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| **AQA TRILOGY Physics (8464) from 2016 Topics T6.5. Forces** |
| **Topic** | **Student Checklist** | **R** | **A** | **G** |
| **6.5.1 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**  |   |   |   |
| **6.5.2 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 ]* |   |   |   |
|  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 |   |   |   |
| **6.5.3 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: ***[ Ee= ½ke2 ]*** |   |   |   |
|  ***Required practical 18:*** *investigate the relationship between force and extension for a spring.*  |   |   |   |

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| **4.5.4 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: ***[ v2 – u2 = 2as ]*** |   |   |   |
|  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 19:*** *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 |   |   |   |
|  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** |   |   |   |

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| **4.5.5 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** |   |   |   |

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| **AQA TRILOGY Physics (8464) from 2016 Topics T6.6. Waves** |
| **Topic** | **Student Checklist** | **R** | **A** | **G** |
| **6.6.1 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 λ] 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 |   |   |   |
|  ***Required practical 20:*** *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*  |   |   |   |

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| **6.6.2 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 |   |   |   |

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| **AQA TRILOGY Physics (8464) from 2016 Topics T6.7. Magnetism and electromagnetism** |
| **TOPIC** | **Student Checklist** | **R** | **A** | **G** |
| **6.7.1 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 |   |   |   |
| **6.7.2 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** |   |   |   |