# YEAR 11- Physics Term 1 plan 2016-2017

| *Week* | *Topic* | *Learning outcomes* |
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| Week 1 | 5.1.2 Nucleus of the Atom | • Describe the composition of the nucleus in terms of protons and neutrons<br>• State the charges of protons and neutrons<br>• Use the term proton number *Z*<br>• Use the term nucleon number *A*<br>• Use the term nuclide and use the nuclide notation *XAZ* |
| | 5.1.1 Atomic Model | • Describe how the scattering of α-particles by thin metal foils provides evidence for the nuclear atom<br>• Describe the structure of an atom in terms of a positive nucleus and negative electrons |
| | 5.2.1 Detecting Radiation | • Demonstrate understanding of back ground radiation |

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| Week 2 | 5.2.2 Characteristics of 3 kinds of emission | • Discuss the random nature of radioactive emission<br>• Identify α, β _and γ-emissions by recalling<br>  – their nature<br>  – their relative ionising effects<br>• – their relative penetrating abilities (β+ are not included, β-particles will be taken to refer to β–) |
| | 5.2.3 Radioactive decay | • State the meaning of radioactive decay, and that the nucleus changes to that of a different element.<br>• Describe their deflection in electric fields and in magnetic fields<br>• Interpret their relative ionising effects<br>• Give and explain examples of practical applications of α, β _and γ-emissions |
| | Half-Life | • Use equations involving nuclide notation to represent changes in the composition of the nucleus when particles are emitted<br>• Use the term half-life in simple calculations, which might involve information in tables or decay curves<br>• Calculate half-life from data or decay curves from which background radiation has not been subtracted |
| Week 3 | Safety Precautions and Uses of radioactivity<br>End of topic test on Radioactivity | • Recall the effects of ionising radiations on living things<br>• Describe how radioactive materials are handled, used and stored in a safe way |
| | 3.1 General wave properties | • Demonstrate understanding that waves transfer energy without transferring matter<br>• Describe what is meant by wave motion as illustrated by vibration in ropes and springs and by experiments using water waves<br>• Use the term wavefront<br>• Give the meaning of speed, frequency, wavelength and amplitude<br>• Distinguish between transverse and longitudinal waves and give suitable examples |

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| Week 4 | 3.1.1 General wave properties (2)<br><br>Extended General wave properties<br><br>Electromagnetic spectrum | • Describe how waves can undergo:<br>– reflection at a plane surface<br>– refraction due to a change of speed<br>– diffraction through a narrow gap<br><br>• Describe the use of water waves to demonstrate reflection, refraction and diffraction<br><br>• Recall and use the equation $v = f\lambda$ _<br>• Describe how wavelength and gap size affects diffraction through a gap<br>• Describe how wavelength affects diffraction at an edge<br><br>• Describe the main features of the electromagnetic spectrum in order of wavelength<br>• State that all e.m. waves travel with the same high speed in a vacuum<br><br>• State that the speed of electromagnetic waves in a vacuum is 3.0×108m/s and is approximately the same in air |

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| Week 5 | Electromagnetic spectrum (2) | • Describe typical properties and uses of radiations in all the different regions of the electromagnetic spectrum including:<br>– radio and television communications (radio waves)<br>– satellite television and telephones (microwaves)<br>– electrical appliances, remote controllers for televisions and intruder alarms (infra-red)<br>– medicine and security (X-rays)<br><br>• Demonstrate an awareness of safety issues regarding the use of microwaves and X-rays |
| | Sound | • Describe the production of sound by vibrating sources<br>• Describe the longitudinal nature of sound waves<br>• Show an understanding that a medium is needed to transmit sound waves<br>• Describe an experiment to determine the speed of sound in air<br>• Describe compression and rarefaction<br>• State typical values of the speed of sound in gases, liquids and solids<br>• State that the approximate range of audible frequencies for a healthy human ear is 20Hz to 20 000Hz<br>• Show an understanding of the term ultrasound<br>• Relate the loudness and pitch of sound waves to amplitude and frequency<br>• Describe how the reflection of sound may produce an echo |

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| Week 6 | **<u>Electricity</u>**<br><br>4.2.1 Electrical Charge | • State that there are positive and negative charges<br>• State that unlike charges attract and that like charges repel<br>• Describe simple experiments to show the production and detection of electrostatic charges<br>• State that charging a body involves the addition or removal of electrons<br>• Distinguish between electrical conductors and insulators and give typical examples<br><br>• State that charge is measured in coulombs<br>• State that the direction of an electric field at a point is the direction of the force on a positive charge at that point<br>• Describe an electric field as a region in which an electric charge experiences a force<br>• Describe simple field patterns, including the field around a point charge, the field around a charged conducting sphere and the field between two parallel plates (not including end effects)<br>• Give an account of charging by induction<br>• Recall and use a simple electron model to distinguish between conductors and insulators |
| Week 7 | 4.2.2 Current<br><br><br><br><br><br>4.2.3 Electromotive Force | • State that current is related to the flow of charge<br>• Use and describe the use of an ammeter, both analogue and digital<br>• State that current in metals is due to a flow of electrons<br><br>• Show understanding that a current is a rate of flow of charge and recall and use the equation $I = Q/t$<br>• Distinguish between the direction of flow of electrons and conventional current<br><br>• State that the e.m.f. of an electrical source of energy is measured in volts<br>• Show understanding that e.m.f. is defined in terms of energy supplied by a source in driving charge round a complete circuit |

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| Week 8 | 4.2.4 Potential Difference | • State that the potential difference (p.d.) across a circuit component is measured in volts<br>• Use and describe the use of a voltmeter, both analogue and digital<br><br>• Recall that 1 V is equivalent to 1 J/C<br><br>• Understand that electric circuits transfer energy from the battery or power source to the circuit components then into the surroundings<br><br>• Recall and use the equations $P = IV$ and $E = IVt$ |
| Week 9 | 4.2.5 Resistance | • State that resistance = p.d./current and understand qualitatively how changes in p.d. or resistance affect current<br>• Recall and use the equation $R = V / I$<br>• Describe an experiment to determine resistance using a voltmeter and an ammeter<br>• Relate (without calculation) the resistance of a wire to its length and to its diameter<br><br>• Sketch and explain the current-voltage characteristic of an ohmic resistor and a filament lamp<br><br>• Recall and use quantitatively the proportionality between resistance and length, and the inverse proportionality between resistance and cross-sectional area of a wire |

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| Week 10 | 4.3.1 Circuit Diagrams | Draw and interpret circuit diagrams containing sources, switches, resistors (fixed and variable), heaters, thermistors, light-dependent resistors, lamps, ammeters, voltmeters, galvanometers, magnetising coils, transformers, bells, fuses and relays<br>**Draw and interpret circuit diagrams containing diodes** |
| | 4.3.2 Series and Parallel Circuits | • Understand that the current at every point in a series circuit is the same<br>• Give the combined resistance of two or more resistors in series<br>• State that, for a parallel circuit, the current from the source is larger than the current in each branch<br>• State that the combined resistance of two resistors in parallel is less than that of either resistor by itself<br>• State the advantages of connecting lamps in parallel in a lighting circuit |

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| Week 11 | 4.3.2 Series and Parallel Circuits | • Calculate the combined e.m.f. of several sources in series<br>• Recall and use the fact that the sum of the p.d.s across the components in a series circuit is equal to the total p.d. across the supply<br>• Recall and use the fact that the current from the source is the sum of the currents in the separate branches of a parallel circuit<br>• Calculate the effective resistance of two resistors in parallel |
| | 4.3.3 Action and use of circuit components | • Describe the action of a variable potential divider (potentiometer)<br>• Describe the action of thermistors and light-dependent resistors and show understanding of their use as input transducers<br>• Describe the action of a relay and show understanding of its use in switching circuits<br>• Describe the action of a diode and show understanding of its use as a rectifier<br>• Recognise and show understanding of circuits operating as light-sensitive switches and temperature-operated alarms (to include the use of a relay) |

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| Week 12 | 4.4 Digital Electronics | • Explain and use the terms analogue and digital in terms of continuous variation and high/low states<br>• Describe the action of NOT, AND, OR, NAND and NOR gates<br>• Recall and use the symbols for logic gates<br>• Design and understand simple digital circuits combining several logic gates<br>• Use truth tables to describe the action of individual gates and simple combinations of gates |
| | 4.5 Dangers of electricity | • State the hazards of:<br>o damaged insulation<br>o overheating of cables<br>o damp conditions<br><br>• State that a fuse protects a circuit<br>• Explain the use of fuses and circuit breakers and choose appropriate fuse ratings and circuit-breaker settings<br>• Explain the benefits of earthing metal cases |

# YEAR 11- Physics Term 2 plan 2016-2017

| *Week* | *Topic* | *Learning outcomes* |
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| Week 1 | **Electromagnetism**<br><br>4.1 Phenomena of magnetism | • Describe the forces between magnets, and between magnets and magnetic materials<br>• Give an account of induced magnetism<br>• Distinguish between magnetic and non-magnetic materials<br>• Describe methods of magnetisation, to include stroking with a magnet, use of d.c. in a coil and hammering in a magnetic field<br>• Draw the pattern of magnetic field lines around a bar magnet<br>• Describe an experiment to identify the pattern of magnetic field lines, including the direction<br>• Distinguish between the magnetic properties of soft iron and steel<br>• Distinguish between the design and use of permanent magnets and electromagnets<br><br>• Explain that magnetic forces are due to interactions between magnetic fields<br>• Describe methods of demagnetisation, to include hammering, heating and use of a.c. in a coil |
| Week 2 | 4.6.1 Electromagnetic induction | • Show understanding that a conductor moving across a magnetic field or a changing magnetic field linking with a conductor can induce an e.m.f. in the conductor<br>• Describe an experiment to demonstrate electromagnetic induction<br>• State the factors affecting the magnitude of an induced e.m.f.<br><br>• Show understanding that the direction of an induced e.m.f. opposes the change causing it<br>• State and use the relative directions of force, field and induced current |
| Week 3 | 4.6.2 a.c generator | • Distinguish between direct current (d.c.) and alternating current (a.c.)<br>• Describe and explain a rotating-coil generator and the use of slip rings<br>• Sketch a graph of voltage output against time for a simple a.c. generator<br>• Relate the position of the generator coil to the peaks and zeros of the voltage output |

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| Week 4 | 4.6.3 Transformer | • Describe the construction of a basic transformer with a soft-iron core, as used for voltage transformations<br>• Recall and use the equation ($V$p / $V$s) = ($N$p / $N$s)<br>• Understand the terms step up and step-down<br>• Describe the use of the transformer in high-voltage transmission of electricity<br>• Give the advantages of high voltage transmission<br>• **Describe the principle of operation of a transformer**<br>• **Recall and use the equation $I$p$V$p = $I$s$V$s (for 100% efficiency)**<br>• **Explain why power losses in cables are lower when the voltage is high** |
| Week 5 | 4.6.4 The magnetic effect of a current | • Describe the pattern of the magnetic field (including direction) due to currents in straight wires and in solenoids<br>• Describe applications of the magnetic effect of current, including the action of a relay<br>• **State the qualitative variation of the strength of the magnetic field over salient parts of the pattern**<br>• **State that the direction of a magnetic field line at a point is the direction of the force on the N pole of a magnet at that point**<br>• **Describe the effect on the magnetic field of changing the magnitude and direction of the current** |
| Week 6 | 4.6.5 Force on a current-carrying conductor | • Describe an experiment to show that a force acts on a current-carrying conductor in a magnetic field, including the effect of reversing:<br>o the current<br>o the direction of the field<br><br>• **State and use the relative directions of force, field and current**<br>• **Describe an experiment to show the corresponding force on beams of charged particles** |

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| Week 7 | 4.6. d.c motor | • State that a current-carrying coil in a magnetic field experiences a turning effect and that the effect is increased by:<br>o increasing the number of turns on the coil<br>o increasing the current<br>o increasing the strength of the magnetic field<br><br>• **Relate this turning effect to the action of an electric motor including the action of a split-ring commutator** |
| Week 8 | **<u>Thermal Physics</u>**<br><br>2.1.1 States of matter<br><br>2.1.2 Molecular model | • State the distinguishing properties of solids, liquids and gases<br><br>• Describe qualitatively the molecular structure of solids, liquids and gases in terms of the arrangement, separation and motion of the molecules<br>• Interpret the temperature of a gas in terms of the motion of its molecules<br>• Describe qualitatively the pressure of a gas in terms of the motion of its molecules<br>• Show an understanding of the random motion of particles in a suspension as evidence for the kinetic molecular model of matter<br>• Describe this motion (sometimes known as Brownian motion) in terms of random molecular bombardment<br><br>• **Relate the properties of solids, liquids and gases to the forces and distances between molecules and to the motion of the molecules**<br>• **Explain pressure in terms of the change of momentum of the particles striking the walls creating a force**<br>• **Show an appreciation that massive particles may be moved by light, fast-moving molecules** |

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| Week 9 | 2.3.1 Conduction<br><br>2.3.2 Convection<br><br>2.3.3 Radiation | • Describe experiments to demonstrate the properties of good and bad thermal conductors<br>• **Give a simple molecular account of conduction in solids including lattice vibration and transfer by electrons**<br><br>• Recognise convection as an important method of thermal transfer in fluids<br>• Relate convection in fluids to density changes and describe experiments to illustrate convection<br><br>• Identify infra-red radiation as part of the electromagnetic spectrum<br>• Recognise that thermal energy transfer by radiation does not require a medium<br>• Describe the effect of surface colour (black or white) and texture (dull or shiny) on the emission, absorption and reflection of radiation<br>• **Describe experiments to show the properties of good and bad emitters and good and bad absorbers of infra-red radiation**<br>• **Show understanding that the amount of radiation emitted also depends on the surface temperature and surface area of a body** |
| Week 10 | 2.2.1 Thermal expansion of solids, liquids and gases | • Describe qualitatively the thermal expansion of solids, liquids, and gases at constant pressure<br>• Identify and explain some of the everyday applications and consequences of thermal expansion<br>• **Explain, in terms of the motion and arrangement of molecules, the relative order of the magnitude of the expansion of solids, liquids and gases** |

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| Week 11 | 2.2.2 Measurement of temperature | • Appreciate how a physical property that varies with temperature may be used for the measurement of temperature, and state examples of such properties<br>• Recognise the need for and identify fixed points<br>• Describe and explain the structure and action of liquid-in-glass thermometers<br><br>• **Demonstrate understanding of sensitivity, range and linearity**<br>• **Describe the structure of a thermocouple and show understanding of its use as a thermometer for measuring high temperatures and those that vary rapidly**<br>• **Describe and explain how the structure of a liquid-in-glass thermometer relates to its sensitivity, range and linearity** |
| Week 12 | 2.2.3 Thermal capacity | • **Give a simple molecular account of an increase in internal energy**<br>• **Recall and use the equation thermal capacity =_ _*mc***<br><br>• **Define specific heat capacity**<br>• **Describe an experiment to measure the specific heat capacity of a substance**<br>• **Recall and use the equation change in energy =_ _*mc*$\Delta$*T*** |

# YEAR 11- Physics Term 3 plan 2016-2017

| *Week* | *Topic* | *Learning outcomes* |
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| 1-5 | **Revision of Year 10 & Year 11 Topics** | • As the syllabus content has been revised and updated to modernise and improve the relevance of the syllabus, go over the syllabus and revise the important topics and the new topics to syllabus.<br>• Revise and practice past year exams<br>• Explain the difficult and major concepts. |