Personalised Learning Checklists Edexcel Single: Physics Paper 1

Edexcel Physics (1PI0) from 2016 Topics P1&2				
Topic	**Student Checklist**	**R**	**A**	**G**
Topic 1 – Key concepts	Recall and use the SI unit for physical quantities, as listed in the specification			
	Recall and use multiples and sub-multiples of units, including giga (G), mega (M), kilo (k), centi (c), milli (m), micro (μ) and nano (n)			
	Be able to convert between different units, including hours to seconds			
	Use significant figures and standard form where appropriate			
Topic 2 – Motion and forces	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)			
	Recall and use the equation: 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			
	Analyse velocity/time graphs to: calculate the acceleration from the gradient (for uniform acceleration only)			
	Analyse velocity/time graphs to: 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			
	Recall Newton's first law and use it where the resultant force on a body is zero			
	Recall Newton's first law and use it where the resultant force is not zero			
	Recall and use Newton's second law as: $F = m \times a$			
	Define weight, recall and use the equation: $W = m \times g$			
	Describe how weight is measured			
	Describe 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			
	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: $p = m \times v$			
	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			
	Explain that the stopping distance of a vehicle is affected by a range of factors and name the factors			
	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 on work done to show the dependence of braking distance for a vehicle on initial velocity squared			

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Edexcel Physics (1PI0) from 2016 Topics P3,4&5				
Topic	**Student Checklist**	**R**	**A**	**G**
Topic 3 – Conservation of energy	Recall and use the equation to calculate the change in gravitational PE when an object is raised above the ground: $\Delta GPE = m \times g \times \Delta h$			
	Recall and use the equation to calculate the amounts of energy associated with a moving object: $KE = \frac{1}{2} \times m \times v^2$			
	Draw and interpret diagrams to represent energy transfers			
	Explain what is meant by conservation of energy			
	Analyse the changes involved in the way energy is stored when a system changes for an object projected upwards or up a slope			
	Analyse the changes involved in the way energy is stored when a system changes for a moving object hitting an obstacle			
	Analyse the changes involved in the way energy is stored when a system changes for an object being accelerated by a constant force			
	Analyse the changes involved in the way energy is stored when a system changes for a vehicle slowing down			
	Analyse the changes involved in the way energy is stored when a system changes for bringing water to a boil in an electric kettle			
	Explain that where there are energy transfers in a closed system there is no net change to the total energy in that system			
	Explain that mechanical processes become wasteful when they cause a rise in temperature so dissipating energy in heating the surroundings			
	Explain, using examples, how in all system changes energy is dissipated so that it is stored in less useful ways			
	Explain ways of reducing unwanted energy transfer including through lubrication, 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			
	Describe the main energy sources available for use on Earth and compare the ways in which both renewable and non-renewable sources are used			
	Explain patterns and trends in the use of energy resources			

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Topic 4 – Waves	Recall that waves transfer energy and information without transferring matter			
	Describe evidence that with water and sound waves it is the wave and not the water or air itself that travels			
	Define and use the terms frequency and wavelength as applied to waves			
	Use the terms amplitude, period, wave velocity and wavefront as applied to waves			
	Describe the difference between longitudinal and transverse waves by referring to sound, electromagnetic, seismic and water waves			
	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			
	HT ONLY: Calculate depth or distance from time and wave velocity			
	Describe the effects of reflection, refraction, transmission, absorption 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			
	HT ONLY: Recall that different substances may absorb, transmit, refract or reflect waves in ways that vary with wavelength			
	HT ONLY: Describe the processes which convert wave disturbances between sound waves and vibrations in solids			
	HT ONLY: Explain why processes that convert wave disturbances only work over a limited frequency range			
	HT ONLY: Use the process that converts wave disturbances to explain the way the human ear works			
	HT ONLY: Recall the frequency of ultrasound and state its units			
	HT ONLY: Explain uses of ultrasound and infrasound			
	Describe how changes, if any, in velocity, frequency and wavelength, in the transmission of sound waves from one medium to another are inter-related			
	Core Practical: Investigate the suitability of equipment to measure the speed, frequency and wavelength of a wave in a solid and a fluid			

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Topic 5 – Light and the electromagnetic spectrum	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			
	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			
	Recall the main groupings of the continuous electromagnetic spectrum			
	Describe the electromagnetic spectrum			
	Recall that our eyes can only detect a limited range of frequencies of electromagnetic radiation			
	HT ONLY: Recall that different substances may absorb, transmit, refract or reflect electromagnetic waves in ways that vary with wavelength			
	Explain the effects of differences in the velocities of electromagnetic waves in different substances			
	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			
	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			

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Edexcel Physics (1PI0) from 2016 Topics P6a/b&7				
Topic	**Student Checklist**	**R**	**A**	**G**
Topic 6a– Radioactivity - part a	Describe the structure of the atom			
	Recall the typical size (order of magnitude) of atoms and small molecules			
	Describe the structure of nuclei of isotopes			
	Define the term isotope			
	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			
	Recall that alpha, β–, β+, gamma rays and neutron radiation are emitted from unstable nuclei in a random process			
	Recall that alpha, β–, β+ and gamma rays are ionising radiation			
	Explain what is meant by background radiation			
	Describe the origins of background radiation from Earth and space			
	Describe methods for measuring and detecting radioactivity limited to photographic film and a Geiger–Müller tube			
	Recall what alpha, beta and gamma radiation are made up of			
	Compare alpha, beta and gamma radiations in terms of their abilities to penetrate and ionise			
	Describe how and why the atomic model has changed over time including reference to the different models and scattering experiments			
	Describe the process of β– and β+ decay			
	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			

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Topic 6b– Radioactivity - part b	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			
	Recall that the unit of activity of a radioactive isotope is the Becquerel, Bq			
	Explain what half life of a radioactive isotope is			
	Explain that it cannot be predicted when a particular nucleus will decay but half-life enables the activity of a very large number of nuclei to be predicted			
	Use the concept of half-life to carry out simple calculations on the decay of a radioactive isotope, including graphical representations			
	Describe uses of radioactivity in: the home, industry and medicine			
	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			
	Phy ONLY: Compare and contrast the treatment of tumours using radiation applied internally or externally			
	Phy ONLY: Explain some of the uses of radioactive substances in diagnosis of medical conditions, including PET scanners and tracers			
	Phy ONLY: Explain why isotopes used in PET scanners have to be produced nearby			
	Phy ONLY: Evaluate the advantages and disadvantages of nuclear power for generating electricity			
	Phy ONLY: Recall that nuclear reactions, including fission, fusion and radioactive decay, can be a source of energy			
	Phy ONLY: Explain the fission of U-235			
	Phy ONLY: Explain the principle of a controlled nuclear chain reaction			
	Phy ONLY: Explain how the chain reaction is controlled in a nuclear reactor, including the action of moderators and control rods			
	Phy ONLY: Describe how thermal (heat) energy from the chain reaction is used in the generation of electricity in a nuclear power station			
	Phy ONLY: Recall that the products of nuclear fission are radioactive			
	Phy ONLY: Describe nuclear fusion			
	Phy ONLY: Explain the difference between nuclear fusion and nuclear fission			
	Phy ONLY: Explain why nuclear fusion does not happen at low temperatures and pressures			
	Phy ONLY: Relate the conditions for fusion to the difficulty of making a practical and economic form of power station			

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Topic 7 – Astronomy	Phy ONLY: Explain how and why both the weight of any body and the value of g differ between the surface of the Earth and the surface of other bodies in space			
	Phy ONLY: Recall what our solar system consists of			
	Phy ONLY: Recall the names and order, in terms of distance from the Sun, of the eight planets			
	Phy ONLY: Describe how ideas about the structure of the Solar System have changed over time			
	Phy ONLY: Describe the orbits of moons, planets, comets and artificial satellites			
	Phy ONLY: Explain for circular orbits how the force of gravity can lead to changing velocity of a planet but unchanged speed			
	Phy ONLY: Explain how, for a stable orbit, the radius must change if orbital speed changes (qualitative only)			
	Phy ONLY: Compare the Steady State and Big Bang theories			
	Phy ONLY: Describe evidence supporting the Big Bang theory, limited to red-shift and the cosmic microwave background (CMB) radiation			
	Phy ONLY: Recall that as there is more evidence supporting the Big Bang theory than the Steady State theory			
	Phy ONLY: Describe that if a wave source is moving relative to an observer there will be a change in the observed frequency and wavelength			
	Phy ONLY: Describe the red-shift in light received from galaxies at different distances away from the Earth			
	Phy ONLY: Explain why the red-shift of galaxies provides evidence for the Universe expanding			
	Phy ONLY: Explain how both the Big Bang and Steady State theories of the origin of the Universe both account for red-shift of galaxies			
	Phy ONLY: Explain how the discovery of the CMB radiation led to the Big Bang theory becoming the currently accepted model			
	Phy ONLY: Describe the evolution of stars of similar mass to the Sun			
	Phy ONLY: Explain how the balance between thermal expansion and gravity affects the life cycle of stars			
	Phy ONLY: Describe the evolution of stars with a mass larger than the Sun			
	Phy ONLY: Describe how methods of observing the Universe have changed over time including why some telescopes are located outside the Earth's atmosphere			