procedural Knowledge 'I know how to'	**5.3 – oscillations** To know how to calculate the frequency and time period of an oscillation To calculate angular frequency and how to derive it from the definition To describe the motion of an oscillating mass on a spring To explain the variation of force at different points of an oscillating mass To use the definition of SHM to derive an equation for acceleration To use the equations for velocity and acceleration for SHM To use knowledge of oscillations and the equations for velocity and acceleration to give expressions for maximum acceleration and velocity To draw graphs of velocity or acceleration from one of displacement of velocity (applying knowledge of motion) Describe how the velocity, acceleration and displacement all vary over time in terms of amplitude. To conduct an experiment that investigates factors affecting SHM Calculate the kinetic or gravitational energy in an oscillation To explain the energy transformations that take place for a mass on a spring Describe the effects of damping Use knowledge of SHM to explain how Barton's pendulum works **5.4 – gravitational fields** To know how to draw gravitational field lines around masses To calculate the gravitational field strength using 2 equations To use newton's law of gravitation to solve proportionalities as well as calculating variables Describe the effect of the force when changing the mass or the distance apart To derive an equation for gravitational field strength from law of gravitation To explain the variation in field strength with distance To derive Kepler's 3rd law from circular motion theory To use Kepler's 3rd law to solve problems To explain motion of a geostationary orbit and how it varies with time To calculate both gravitational potential and potential energy To explain the variation of potential with distance to calculate the change in gravitation between 2 points in a gravitational field to calculate the escape velocity of the Earth using knowledge of kinetic energy **6.5 – medical physics** To explain how x rays are produced To calculate the energy of an x ray photon To describe the x ray production processes of simple scattering, Compton scattering, and pair production To explain how the intensity varies with thickness To use the equation for attenuation To describe how x rays are absorbed by the patient	**6.3 – electromagnetism** To use the equation for magnetic flux and flux density To know how to calculate the Area that is perpendicular to the magnetic field and to explain why this affects the flux To explain what happens to 2 magnetic fields in one area To use left hand rule to determine the direction of the force acting on a conductor To use the equation to calculate the force acting on a current carrying wire To describe an experiment that will investigate the force acting on a current carrying wire To describe the motion of a charged particle in a uniform magnetic field To use the equation for a moving particle in a magnetic field To derive an equation for the radius of the motion of a charged particle in a magnetic field To connect electric fields and magnetic fields and look at the motion of particles To explain how emf is induced in a current wire To describe the factors that increase the emf To use the right hand rule to determine the direction of the current on a conductor when it is moved in a magnetic field To explain how the magnetic flux varies through the magnetic field To use the equation for flux linkage To use the equation for faraday's law To use lenz's law to explain the direction of the magnetic field produced in a solenoid To combine and use faraday's law and lenz's law To describe the variation of current with time for AC generator To explain the variation of emf and flux with time for a generator To explain how a transformer works To use the equations for number of turns, power and voltage of transformers To use knowledge of efficiency to calculate power loss in the national grid **6.4 – nuclear and particle physics** To know how to describe Rutherford's alpha particle scattering experiment To explain the results of the scattering experiment To calculate the nucleon and atomic numbers for different elements To calculate the nuclear density and the strong nuclear force To describe how the strength of the strong nuclear force varies with separation

	To explain how a CAT scan works To describe how a tracer works To explain how the components of the gamma camera work To explain how a PET scan works To describe how a PET scan is carried out To describe how ultrasound travels through the body To explain how ultrasound waves are detected To use a graph showing the intensity of the reflected waves to calculate the distance the wave has travelled To know how to calculate the image from reflected time values To explain how a piezoelectric crystal produces ultrasound waves To calculate acoustic impedance To use acoustic impedance to calculate the variation in intensity To know how impedance matching works and why it is important To use the doppler equation to calculate the velocity of blood flow To explain how the doppler effect can be used to find the velocity of blood flow qualitatively	To describe an experiment that looks at radioactive decay To know how to write decay equations for alpha beta plus, beta minus and gamma To label a graph of nucleon number with when it is stable or unstable To use the equation for activity to identify decay constant To combine equations to produce an equation for half life To use the exponential equations for activity and nucleon number To know how to use the decay curves to calculate half life To know how to use natural logs to measure the decay constant To use data to calculate the number of half lives that have happened To use spreadsheets to model decay To describe an experiment used to measure the half life of radioactive decay Use the half life of a sample to predict the approximate age To use the equation linking mass and energy To use knowledge of mass defect to discuss what happens when particles bind To describe the binding energy graph and use it draw conclusions on the energy released Describe how a chain reaction works Describe the components of a nuclear reactor Explain what a moderator does and why it is important To write equations for the fusion reactions that happen in stars
Strategies Conditional Knowledge 'I know when to'	**5.3 – oscillations** Interpret diagrams for oscillating masses or pendulums and explain the variation to the force or the acceleration To know when the SHM equations should have max acceleration or max velocity To draw conclusions for a pendulum that satisfy the conditions for SHM To interpret the graphs for oscillations of displacement, velocity or acceleration to evaluate the data or draw conclusions about the oscillation To analyse the graphs of motion to comment on the variation of displacement/velocity or acceleration To interpret the energy graphs to draw conclusions on what transformations are taking place during each oscillation To know when to use a forces oscillation or a free oscillation To apply knowledge of resonance to explain the vibrations of different situations and any dangers there may be. To evaluate data from a practical investigate factors affecting SHM to draw conclusions and address uncertainties. **5.4 – gravitational fields**	**6.3 – electromagnetism** To interpret diagrams of magnetic flux to calculate the area To apply knowledge of the motor effect to different situations to predict the movement and to calculate the size of the force To evaluate the experiment on the flux density to highlight an uncertainties and how to improve accuracy Apply knowledge of Flemings rules to explain the motion of charged particles in electric and magnetic fields To know when to decide on the motion of a magnet to produce the magnetic field in a certain direction (using Lenz's law) To interpret graphs of flux or emf against time and use them to explain how a generator works Evaluate the efficiency of a transformer and to apply electricity knowledge to calculate power loss and resistance To know when to use each transformer equation for the question **6.4 – nuclear and particle physics** To know when to choose which type of radioactivity is most suitable for the use using the properties

	To interpret graph of force variation with distance for gravitational energy and to draw conclusions and calculate work done To apply knowledge of year 12 theory to derive formula for escape velocity To know when to use theory for potential compared to potential energy To compare and contrast gravitational fields with electric fields To apply knowledge of circular motion to derive Kepler's 3rd law Interpret diagrams connected to Newton's law of gravitation to draw conclusions and to predict result when changing a variable. **6.5 – medical physics** To know when to apply the different methods of x ray production and the reasons why each is used To discuss and compare and decide whether a CAT scan or an x ray is the better option To evaluate the use of medical tracers based on evidence given To compare and contrast PET scans with CAT scans To interpret the diagrams for PET scans and to use them to explain how the process works To draw conclusions about the ultrasound from a graph of the results, analysing the data to calculate the distance away To know when to describe an A scan or a B scan To apply knowledge of the doppler effect to explain how you can measure the flow of blood	To evaluate the experiment comparing radioactive decay to look at improving accuracy To evaluate the limitations of carbon dating To interpret decay curves to discuss relationships, half life, and also discuss the differences in decay Draw conclusions from the half life practical and discuss any associated limitations To use the binding energy graph to know when an atom will undergo fission or fusion To interpret energy data and use these to calculate the mass involved in reactions To know when to decide if nuclear fusion and fission is a good idea based on evidence provided. This includes the impact of environmental impact of nuclear waste
Key Questions	How does resonance happen? What is simple harmonic motion? How does a PET scan, CAT scan, X rays gamma camera work? What are the implications of each diagnostic technique? How does a satellite stay in orbit?	What are the impacts of radioactive decay, nuclear fusion and nuclear fission? How many particles are there in the universe? How does a generator work? How can electricity be used to explain the rotational movement of a generator? How is electricity linked with magnetism?
Assessment topics	End of module 5.3 assessment. PPE in February assessing all year 13 content, medical physics assessed around Easter	end of electromagnetism topic in February and it is assessed in PPEs at end of Feb. Radioactivity topic assessed round Easter in end of topic assessment
Cross curricular links/Character Education	Ultrasound, x rays and PET scans – Biology Rearranging equations and interpreting graphs - maths Resonance and frequency – music Satellites – geography	maths – rearranging equations, graphical analysis DT electronics – electromagnetism Chemistry – decay and minding energy with nuclear density and nuclear forces Geography – environmental impacts of nuclear fission and fusion History – history of the atom and experiments that led up to the nuclear model.