Personalised Learning Checklists AQA Physics Paper 2

AQA Physics (8463) from 2016 Topics P4.5. Forces				
Topic	**Student Checklist**	**R**	**A**	**G**
4.5.1 Forces and their interactions	Identify and describe scalar quantities and vector quantities			
	Identify and give examples of forces as contact or non-contact forces			
	Describe the interaction between two objects and the force produced on each as a vector			
	Describe weight and explain that its magnitude at a point depends on the gravitational field strength			
	Calculate weight by recalling and using the equation: ***[W = mg]***			
	Represent the weight of an object as acting at a single point which is referred to as the object's 'centre of mass'			
	Calculate the resultant of two forces that act in a straight line			
	HT ONLY: describe examples of the forces acting on an isolated object or system			
	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			
	HT ONLY: Use free body diagrams and accurate vector diagrams to scale, to resolve multiple forces and show magnitude and direction of the resultant			
	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			
4.5.2 Work done and energy	Describe energy transfers involved when work is done and calculate the work done by recalling and using the equation: *[W = Fs]*			
	Describe what a joule is and state what the joule is derived from			
	Convert between newton-metres and joules.			
	Explain why work done against the frictional forces acting on an object causes a rise in the temperature of the object			
4.5.3 Forces and elasticity	Describe examples of the forces involved in stretching, bending or compressing an object			
	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			
	Describe the difference between elastic deformation and inelastic deformation caused by stretching forces			
	Describe the extension of an elastic object below the limit of proportionality and calculate it by recalling and applying the equation: ***[F = ke]***			
	Explain why a change in the shape of an object only happens when more than one force is applied			
	Describe and interpret data from an investigation to explain possible causes of a linear and non-linear relationship between force and extension			
	Calculate work done in stretching (or compressing) a spring (up to the limit of proportionality) by applying, but not recalling, the equation: **[$E_e = ½ke^2$]**			
	Required practical 6: *investigate the relationship between force and extension for a spring.*			
4.5.4 Moments, levers and gears	*PHY ONLY: State that a body in equilibrium must experience equal sums of clockwise and anticlockwise moments, recall and apply the equation:* ***[M = Fd]***			
	PHY ONLY: Apply the idea that a body in equilibrium experiences an equal total of clockwise and anti-clockwise moments about any pivot			
	PHY ONLY: Explain why the distance, d, must be taken as the perpendicular distance from the line of action of the force to the pivot			
	PHY ONLY: Explain how levers and gears transmit the rotational effects of forces			

4.5.5 Pressure and pressure differences in fluid	*PHY ONLY: Describe a fluid as either a liquid or a gas and explain that the pressure in a fluid causes a force to act at right angles (normal) to the surface of its container*			
	PHY ONLY: Recall and apply the equation: ***[p = F/A]***			
	PHY & HT ONLY: Explain why the pressure at a point in a fluid increases with the height of the column of fluid above and calculate differences in pressure in a liquid by applying [p = h ρ g]			
	PHY & HT ONLY: Describe up thrust an object and explain why the density of the fluid has an effect on the up thrust experienced by an object submerged in it			
	PHY & HT ONLY: Explain why an object floats or sinks, with reference to its weight, volume and the up thrust it experiences			
	PHY ONLY: Describe a simple model of the Earth's atmosphere and of atmospheric pressure, explaining why atmospheric pressure varies with height above a surface			
4.5.6 Forces and motion	Define distance and displacement and explain why they are scalar or vector quantities			
	Express a displacement in terms of both the magnitude and direction			
	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			
	Make measurements of distance and time and then calculate speeds of objects in calculating average speed for non-uniform motion			
	Explain why the speed of wind and of sound through air varies and calculate speed by recalling and applying the equation: ***[s = v t]***			
	Explain the vector–scalar distinction as it applies to displacement, distance, velocity and speed			
	HT ONLY: Explain qualitatively, with examples, that motion in a circle involves constant speed but changing velocity			
	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			
	Draw distance–time graphs from measurements and extract and interpret lines and slopes of distance–time graphs,			
	Describe an object which is slowing down as having a negative acceleration and estimate the magnitude of everyday accelerations			
	Calculate the average acceleration of an object by recalling and applying the equation: ***[a = Δv/t]***			
	Represent motion using velocity–time graphs, finding the acceleration from its gradient and distance travelled from the area underneath			
	HT ONLY: Interpret enclosed areas in velocity–time graphs to determine distance travelled (or displacement)			
	HT ONLY: Measure, when appropriate, the area under a velocity– time graph by counting square			
	Apply, but not recall, the equation: ***[$v^2 - u^2 = 2as$]***			
	PHY ONLY: Draw and interpret velocity-time graphs for objects that reach terminal velocity			
	PHY ONLY: Interpret and explain the changing motion of an object in terms of the forces acting on it			
	PHY ONLY: Explain how an object falling from rest through a fluid due to gravity reaches its terminal velocity			
	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			
	Define and apply Newton's second law relating to the acceleration of an object			
	Recall and apply the equation: ***[F = ma]***			
	HT ONLY: Describe what inertia is and give a definition			
	Estimate the speed, accelerations and forces of large vehicles involved in everyday road transport			
	Required practical 7: *investigate the effect of varying the force on the acceleration of an object of constant mass, and the effect of varying the mass of an object on the acceleration*			

	Apply Newton's Third Law to examples of equilibrium situations			
	Describe factors that can affect a driver's reaction time			
	Explain methods used to measure human reaction times and recall typical results			
	Interpret and evaluate measurements from simple methods to measure the different reaction times of students			
	Evaluate the effect of various factors on thinking distance based on given data			
	PHY ONLY: Estimate the distance required for an emergency stop in a vehicle over a range of typical speeds			
	PHY ONLY: Interpret graphs relating speed to stopping distance for a range of vehicles			
	State typical reaction times and describe how reaction time (and therefore stopping distance) can be affected by different factors			
	Explain methods used to measure human reaction times and take, interpret and evaluate measurements of the reaction times of students			
	Explain how the braking distance of a vehicle can be affected by different factors, including implications for road safety			
	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			
	Explain and apply the idea that a greater braking force causes a larger deceleration and explain how this might be dangerous for drivers			
	HT ONLY: Estimate the forces involved in the deceleration of road vehicles			

4.5.7 Momentum	HT ONLY: Calculate momentum by recalling and applying the equation: *[p = mv]*			
	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			
	HT ONLY: Describe examples of momentum in a collision			
	PHY & HT ONLY: Complete conservation of momentum calculations involving two objects			
	PHY & HT ONLY: Explain that when a force acts on an object that is moving, or able to move, a change in momentum occurs			
	PHY & HT ONLY: Calculate a force applied to an object, or the change in momentum it causes, by applying but not recalling the equation: [F = m Δv / Δt]			
	PHY & HT ONLY: Explain that an increased force delivers an increased rate of change of momentum			
	PHY & HT ONLY: Apply the idea of rate of change of momentum to explain safety features such as air bags, seat belts, helmets and cushioned surfaces			

AQA Physics (8463) from 2016 Topics P4.6. Waves				
Topic	**Student Checklist**	**R**	**A**	**G**
4.6.1 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			
	Define waves as transfers of energy from one place to another, carrying information			
	Define amplitude, wavelength, frequency, period and wave speed and Identify them where appropriate on diagrams			
	State examples of methods of measuring wave speeds in different media and Identify the suitability of apparatus of measuring frequency and wavelength			
	Calculate wave speed, frequency or wavelength by applying, but not recalling, the equation: ***[$v = f\lambda$] and*** calculate wave period by recalling and applying the equation: ***[$T = 1/f$]***			
	Identify amplitude and wavelength from given diagrams			
	Describe a method to measure the speed of sound waves in air			
	Describe a method to measure the speed of ripples on a water surface			
	PHY ONLY: Demonstrate how changes in velocity, frequency and wavelength are inter-related in the transmission of sound waves from one medium to another			
	Required practical 8: *make observations to identify the suitability of apparatus to measure the frequency, wavelength and speed of waves in a ripple tank and waves in a solid*			
	PHY ONLY: Discuss the importance of understanding both mechanical and electromagnetic waves by giving examples, such as designing comfortable and safe structures and technologies			
	PHY ONLY: Describe a wave's ability to be reflected, absorbed or transmitted at the boundary between two different materials			
	PHY ONLY: Draw the reflection of a wave at a surface by constructing ray diagrams			
	Required practical 9 *(physics only): investigate the reflection of light by different types of surface and the refraction of light by different substances.*			
	PHY & HT ONLY: Describe, with examples, processes which convert wave disturbances between sound waves and vibrations in solids			
	PHY & HT ONLY: Explain why such processes only work over a limited frequency range and the relevance of this to the range of human hearing, which is from 20 Hz to 20 kHz			
	PHY & HT ONLY: Define ultrasound waves and explain how these are used to form images of internal structures in both medical and industrial imaging			
	PHY & HT ONLY: Compare the two types of seismic wave produced by earthquakes with reference to the media they can travel in and the evidence they provide of the structure of the Earth			
	PHY & HT ONLY: Describe how echo sounding using high frequency sound waves is used to detect objects in deep water and measure water depth			

4.6.2 Electromagnetic waves	Describe what electromagnetic waves are and explain how they are grouped			
	List the groups of electromagnetic waves in order of wavelength			
	Explain that because our eyes only detect a limited range of electromagnetic waves, they can only detect visible light			
	HT ONLY: Explain how different wavelengths of electromagnetic radiation are reflected, refracted, absorbed or transmitted differently by different substances and types of surface			
	Illustrate the refraction of a wave at the boundary between two different media by constructing ray diagrams			
	HT ONLY: Describe what refraction is due to and illustrate this using wave front diagrams			
	Required practical activity 10: *investigate how the amount of infrared radiation absorbed or radiated by a surface depends on the nature of that surface.*			
	HT ONLY: Explain how radio waves can be produced by oscillations in electrical circuits, or absorbed by electrical circuits			
	Explain that changes in atoms and the nuclei of atoms can result in electromagnetic waves being generated or absorbed over a wide frequency range			
	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			
	State examples of the uses of each group of electromagnetic radiation, explaining why each type of electromagnetic wave is suitable for its applications			
	PHY ONLY: State that a lens forms an image by refracting light and that the distance from the lens to the principal focus is called the focal length			
	PHY ONLY: Explain that images produced by a convex lens can be either real or virtual, but those produced by a concave lens are always virtual			
	PHY ONLY: Construct ray diagrams for both convex and concave lenses			
	PHY ONLY: Calculate magnification as a ratio with no units by applying, but not recalling, the formula: [magnification = image height / object height]			
	PHY ONLY: Explain how the colour of an object is related to the differential absorption, transmission and reflection of different wavelengths of light by the object			
	PHY ONLY: Describe the effect of viewing objects through filters or the effect on light of passing through filters and the difference between transparency and translucency			
	PHY ONLY: Explain why an opaque object has a particular colour, with reference to the wavelengths emitted			
	PHY ONLY: State that all bodies, no matter what temperature, emit and absorb infrared radiation and that the hotter the body, the more infrared radiation it radiates in a given time			
	PHY ONLY: Describe a perfect black body as an object that absorbs all the radiation incident on it and explain why it is the best possible emitter			
	PHY ONLY: Explain why when the temperature is increased, the intensity of every wavelength of radiation emitted increases, but the intensity of the shorter wavelengths increases more rapidly			
	PHY & HT ONLY: Explain and apply the idea that the temperature of a body is related to the balance between incoming radiation absorbed and radiation emitted			
	PHY & HT ONLY: Describe how the temperature of the Earth as dependent on the rates of absorption and emission of radiation and draw and interpret diagrams that show this			

AQA Physics (8463) from 2016 Topics P4.7. Magnetism and electromagnetism				
TOPIC	**Student Checklist**	**R**	**A**	**G**
4.7.1 Permanent and induced magnetism, magnetic forces and fields	Describe the attraction and repulsion between unlike and like poles of permanent magnets and explain the difference between permanent and induced magnets			
	Draw the magnetic field pattern of a bar magnet, showing how field strength and direction are indicated and change from one point to another			
	Explain how the behaviour of a magnetic compass is related to evidence that the core of the Earth must be magnetic			
	Describe how to plot the magnetic field pattern of a magnet using a compass			
4.7.2 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			
	Draw the magnetic field pattern for a straight wire carrying a current and for a solenoid (showing the direction of the field)			
	PHY ONLY: Interpret diagrams of electromagnetic devices in order to explain how they work			
	HT ONLY: State and use Fleming's left-hand rule and explain what the size of the induced force depends on			
	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]*			
	HT ONLY: Explain how rotation is caused in an electric motor			
	PHY & HT ONLY: Explain how a moving-coil loudspeaker and headphones work			
4.7.3 Induced potential, transformers and the National Grid	***PHY & HT ONLY: Describe the principles of the generator effect, including the direction of induced current, effects of Lenz' Law and factors that increase induced p.d.***			
	PHY & HT ONLY: Explain how the generator effect is used in an alternator to generate a.c. and in a dynamo to generate d.c.			
	PHY & HT ONLY: Draw/interpret graphs of potential difference generated in the coil against time			
	PHY & HT ONLY: Explain how a moving-coil microphone works			
	PHY & HT ONLY: Explain how the effect of an alternating current in one coil inducing a current in another is used in transformers			
	PHY & HT ONLY: Explain how the ratio of the potential differences across the two coils depends on the ratio of the number of turns on each			
	PHY & HT ONLY: Apply the equation linking the p.d.s and number of turns in the two coils of a transformer to the currents and the power transfer			
	PHY & HT ONLY: Apply but not recalling the equations: [Vs × Is = Vp × Ip] and [vp / vs = np / ns] for transformers			

AQA Physics (8463) from 2016 Topics P4.8. Space physics				
TOPIC	**Student Checklist**	**R**	**A**	**G**
4.8.1 Solar system; stability of orbital motions; satellites	*PHY ONLY: List the types of body that make up the solar system and describe our solar system as part of a galaxy*			
	PHY ONLY: Explain how stars are formed			
	PHY ONLY: Describe the life cycle of a star the size of the Sun and of a star which is much more massive than the Sun			
	PHY ONLY: Explain how fusion processes lead to the formation of new elements and how supernovas have allowed heavy elements to appear in later solar systems			
	PHY & HT ONLY: Explain that, for circular orbits, the force of gravity leads to a constantly changing velocity but unchanged speed			
	PHY & HT ONLY: Explain that, for a stable orbit, the radius must change if the speed changes			
4.8.2 Red-shift	*PHY ONLY: Explain, qualitatively, the red-shift of light from galaxies that are receding and how this red-shift changes with distance from Earth*			
	PHY ONLY: Explain why the change of each galaxy's speed with distance is evidence of an expanding universe			
	PHY ONLY: Explain how scientists are able to use observations to arrive at theories, such as the Big Bang theory and discuss that there is still much about the universe that is not understood			