Combined Science Physics Academic Overview 2018-19

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	End of year assessment preparation and feedback
Year 10	EM Waves Radioactivity 1 Atoms and isotopes	Radioactivity 2 Nuclear decay and dangers	Electricity 1 Circuits and resistance	Electricity 2 Energy transfers and electrical safety	Magnetism	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	

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Year 10 Combined Science Physics Curriculum Content Overview 2018-19

Knowledge and Skills Students will be taught to….	Reading, Oracy, Literacy and Numeracy	Assessment
• Recall, use and apply a variety of equations relating to waves, radioactivity, electricity and magnetism • 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 • Recall and describe the parts, properties, uses and dangers of the Electromagnetic Spectrum • Describe and explain how to investigate the refraction of light • 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 • Construct series and parallel circuits in order to investigate the relationship between current, potential difference and resistance • Describe and explain both mathematically and using scientific principles how current, potential difference and resistance are affected by different types of circuits and components • Explain how energy is transferred in circuits and transmitted safely to homes and buildings • Describe and explain the production and interaction of magnetic fields and how they can be used in motors and to produce electricity	**Reading** • Edexcel combined science text book • Recommended reading texts • CGP revision guide • PLC checklists **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	**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

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Assessment Skills, Knowledge and Concepts Map

Key learning questions	Edexcel Combined Science Physics Year 10 Assessment Phase 1 The Electromagnetic Spectrum
☐ 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
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 and how this can also lead to 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	Edexcel Combined Science Physics Year 10 Assessment Phase 2 Radioactivity 2 Nuclear decay and dangers
☐ 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	☐ 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

Key learning questions	Electricity 1 Circuits and resistance
☐ What is the correct circuit symbol for a cell, battery, switch, voltmeter, ammeter, resistor, variable resistor, filament lamp, diode, thermistor, LDR and LED? ☐ Draw a diagram to show the difference between a series and parallel circuit ☐ How do you connect an ammeter and voltmeter in a circuit? ☐ What is meant by current, potential difference and resistance? ☐ What flows in a circuit to provide the current? ☐ Describe how you would use a circuit to investigate the resistance of a filament lamp and fixed resistor ☐ Explain what happens to the current in the circuit when you change the potential difference for a fixed resistor, filament lamp and diode ☐ What sequence of events causes heat to be transferred when a current flows through a component? ☐ Describe and example of where the heating effect of a current is useful and where it is not useful ☐ What happens to the resistance of an LDR and thermistor when you increase the light intensity and temperature? How does this affect the current in the circuit? ☐ In what devices might and LDR or thermistor be useful? ☐ How would the total resistance of two resistors be different when connected in series and in parallel? How would this affect the current in the circuit? ☐ How does the current in a circuit and potential difference across components differ in series and parallel circuits?	☐ Draw and use electric circuit diagrams representing them with correct symbols for common components and the positive and negative terminals of the cell / battery ☐ Describe the differences between series and parallel circuits and recall how to correctly measure current and potential difference using the appropriate equipment ☐ Define potential difference and describe what a volt is ☐ Recall and use the equation: $E = Q \times V$ ☐ Explain what electrical current is and what is the source of current in metals ☐ Recall and use the equation: $Q = I \times t$ ☐ Describe that a closed circuit with a source of potential difference will cause a current in the circuit ☐ Recall and use the equation: $V = I \times R$ ☐ Core Practical: Construct electrical circuits to: investigate the relationship between, V, I and R for a resistor and a filament lamp ☐ Explain how a circuit should be constructed to investigate resistance including the use of a variable resistor and how to correctly connect an ammeter and voltmeter for the component being investigated ☐ Explain how changing the potential difference affects the current in the circuit for a filament lamp, diode and fixed resistor and explain how this relates to resistance ☐ Describe how the resistance of a light-dependent resistor (LDR) varies with light intensity ☐ Describe how the resistance of a thermistor varies with change of temperature ☐ Recall that, when there is an electric current in a resistor, there is an energy transfer which heats the resistor ☐ Explain how electrical energy is dissipated when an electrical current does work against electrical resistance ☐ Explain ways of reducing unwanted energy transfer through low resistance wires ☐ Describe the advantages and disadvantages of the heating effect of an electric current ☐ Recall that current is conserved at a junction in a circuit ☐ Explain why, if two resistors are in series, the net resistance is increased, whereas with two in parallel the net resistance is decreased ☐ Calculate the currents, potential differences and resistances in series circuits

Edexcel Combined Science Physics Year 10 Assessment Phase 3

Electricity 2 Energy transfers and electrical safety

Key learning questions	
☐ Describe the energy transfer that takes place in a kettle and a battery operated fan	☐ Describe power as the energy transferred per second and recall that it is measured in watt
☐ What is an advantage and disadvantage of the heating effect in an electrical circuit?	☐ Recall and use the equation: P = E/t, P = I × V and P = I 2 × R, use the equation E = I × V × t
☐ What is a power rating?	☐ Explain how the power transfer in any circuit device is related to potential difference and current
☐ How do potential difference and current relate to power?	☐ Describe examples of the relationship between power ratings and energy transfers for domestic devices
☐ What is an alternating current and how is it produced?	☐ Describe how, in domestic devices, energy is transferred from batteries, a.c. mains motors and heating devices
☐ What is the frequency and potential difference of a UK domestic mains supply?	☐ Explain the difference between direct and alternating voltage
☐ What is the purpose of the different wires in a plug?	☐ Describe what direct current (d.c.) is and recall the objects that supply it
☐ How do fuses and circuit breakers work?	☐ Describe what alternating current (a.c.) is and recall the frequency and voltage in the UK
	☐ Explain the difference in function between the live, neutral and earth wire of a three-core electrical cable and recall the potential differences between each wire
	☐ Explain the function of an earth wire and of fuses or circuit breakers in ensuring safety
	☐ Explain why switches and fuses should be connected in the live wire of a domestic circuit
	☐ Explain the dangers of providing any connection between the live wire and earth

Magnetism and the Motor Effect

Key learning questions	
☐ What is a magnetic field and which direction does it point?	☐ Describe the interactions between like and unlike magnetic poles
☐ How can you observe a magnetic field?	☐ Explain the difference between permanent and induced/ temporary magnets and describe their uses
☐ Explain what happens when you bring two magnets close together	☐ Describe the shape, direction and strength of the magnetic field around bar magnets and for a uniform field
☐ What is the difference between a temporary and induced magnet?	☐ Describe how to observe the shape and direction of a magnetic field and how the behaviour of plotting compases are related to evidence that the core of the Earth must be magnetic
☐ What shape is the field around a current carrying wire?	☐ Describe how to show that a current can create a magnetic effect around a long straight conductor
☐ How do you increase the strength of the field around a wire and how does this change when it is wrapped into a solenoid?	☐ Describe the shape and direction of a magnetic field around a conductor relating to the direction of the current
☐ What is the motor effect?	☐ Recall that the strength of the field depends on the size of the current and the distance from the conductor
☐ What is Fleming's left hand rule and what does it show?	☐ Explain how inside a solenoid the fields from individual coils can add together or cancel
☐ What is electromagnetic induction and how is it caused?	☐ HT ONLY: Explain how magnetic forces are due to interactions between magnetic fields
☐ How do you increase the size of an induced p.d?	☐ HT ONLY: Recall that a current carrying conductor and a magnetic will experience and equal and opposite force when placed near each other
☐ What is a transformer and where would you find them?	☐ HT ONLY: Recall and use Fleming's left-hand rule to represent the relative directions of the force
☐ What is the national grid?	☐ HT ONLY: Use the equation: F = B× I ×l
☐ Why are different transformers used in the national grid?	☐ HT ONLY: Explain how the force on a conductor in a magnetic field is used to cause rotation in electric motors
☐ How is energy lost in the national grid?	☐ Explain why, in the national grid, electrical energy is transferred at different voltages
	☐ Explain where and why step-up and step-down transformers are in the national grid
	☐ Use the power equation (for transformers with100% efficiency): Vp × Ip =Vs × Is