HASTINGS HIGH SCHOOL

YEAR 11 EXAMINATION GUIDE

Subject	COMBINED SCIENCE TRILOGY Physics
Course code	AQA GCSE COMBINED SCIENCE TRILOGY Physics 8464
Website address	http://www.aqa.org.uk/subjects/science/gcse/combined-science-trilogy-8464
Provisional examination dates	Paper 1: Topics 18-21: Energy, Electricity, Particle model of matter, Atomic structure: Paper 2: Topics 22-24: Forces, Waves, Magnetism and Electromagnetism. **Tuesday 22nd June 2021**
GCSE grade type awarded	9-1 (New 2016 Specification)
Coursework	There is no coursework but students are tested on 8 key practical investigations completed during the course in both examination papers.
Paper 1 **Paper 2**	**Paper 1**: Written exam: 1 hour 15 minutes Foundation and Higher Tiers 70 marks 16.7% of GCSE **Paper 2:** Written exam: 1 hour 15 minutes Foundation and Higher Tier 70 marks 16.7% of GCSE *Multiple choice, structured, closed short answer and open response style questions will be given in the examinations.* *40% of the Physics examinations as a minimum will be Mathematically based questions.*
Extra Support	The class will use past papers extensively throughout the course. We will focus on the extended style questions and the mathematical requirements of the course. Students have also been provided with a Required Practical Handbook.
Revision book	CGP Higher Revision Guide ISBN: 978 1 78294 559 8 CGP Higher Revision Guide ISBN: 978 1 78294 560 4
Useful websites	https://www.youtube.com/@Cognitoedu

	https://www.senecalearning.com/ https://www.bbc.co.uk/bitesize/examspecs/z8r997h

KNOWLEDGE GAPS ANALYSIS

Topic	Collins (H)	Collins (F)	Notes
Unit 18 Energy	P170-201	P164-167	
P6.1.1 Energy changes in a System			
Define a system as an object or group of objects and state examples of changes in the way energy is stored in a system	170	164	
Describe how all the energy changes involved in an energy transfer and calculate relative changes in energy when the heat, work done or flow of charge in a system changes	170	165	
Use calculations to show on a common scale how energy in a system is redistributed	170	164	
Calculate the kinetic energy of an object by recalling and applying the equation: ***[$E_k = ½mv^2$]***	170	164	
Calculate the amount of elastic potential energy stored in a stretched spring by applying, but not recalling, the equation: ***[$E_e= ½ke^2$]***	170	164	
Calculate the amount of gravitational potential energy gained by an object raised above ground level by recalling and applying, the equation: ***[$E_e = mgh$]***	170	164	
Calculate the amount of energy stored in or released from a system as its temperature changes by applying, but not recalling, the equation: ***[$ΔE = mcΔθ$]***	170	166	
Define the term 'specific heat capacity'	171	165	

Topic	Collins (H)	Collins (F)	Notes
Define power as the rate at which energy is transferred or the rate at which work is done and the watt as an energy transfer of 1 joule per second	171	164	
Calculate power by recalling and applying the ***equations:*** ***[P = E/t & P = W/t]***	171	164	
Explain, using examples, how two systems transferring the same amount of energy can differ in power output due to the time taken	171	166	
P6.1.2 Conservation and dissipation of Energy			
State that energy can be transferred usefully, stored or dissipated, but cannot be created or destroyed and so the total energy in a system does not change	171	166	
Explain that only some of the energy in a system is usefully transferred, with the rest 'wasted', giving examples of how this wasted energy can be reduced	171	166	
Explain ways of reducing unwanted energy transfers and the relationship between thermal conductivity and energy transferred	172	166	
Describe how the rate of cooling of a building is affected by the thickness and thermal conductivity of its walls	172		
Calculate efficiency by recalling and applying the equation: ***[efficiency = useful power output / total power input]***	172		
HT ONLY: Suggest and explain ways to increase the efficiency of an intended energy transfer	172		
P6.1.3 National and Global Energy Resources			
List the main renewable and non-renewable energy resources and define what a renewable energy resource is	173	167	

Topic	Collins (H)	Collins (F)	Notes
Compare ways that different energy resources are used, including uses in transport, electricity generation and heating	173	167	
Explain why some energy resources are more reliable than others, explaining patterns and trends in their use	173	167	
Evaluate the use of different energy resources, taking into account any ethical and environmental issues which may arise	173	167	
Justify the use of energy resources, with reference to both environmental issues and the limitations imposed by political, social, ethical or economic considerations	173	167	

Topic	Collins (H)	Collins (F)	Notes
Unit 2 Electricity	188-221	182-213	
P6.2.1 Current, potential difference and resistance			
Draw and interpret circuit diagrams, including all common circuit symbols	188	182	
Define electric current as the rate of flow of electrical charge around a closed circuit	188	182	
Calculate charge and current by recalling and applying the formula: ***[Q = It]***	188	182	
Explain that current is caused by a source of potential difference and it has the same value at any point in a single closed loop of a circuit	188	182	
Describe and apply the idea that the greater the resistance of a component, the smaller the current for a given potential difference (p.d.) across the component	190	184	
Calculate current, potential difference or resistance by recalling and applying the equation: ***[V = IR]***	190	184	
Define an ohmic conductor	190	184	
Explain the resistance of components such as lamps, diodes, thermistors and LDRs and sketch/interpret IV graphs of their characteristic electrical behaviour	190	185	
Explain how to measure the resistance of a component by drawing an appropriate circuit diagram using correct circuit symbols	192	184	
P.6.2.2 Series and Parallel circuits			
Show by calculation and explanation that components in series have the same current passing through them	192	186	
Show by calculation and explanation that components connected in parallel have the same the potential difference across each of them	192	186	

Topic	Collins (H)	Collins (F)	Notes
Calculate the total resistance of two components in series as the sum of the resistance of each component using the equation: ***[$R_{total} = R_1 + R_2$]***	190	186	
Explain qualitatively why adding resistors in series increases the total resistance whilst adding resistors in parallel decreases the total resistance	1890	186	
Solve problems for circuits which include resistors in series using the concept of equivalent resistance	190	186	
P6.2.3 Domestic uses and safety			
Explain the difference between direct and alternating voltage and current, stating what UK mains is	194	188	
Identify and describe the function of each wire in a three-core cable connected to the mains	194	188	
State that the potential difference between the live wire and earth (0 V) is about 230 V and that both neutral wires and our bodies are at, or close to, earth potential (0 V)	194	188	
Explain that a live wire may be dangerous even when a switch in the mains circuit is open by explaining the danger of providing any connection between the live wire and earth	194	188	
P6.2.4 Energy Transfers			
Explain how the power transfer in any circuit device is related to the potential difference across it and the current through it	195	189	
Calculate power by recalling and applying the equations: ***[$P = VI$]*** and ***[$P = I^2 R$]***	195	189/ 190	
Describe how appliances transfer energy to the kinetic energy of motors or the thermal energy of heating devices	195	184	
Calculate and explain the amount of energy transferred by electrical work by recalling and applying the equations: ***[$E = Pt$]*** and ***[$E = QV$]***	195	189/190	

Topic	Collins (H)	Collins (F)	Notes
Explain how the power of a circuit device is related to the potential difference across it, the current through it and the energy transferred over a given time.	195	189	
Describe, with examples, the relationship between the power ratings for domestic electrical appliances and the changes in stored energy when they are in use	196	189/190	
Identify the National Grid as a system of cables and transformers linking power stations to consumers	197	191	
Explain why the National Grid system is an efficient way to transfer energy, with reference to change in potential difference reducing current	197	191	

Topic	Collins (H)	Collins (F)	Notes
Unit 3 Particle model of matter	210-227	202-219	
P6.3.1 Changes of state and particle model			
Calculate the density of a material by recalling and applying the equation: [ρ = m/V]	210	202	
Recognise/draw simple diagrams to model the difference between solids, liquids and gases	210	202	
Use the particle model to explain the properties of different states of matter and differences in the density of materials	210	202	
Recall and describe the names of the processes by which substances change state	210	203	
Use the particle model to explain why a change of state is reversible and affects the properties of a substance, but not its mass	210	203	
P6.3.2 Internal energy and energy transfers			
State that the internal energy of a system is stored in the atoms and molecules that make up the system	211	203	
Explain that internal energy is the total kinetic energy and potential energy of all the particles in a system	211	203	
Calculate the change in thermal energy by applying but not recalling the equation ***[$\Delta E = m\ c\ \Delta\theta$]***	211	203	
Calculate the specific latent heat of fusion/vaporisation by applying, but not recalling, the equation: ***[E = mL]***	211	203	
Interpret and draw heating and cooling graphs that include changes of state	211	203	
Distinguish between specific heat capacity and specific latent heat	211	203	
P6.3.3 Particle model and pressure			
Explain why the molecules of a gas are in constant random motion and that the higher the temperature of a gas, the greater the particles' average kinetic energy	211	203	

Topic	Collins (H)	Collins (F)	Notes
Explain, with reference to the particle model, the effect of changing the temperature of a gas held at constant volume on its pressure	211	203	
Calculate the change in the pressure of a gas or the volume of a gas (a fixed mass held at constant temperature) when either the pressure or volume is increased or decreased	211	203	

Topic	Collins (H)	Collins (F)	Notes
Unit 4 Atomic structure	212-219	204-208	
P6.4.1 Atoms and isotopes			
Describe the basic structure of an atom and how the distance of the charged particles vary with the absorption or emission of electromagnetic radiation	212	204	
Define electrons, neutrons, protons, isotopes and ions	212	204	
Relate differences between isotopes to differences in conventional representations of their identities, charges and masses	212	204	
Describe how the atomic model has changed over time due to new experimental evidence, inc discovery of the atom and scattering experiments (inc the work of James Chadwick)	213	205	
P6.4.2 Atoms and nuclear radiation			
Describe and apply the idea that the activity of a radioactive source is the rate at which its unstable nuclei decay, measured in Becquerel (Bq) by a Geiger-Muller tube	214	206	
Describe the penetration through materials, the range in air and the ionising power for alpha particles, beta particles and gamma rays	214	206	
Apply knowledge of the uses of radiation to evaluate the best sources of radiation to use in a given situation	214	206	
Use the names and symbols of common nuclei and particles to complete balanced nuclear equations, by balancing the atomic numbers and mass numbers	217		
Define half-life of a radioactive isotope	214	208	
HT ONLY: Determine the half-life of a radioactive isotope from given information and calculate the net decline, expressed as a ratio, in a radioactive emission after a given number of half-lives	216		

Topic	Collins (H)	Collins (F)	Notes
Compare the hazards associated with contamination and irradiation and outline suitable precautions taken to protect against any hazard the radioactive sources may present	215	207	
Discuss the importance of publishing the findings of studies into the effects of radiation on humans and sharing findings with other scientists so that they can be checked by peer review	215		

Topic	Collins (H)	Collins (F)	Notes
Unit 5 Forces	158-200	154-194	
P6.5.1 Forces and their interactions			
Identify and describe scalar quantities and vector quantities	158	154	
Identify and give examples of forces as contact or non-contact forces	158	154	
Describe the interaction between two objects and the force produced on each as a vector	158	154	
Describe weight and explain that its magnitude at a point depends on the gravitational field strength	159	155	
Calculate weight by recalling and using the equation: ***[W = mg]***	159	155	
Represent the weight of an object as acting at a single point which is referred to as the object's 'centre of mass'	158		
Calculate the resultant of two forces that act in a straight line	159	155	
HT ONLY: describe examples of the forces acting on an isolated object or system	159		
HT ONLY: Use free body diagrams to qualitatively describe examples where several forces act on an object and explain how that leads to a single resultant force or no force	159		
HT ONLY: Use free body diagrams and accurate vector diagrams to scale, to resolve multiple forces and show magnitude and direction of the resultant	159		
HT ONLY: Use vector diagrams to illustrate resolution of forces, equilibrium situations and determine the resultant of two forces, to include both magnitude and direction	159		
P6.4.2 Work done and energy transfer			
Describe energy transfers involved when work is done and calculate the work done by recalling and using the equation: *[W = Fs]*	160	156	
Describe what a joule is and state what the joule is derived from	160	156	

Topic	Collins (H)	Collins (F)	Notes
Convert between newton-metres and joules.	160	156	
Explain why work done against the frictional forces acting on an object causes a rise in the temperature of the object	160	156	
P6.5.3 Forces and elasticity			
Describe examples of the forces involved in stretching, bending or compressing an object	161	157	
Explain why, to change the shape of an object (by stretching, bending or compressing), more than one force has to be applied – this is limited to stationary objects only	161	157	
Describe the difference between elastic deformation and inelastic deformation caused by stretching forces	161	157	
Describe the extension of an elastic object below the limit of proportionality and calculate it by recalling and applying the equation: ***[F = ke]***	161	157	
Explain why a change in the shape of an object only happens when more than one force is applied	161	157	
Describe and interpret data from an investigation to explain possible causes of a linear and non-linear relationship between force and extension	161	157	
Calculate work done in stretching (or compressing) a spring (up to the limit of proportionality) by applying, but not recalling, the equation: [$E_e = ½ke^2$]	161	157	
P4.5.4 Forces and motion			
Define distance and displacement and explain why they are scalar or vector quantities	162	154/156	
Express a displacement in terms of both the magnitude and direction	162	156	
Explain that the speed at which a person can walk, run or cycle depends on a number of factors and recall some typical speeds for walking, running, cycling	162	156	

Topic	Collins (H)	Collins (F)	Notes
Make measurements of distance and time and then calculate speeds of objects in calculating average speed for non-uniform motion	161	158	
Explain why the speed of wind and of sound through air varies and calculate speed by recalling and applying the equation: ***[s = v t]***	161	158	
Explain the vector–scalar distinction as it applies to displacement, distance, velocity and speed	161	158	
HT ONLY: Explain qualitatively, with examples, that motion in a circle involves constant speed but changing velocity	161		
Represent an object moving along a straight line using a distance-time graph, describing its motion and calculating its speed from the graph's gradient	162	159	
Draw distance–time graphs from measurements and extract and interpret lines and slopes of distance–time graphs,	162	159	
Describe an object which is slowing down as having a negative acceleration and estimate the magnitude of everyday accelerations	164	160	
Calculate the average acceleration of an object by recalling and applying the equation: ***[a = Δv/t]***	164	160	
Represent motion using velocity–time graphs, finding the acceleration from its gradient and distance travelled from the area underneath	164	160	
HT ONLY: Interpret enclosed areas in velocity–time graphs to determine distance travelled (or displacement)	164		
HT ONLY: Measure, when appropriate, the area under a velocity– time graph by counting square	164		
Apply, but not recall, the equation: **[$v^2 - u^2 = 2as$]**	163	160	

Topic	**Collins (H)**	**Collins (F)**	**Notes**
Explain the motion of an object moving with a uniform velocity and identify that forces must be in effect if its velocity is changing, by stating and applying Newton's First Law	163	159	
Define and apply Newton's second law relating to the acceleration of an object	165	161	
Recall and apply the equation: ***[F = ma]***	165	161	
HT ONLY: Describe what inertia is and give a definition	165		
Estimate the speed, accelerations and forces of large vehicles involved in everyday road transport			
Apply Newton's Third Law to examples of equilibrium situations	166	162	
Describe factors that can effect a driver's reactions time	168	163	
Explain methods used to measure human reaction times and recall typical results	168	163	
Interpret and evaluate measurements from simple methods to measure the different reaction times of students	168		
Evaluate the effect of various factors on thinking distance based on given data	169	163	
State typical reaction times and describe how reaction time (and therefore stopping distance) can be affected by different factors	169	163	
Explain methods used to measure human reaction times and take, interpret and evaluate measurements of the reaction times of students	169	163	
Explain how the braking distance of a vehicle can be affected by different factors, including implications for road safety	169	163	
Explain how a braking force applied to the wheel does work to reduce the vehicle's kinetic energy and increases the temperature of the brakes	169	163	
Explain and apply the idea that a greater braking force causes a	169	163	

Topic	Collins (H)	Collins (F)	Notes
larger deceleration and explain how this might be dangerous for drivers			
HT ONLY: Estimate the forces involved in the deceleration of road vehicles	169		
P6.5.5 Momentum			
HT ONLY: Calculate momentum by recalling and applying the equation: ***[p = mv]***	167		
HT ONLY: Explain and apply the idea that, in a closed system, the total momentum before an event is equal to the total momentum after the event	167		
HT ONLY: Describe examples of momentum in a collision	167		
Unit 6 Waves	182-219	176-211	

Topic	Collins (H)	Collins (F)	Notes
P6.6.1 Waves in air, fluids and solids			
Describe waves as either transverse or longitudinal, defining these waves in terms of the direction of their oscillation and energy transfer and giving examples of each	182	176	
Define waves as transfers of energy from one place to another, carrying information	182	176	
Define amplitude, wavelength, frequency, period and wave speed and Identify them where appropriate on diagrams	182	176	
State examples of methods of measuring wave speeds in different media and Identify the suitability of apparatus of measuring frequency and wavelength	182	177	
Calculate wave speed, frequency or wavelength by applying, but not recalling, the equation: ***[v = f λ]***and calculate wave period by recalling and applying the equation: ***[T = 1/f]***	183	177	
Identify amplitude and wavelength from given diagrams	182	176	
Describe a method to measure the speed of sound waves in air	183	177	
Describe a method to measure the speed of ripples on a water surface	183	177	
P6.6.2 Electromagnetic waves			
Describe what electromagnetic waves are and explain how they are grouped	184	178	
List the groups of electromagnetic waves in order of wavelength	184	178	
Explain that because our eyes only detect a limited range of electromagnetic waves, they can only detect visible light	184	178	
HT ONLY: Explain how different wavelengths of electromagnetic radiation are reflected, refracted, absorbed or transmitted differently by different substances and types of surface	184		
Illustrate the refraction of a wave at the boundary between two	185	179	

Topic	Collins (H)	Collins (F)	Notes
different media by constructing ray diagrams			
HT ONLY: Describe what refraction is due to and illustrate this using wave front diagrams	185		
HT ONLY: Explain how radio waves can be produced by oscillations in electrical circuits, or absorbed by electrical circuits	186		
Explain that changes in atoms and the nuclei of atoms can result in electromagnetic waves being generated or absorbed over a wide frequency range	186	181	
State examples of the dangers of each group of electromagnetic radiation and discuss the effects of radiation as depending on the type of radiation and the size of the dose	186	181	
State examples of the uses of each group of electromagnetic radiation, explaining why each type of electromagnetic wave is suitable for its applications	186	181	
Unit 7 Magnetism and electromagnetism	206-227	200-218	
P6.7.1 Permanent and induced magnetism, magnetic forces			

Topic	Collins (H)	Collins (F)	Notes
Describe the attraction and repulsion between unlike and like poles of permanent magnets and explain the difference between permanent and induced magnets	206	200	
Draw the magnetic field pattern of a bar magnet, showing how field strength and direction are indicated and change from one point to another	206	200	
Explain how the behaviour of a magnetic compass is related to evidence that the core of the Earth must be magnetic	206	200	
Describe how to plot the magnetic field pattern of a magnet using a compass	206	200	
P6.7.2 The motor effect			
State examples of how the magnetic effect of a current can be demonstrated and explain how a solenoid arrangement can increase the magnetic effect of the current	207	201	
Draw the magnetic field pattern for a straight wire carrying a current and for a solenoid (showing the direction of the field)	207	201	
HT ONLY: State and use Fleming's left-hand rule and explain what the size of the induced force depends on	208		
HT ONLY: Calculate the force on a conductor carrying a current at right angles to a magnetic field by applying, but not recalling, the equation: ***[F = BIL]***	209		
HT ONLY: Explain how rotation is caused in an electric motor	209		

1. OVERVIEW OF THE COURSE

Unit	Topics	Brief summary	Notes