GCSE Physics Academic Overview 2018-2019

Science						
	Term 1.1	**Term 1.2**	**Term 2.1**	**Term 2.2**	**Term 3.1**	**Term 3.1**
Year 9	Motion Forces 1 Newton's Laws Forces 2 Momentum and Safety	Energy	Waves Light	EM Waves Radioactivity 1 Atoms and isotopes	Radioactivity 2 Nuclear decay and nuclear energy	End of year assessment preparation and feedback
Year 10	Astronomy Forces doing work and their Effects	Electricity 1 Circuits and resistance Electricity 2 Energy transfers and electrical safety	Static Electricity Magnetism	Particle Model	Forces and Matter	End of year assessment preparation and feedback
Year 11	Particle Model	Forces and matter and forces doing work	PPE 1 feedback and revision	PPE 2 preparation and feedback	Revision for GCSE examinations	

Year 9 GCSE Physics Curriculum Content Overview 2018-2019

Knowledge and Skills Students will be taught to….	
• Recall, use and apply a variety of equations relating to motion, forces, energy, waves and radioactivity • Analyse and interpret information presented in a variety of forms including graphs, tables and writen text • Carry out practical activities in order to obtain results and explain their findings using correct scientific principles • For each core pracical explain; what equipment is used, how to carry out the practical, what is being changed (independent variable), what is being measured (dependent variable), what is being controlled and why • Draw labelled diagrams of relevant practical equipment • Describe, explain and analyse information regarding the motion of objects including the use of distance-time and velocity-time graphs • Explain the effects of a variety of different forces and how these relate to Netwons laws of motion • Describe and explain how Newtons second law can be investigated • Explain how momentum is conserved during collisions and how this relates to safety features in vehicles • Explain mathematically the relationship between braking distance and energy • Explain how energy is conserved when being transferred to one form or another as both both useful and unwated forms of energy • Interpret energy transfer diagrams and evaluate the efficiency of the energy transfers • Explain the differnce between renewable and non renewable energy sources and how the use of these has changed over time • Identify the parts of waves and use these to explain the differences between different types of waves • Describe and explain how the speed of a wave can be investigated in air, liquids and solids • Describe and explain how the ear is adapted for its function	• How ultra and infrasound are used • Describe and explain the process of refraction, how it can be investigated and how it is used in the different forms of lenses • Explain how we see different colours and how this is affected by different filters • Recall and describe the parts, properties, uses and dangers of the Electromagnetic Spectrum • Recall the structure of the atom and describe how atomic models have chaged over time with reference to key scientists and discoveries • Describe and explain the process of radioactive decay including the changes that occur in the nucleus and the properties of each type of radiation • Explain the dangers of ionising radiation and why different isotopes have different half lives • Explain the different uses of radioactivity in medicine • Explain how nuclear energy can be produced in different ways and the impact this has had on society

Reading, Oracy, Literacy and Numeracy	Assessment
Reading • Edexcel combined science text book • Recommended reading texts • CGP revision guide • PLC checklists	**Formative** • Questioning in lessons • Live student performance in lessons followed by questions • Whole class feedback during lessons • Regular peer and self assessment • Book checks for general presentation, work completion and spellings • Low stakes quizzing • Learning checkpoints in between main assessments **Summative** • 3 cumulative assessments throughout the year
Numeracy • Recall of key values and quantities • Recall, use and application of equations • Conversion between units • Working with numbers in standard form • Drawing appropriate graphs and tables with suitable scales/ headings and plotting/ recording data • Describing mathematical patterns in experimental data and explaining them using scientific concepts • Perform calculations based on extracting data from both tables and graphs	
Oracy and Literacy • Key words • Writing a method for core practicals • Six mark questions	

ERASMUS DARWIN ACADEMY

Excellence for All

Assessment Skills, Knowledge and Concepts Map

Key learning questions	Edexcel GCSE Physics Year 9 Assessment Phase 1 Motion
☐ What is the difference between scalar and vectors quantities? ☐ What are some typical speeds for everyday activities such as walking, running, cycling and driving a car? ☐ What are the equations related to the motion of an object? ☐ What do the different lines mean on distance-time and velocity-time graphs? ☐ How can you calculate speed, acceleration and distance from graphs of motion? ☐ Describe how light gates and other equipment can be used to measure speed and acceleration?	☐ Describe what scalar and vector quantities are and explain the differences ☐ Recall vector and scalar quantities, including: displacement/distance, velocity/speed, acceleration, force, weight/mass, momentum and energy ☐ Define what velocity is ☐ Recall and use the equations: (average) speed (metre per second, m/s) = distance (metre, m) ÷ time (s), distance travelled (metre, m) = average speed (metre per second, m/s) × time (s) ☐ Analyse distance/time graphs including determination of speed from the gradient ☐ Recall and use the equation: a=(v-u)/t, Use the equation: $v^2 - u^2 = 2 \times a \times x$ ☐ Analyse velocity/time graphs to: compare acceleration from gradients qualitatively, calculate the acceleration from the gradient (for uniform acceleration only), determine distance travelled using area between the graph line and the axis (for uniform acceleration only) ☐ Describe a range of laboratory methods for determining the speeds of objects such as the use of light gates ☐ Recall some typical speeds encountered in everyday experience for wind and sound, and for walking, running, cycling and other transportation systems
Key learning questions	**Forces Part 1 Newtons Laws**
☐ What is a resultant force and how can you calculate it? ☐ Explain what happens to the motion of an object when the resultant force is zero and when it is not zero ☐ Describe the relationship between mass, weight and gravitational field strength ☐ Describe the relationship between force, mass and acceleration and the practical techniques you would use to observe this ☐ HT Only: Explain using an example why an object moving in a circular path is accelerating ☐ HT Only: Explain what is meant by inertia ☐ Describe examples of Newton's third law giving the names of the forces involved	☐ Recall Newton's first law and use it where the resultant force on a body is zero and where the resultant force is not zero ☐ Recall and use Newton's second law as: F = m x a ☐ Define weight, recall and use the equation: W = m x g ☐ Describe how weight is measured and the relationship between the weight of a body and the gravitational field strength ☐ Core Practical: Investigate the relationship between force, mass and acceleration by varying the masses added to trolleys ☐ HT ONLY: Explain that an object moving in a circular orbit at constant speed has a changing velocity ☐ HT ONLY: Explain that for motion in a circle there must be a resultant force known as a centripetal force that acts towards the centre of the circle ☐ HT ONLY: Explain that inertial mass is a measure of how difficult it is to change the velocity of an object ☐ Recall and apply Newton's third law both to equilibrium situations

Key learning questions	Forces Part 2 Momentum and Safety
☐ Explain how action-reaction forces are different to resultant forces using examples ☐ HT Only: How can you show using equations that momentum is conserved during collisions? ☐ HT Only: Describe and explain the size and direction of the forces experienced by two objects colliding using Newton's third law ☐ Explain how different factors can affect both reaction time and stopping distance of a car ☐ Describe how stopping distance changes with speed ☐ How can thinking distance and stopping distance be determined using a velocity-time graph?	☐ Recall and apply Newton's third law both to equilibrium situations ☐ HT ONLY: Recall and apply Newton's third law collision interactions and relate it to the conservation of momentum in collisions ☐ HT ONLY: Define momentum, recall and use the equation: p = m x v ☐ HT ONLY: Describe examples of momentum in collisions ☐ HT ONLY: Use Newton's second law as: F = (mv - mu)/t ☐ Explain methods of measuring human reaction times and recall typical results ☐ Recall what the stopping distance of a vehicle is the sum of and explain the effect of named factors on stopping distance ☐ Describe the factors that could affect a driver's reaction time ☐ Explain the dangers caused by large decelerations ☐ HT ONLY: Estimate the forces involved in typical situations on a public road due to decelerations ☐ Estimate how the distance required for a road vehicle to stop in an emergency varies over a range of typical speeds ☐ Carry out calculations showing the link between braking distance and work done (with work being equal to kinetic energy)

Key learning questions	Edexcel GCSE Physics Year 9 Assessment Phase 2 Energy
☐ Explain what factors affect GPE and KE ☐ Explain how energy can be transferred between GPE and KE in situations when an object is moving up and down ☐ What is meant by conservation of energy? ☐ Describe some typical energy transfers in everyday situations ☐ Describe common ways in which energy can be dissipated in unwanted forms and how these can be reduced ☐ Explain how different building materials can affect the rate of heat loss using the term thermal conductivity	☐ Recall and use the equation to calculate the change in gravitational PE: $\Delta GPE = m \times g \times \Delta h$ ☐ Recall and use the equation to calculate the amounts of energy associated with a moving object: $KE = \frac{1}{2} \times m \times v2$ ☐ Draw and interpret diagrams to represent energy transfers ☐ Explain what is meant by conservation of energy and that in a closed system there is no net change in the total energy when energy is transferred from one store into another ☐ Analyse the changes involved in energy stors and transfers for an object projected upwards or up a slope, hitting an obstacle, being accelerated by a constant force, a vehicle slowing down, bringing water to a boil in an electric kettle ☐ Explain how energy can be dissipated and stored in less useful ways such as heating the surroundings ☐ Explain ways of reducing unwanted energy transfer including through lubrication and thermal insulation ☐ Describe the effects of the thickness and thermal conductivity of the walls of a building on its rate of cooling qualitatively ☐ Recall and use the equation: efficiency = useful energy transferred / total energy supplied ☐ HT ONLY: Explain how efficiency can be increased

☐ Explain the difference between renewable and non-renewable and explain how their use has changed over time	☐ Describe the main energy sources available for use on Earth and compare the ways in which both renewable and non-renewable sources are used and how patterns and trends in their use have changed over time
Key learning questions	**Waves**
☐ Explain using examples such as a cork floating in water how waves transfer energy and not matter ☐ Draw a labelled diagram to show the difference between longitudinal and transverse waves ☐ Describe how to observe reflection and refraction using practical equipment ☐ HT Only: Explain why refraction occurs in terms of wave speed ☐ HT Only: Explain what happens to the wavelength of waves during refraction ☐ Explain how to measure the speed of waves in air using a stop watch or microphone connected to an oscilloscope ☐ What are the different parts of the ear and how do they convert sound waves into vibrations and how does this lead to hearing? ☐ What frequency are ultra and infrasound waves? ☐ How does foetal scanning and sonar work? ☐ What do S and P waves tell us about the structure of the Earth?	☐ Recall that waves transfer energy and information without transferring matter ☐ Define and use the terms frequency, wavelength, amplitude, period, wave velocity and wavefront as applied to waves ☐ Describe the difference between longitudinal and transverse waves by referring to specific examples ☐ Recall and use both the equations for all waves: $v = f \times \lambda$ and $v = x/t$ ☐ Describe how to measure the velocity of sound in air and ripples on water surfaces ☐ Describe the effects of reflection and refraction of waves at material interfaces ☐ Explain how waves will be refracted at a boundary in terms of the change of direction ☐ HT ONLY: Explain how waves will be refracted at a boundary in terms of the change of speed ☐ Core Practical: Investigate the suitability of equipment to measure the speed, frequency and wavelength of a wave in a solid and a fluid ☐ Describe the processes which convert wave disturbances between sound waves and vibrations in solids ☐ Explain how the human ear works and why the processes involved only work over a limited frequency ☐ Recall what an ultrasound wave is ☐ Explain the uses of ultrasound including sonar and foetal scanning ☐ Be able to calculate depth (relating to ultrasound waves) from time and wave velocity ☐ Recall what an infrasound is ☐ Explain the uses of infrasound including exploration of the Earth's core
Key learning questions	**EM Spectrum Part 1 Light**
☐ What are the laws of reflection and refraction? ☐ What is the difference between specular and diffuse reflection? ☐ What are the key parts of a ray diagram? ☐ When does total internal reflection occur? ☐ What are the two different types of lenses and what types of images can they form? ☐ What makes a lens more powerful? ☐ How do you see a particular colour of light? ☐ What happens to light as it travels through a filter?	☐ Explain, with the aid of ray diagrams, reflection, refraction and total internal reflection (TIR), including the law of reflection and critical angle ☐ Explain the difference between specular and diffuse reflection ☐ Explain how colour of light is related to differential absorption at surfaces and transmission of light through filters ☐ Relate the power of a lens to its focal length and shape ☐ Use ray diagrams to show the similarities and differences in the refraction of light by converging and diverging lenses ☐ Explain the effects of different types of lens in producing real and virtual images

Key learning questions	Edexcel GCSE Physics Year 9 Assessment Phase 3 EM Spectrum Part 2 Properties, Uses and Dangers of EM Waves
☐ What is the EM spectrum? ☐ What properties do all EM waves have in common? ☐ What is refraction? ☐ Describe and explain how the speed and direction of an EM wave will change in different mediums ☐ Describe how you can observe refraction in a practical ☐ Describe and explain an example for how each part of the EM spectrum can be useful ☐ Describe and explain which parts of the EM spectrum are most damaging and why ☐ HT Only: Explain how radio waves are produced and detected ☐ HT Only: Explain why radio waves are used for long distance communication	☐ Recall that all electromagnetic waves are transverse, that they travel at the same speed in a vacuum ☐ Explain, with examples, that all electromagnetic waves transfer energy from source to observer ☐ Investigate refraction in rectangular glass blocks in terms of the interaction of electromagnetic waves with matter ☐ HT ONLY: Explain refraction at a boundary in terms of change in speed and wave fronts ☐ Recall and describe the main groupings of the continuous electromagnetic spectrum ☐ Recall that our eyes can only detect a limited range of frequencies of electromagnetic radiation ☐ Recall that the potential danger associated with an electromagnetic wave increases with increasing frequency ☐ Describe the harmful effects on people of excessive exposure to electromagnetic radiation ☐ Describe some uses of electromagnetic radiation ☐ HT ONLY: Recall that radio waves can be produced by, or can themselves induce, oscillations in electrical circuits ☐ Recall that changes in atoms and nuclei can generate radiations over a wide frequency range and be caused by absorption of a range of radiations ☐ Explain that all bodies emit radiation, that the intensity and wavelength distribution of any emission depends on their temperature ☐ HT ONLY: Explain that for a body to be at a constant temperature it needs to radiate the same average power that it absorbs ☐ HT ONLY: Explain what happens to a body if the average power it radiates is less or more than the average power that it absorbs ☐ HT ONLY: Explain how the temperature of the Earth is affected by factors controlling the balance between incoming radiation and radiation emitted ☐ Core Practical: Investigate how the nature of a surface affects the amount of thermal energy radiated or absorbed
Key learning questions	**Radioactivity 1 Atoms and Isotopes**
☐ Describe the plum pudding model of the atom and the reasons it was proposed ☐ Describe and explain how Rutherford and Bohr's observations led the current nuclear model of the atom ☐ Describe the current nuclear model of the atom including the location of the subatomic particles ☐ Describe what is meant by an 'electron energy level' ☐ Describe what can happen to an electron if it absorbs energy including ionisation	☐ Recall and describe the structure of the atom including; the typical size (order of magnitude) of atoms and small molecules, the names and properties of the particles found in an atom and where in the atom they are located ☐ Describe how and why the atomic model has changed over time with reference to the plum pudding model, Rutherford's aplha scattering experiment and the work of Niels Bohr on absorption and emission spectra ☐ Define the term isotope and describe how the nuclei of different isotopes are different ☐ Recall the relative masses and relative electric charges of protons, neutrons, electrons and positrons ☐ Recall that in an atom the number of protons equals the number of electrons and is therefore neutral ☐ Recall that in each atom its electrons orbit the nucleus at different set distances from the nucleus ☐ Explain that electrons change orbit when there is absorption or emission of electromagnetic radiation ☐ Explain how atoms may form positive ions

Key learning questions	Radioactivity 2 Nuclear Decay, Dangers and Uses in Medicine
☐ Explain why an alpha particle can be described as a helium nucleus ☐ Describe the difference between a β– and a β+ particle ☐ Which type of radiation is most ionising and which is most penetrating? ☐ For each type of radioactive decay, state what happens to both the atomic and mass number of an isotope ☐ Describe how photographic film and a Geiger–Müller tube can be used to measure and monitor the levels of radiation ☐ Explain what is meant by half-life and activity ☐ Explain what is meant by background radiation and why some people are exposed to higher levels than others ☐ List the safety precautions that need to be taken when working with or being exposed to radiation ☐ Describe how the half-life of a radioactive source is related to dangers it poses ☐ How is radioactivity used on fire alarms, sterilising food and medical equipment and in gauging thickness? ☐ How is radioactivity used in medical tracers, PET scans and radiotherapy? ☐ How are the isotopes using in internal and external treatment of cancer different?	☐ Recall that alpha, β–, β+, gamma rays and neutron radiation are emitted from unstable nuclei in a random process and that alpha, β–, β+ and gamma rays are ionising radiation ☐ Explain what is meant by background radiation and recall sources of background radiation from Earth and space ☐ Describe methods for measuring and detecting radioactivity using photographic film and a Geiger–Müller tube ☐ Recall and compare the make up and properties of alpha, beta and gamma radiation ☐ Describe the process of β– and β+ decay in terms of changes to the nucleus ☐ Explain the effects on the atomic (proton) number and mass (nucleon) number of radioactive decays (α, β, γ and neutron emission) ☐ Recall that nuclei that have undergone radioactive decay often undergo nuclear rearrangement with a loss of energy as gamma radiation ☐ Use given data to balance nuclear equations in terms of mass and charge ☐ Describe how the activity of a radioactive source decreases over a period of time and that the unit of activity of a radioactive isotope is the Becquerel, Bq ☐ Explain what is meant by half-life and how this relates to the random nature of decay ☐ Use the concept of half-life to carry out simple calculations on the decay of a radioactive isotope, including graphical representations ☐ Describe the dangers of ionising radiation in terms of tissue damage and possible mutations and relate this to the precautions needed ☐ Explain how the dangers of ionising radiation depend on half-life and relate this to the precautions needed ☐ Explain the precautions taken to ensure the safety of people exposed to radiation, including limiting the dose ☐ Describe the differences between contamination and irradiation effects and compare the hazards associated with these two ☐ Describe uses of radioactivity in: the home, industry and medicine ☐ Compare and contrast the treatment of tumours using radiation applied internally or externally ☐ Explain some of the uses of radioactive substances in diagnosis of medical conditions, including PET scanners and tracers ☐ Explain why isotopes used in PET scanners have to be produced nearby

Key learning questions	Radioactivity 3 Nuclear Power
☐ How is the energy produced in nuclear power stations used? ☐ What are the advantages and disadvantages of nuclear power? ☐ What is nuclear fission and a chain reaction? ☐ How are chain reactions controlled in a nuclear reactor? ☐ What is nuclear fusion and where is it common? ☐ What conditions are needed for nuclear fission to take place?	☐ Evaluate the advantages and disadvantages of nuclear power for generating electricity ☐ Recall that nuclear reactions, including fission, fusion and radioactive decay, can be a source of energy ☐ Explain the fission of U-235 ☐ Explain the principle of a controlled nuclear chain reaction ☐ Explain how the chain reaction is controlled in a nuclear reactor, including the action of moderators and control rods ☐ Describe how thermal (heat) energy from the chain reaction is used in the generation of electricity in a nuclear power station ☐ Recall that the products of nuclear fission are radioactive ☐ Describe nuclear fusion ☐ Explain the difference between nuclear fusion and nuclear fission ☐ Explain why nuclear fusion does not happen at low temperatures and pressures ☐ Relate the conditions for fusion to the difficulty of making a practical and economic form of power station