Personalised Learning Checklist

AQA TRILOGY Physics (8464) from 2016 Topics T6.1. Energy

Topic	Student Checklist	R	A	G
6.1.1 Energy changes in a system, and the ways energy is stored before and after such changes	Define a system as an object or group of objects and state examples of changes in the way energy is stored in a system			
	Describe how all the energy changes involved in an energy transfer and calculate relative changes in energy when the heat, work done or flow of charge in a system changes			
	Use calculations to show on a common scale how energy in a system is redistributed			
	Calculate the kinetic energy of an object by recalling and applying the equation: ***[$E_k = ½mv^2$]***			
	Calculate the amount of elastic potential energy stored in a stretched spring by applying, but not recalling, the equation: ***[$E_e = ½ke^2$]***			
	Calculate the amount of gravitational potential energy gained by an object raised above ground level by recalling and applying, the equation: ***[$E_e = mgh$]***			
	Calculate the amount of energy stored in or released from a system as its temperature changes by applying, but not recalling, the equation: ***[$\Delta E = mc\Delta\theta$]***			
	Define the term 'specific heat capacity'			
	Required practical 14: *investigation to determine the specific heat capacity of one or more materials.*			
	Define power as the rate at which energy is transferred or the rate at which work is done and the watt as an energy transfer of 1 joule per second			
	Calculate power by recalling and applying the ***equations: [P = E/t & P = W/t]***			
	Explain, using examples, how two systems transferring the same amount of energy can differ in power output due to the time taken			
6.1.2 Conservation and dissipation of energy	State that energy can be transferred usefully, stored or dissipated, but cannot be created or destroyed and so the total energy in a system does not change			
	Explain that only some of the energy in a system is usefully transferred, with the rest 'wasted', giving examples of how this wasted energy can be reduced			
	Explain ways of reducing unwanted energy transfers and the relationship between thermal conductivity and energy transferred			
	Describe how the rate of cooling of a building is affected by the thickness and thermal conductivity of its walls			
	Calculate efficiency by recalling and applying the equation: ***[efficiency = useful power output / total power input]***			
	HT ONLY: Suggest and explain ways to increase the efficiency of an intended energy transfer			
6.1.3 National	List the main renewable and non-renewable energy resources and define what a renewable energy resource is			
	Compare ways that different energy resources are used, including uses in transport, electricity generation and heating			

	Explain why some energy resources are more reliable than others, explaining patterns and trends in their use			
	Evaluate the use of different energy resources, taking into account any ethical and environmental issues which may arise			
	Justify the use of energy resources, with reference to both environmental issues and the limitations imposed by political, social, ethical or economic considerations			

AQA TRILOGY Physics (8464) from 2016 Topics T6.2. Electricity (Paper 1)

Topic	Student Checklist	R	A	G
6.2.1 Current, potential difference and resistance	Draw and interpret circuit diagrams, including all common circuit symbols			
	Define electric current as the rate of flow of electrical charge around a closed circuit			
	Calculate charge and current by recalling and applying the formula: ***[Q = It]***			
	Explain that current is caused by a source of potential difference and it has the same value at any point in a single closed loop of a circuit			
	Describe and apply the idea that the greater the resistance of a component, the smaller the current for a given potential difference (p.d.) across the component			
	Calculate current, potential difference or resistance by recalling and applying the equation: ***[V = IR]***			
	Required practical 15: *Use circuit diagrams to set up and check circuits to investigate the factors affecting the resistance of electrical circuits*			
	Define an ohmic conductor			
	Explain the resistance of components such as lamps, diodes, thermistors and LDRs and sketch/interpret IV graphs of their characteristic electrical behaviour			
	Explain how to measure the resistance of a component by drawing an appropriate circuit diagram using correct circuit symbols			
	Required practical 16: *use circuit diagrams to construct appropriate circuits to investigate the I–V characteristics of a variety of circuit elements*			
6.2.2 Series and parallel circuits	Show by calculation and explanation that components in series have the same current passing through them			
	Show by calculation and explanation that components connected in parallel have the same the potential difference across each of them			
	Calculate the total resistance of two components in series as the sum of the resistance of each component using the equation: ***[$R_{total} = R_1 + R_2$]***			
	Explain qualitatively why adding resistors in series increases the total resistance whilst adding resistors in parallel decreases the total resistance			
	Solve problems for circuits which include resistors in series using the concept of equivalent resistance			
6.2.3 Domestic uses and safety	Explain the difference between direct and alternating voltage and current, stating what UK mains is			
	Identify and describe the function of each wire in a three-core cable connected to the mains			
	State that the potential difference between the live wire and earth (0 V) is about 230 V and that both neutral wires and our bodies are at, or close to, earth potential (0 V)			
	Explain that a live wire may be dangerous even when a switch in the mains circuit is open by explaining the danger of providing any connection between the live wire and earth			

6.2.4 Energy transfers	Explain how the power transfer in any circuit device is related to the potential difference across it and the current through it			
	Calculate power by recalling and applying the equations: ***[P = VI]*** and ***[$P = I^2 R$]***			
	Describe how appliances transfer energy to the kinetic energy of motors or the thermal energy of heating devices			
	Calculate and explain the amount of energy transferred by electrical work by recalling and applying the equations: ***[E = Pt]*** and ***[E = QV]***			
	Explain how the power of a circuit device is related to the potential difference across it, the current through it and the energy transferred over a given time.			
	Describe, with examples, the relationship between the power ratings for domestic electrical appliances and the changes in stored energy when they are in use			
	Identify the National Grid as a system of cables and transformers linking power stations to consumers			
	Explain why the National Grid system is an efficient way to transfer energy, with reference to change in potential difference reducing current			

AQA TRILOGY Physics (8464) from 2016 Topics T6.3. Particle model of matter (Paper 1)

TOPIC	**Student Checklist**	**R**	**A**	**G**
6.3.1 Changes of state and the particle model	Calculate the density of a material by recalling and applying the equation: ***[ρ = m/V]***			
	Recognise/draw simple diagrams to model the difference between solids, liquids and gases			
	Use the particle model to explain the properties of different states of matter and differences in the density of materials			
	Required practical 17: *use appropriate apparatus to make and record the measurements needed to determine the densities of regular and irregular solid objects and liquids*			
	Recall and describe the names of the processes by which substances change state			
	Use the particle model to explain why a change of state is reversible and affects the properties of a substance, but not its mass			
6.3.2 Internal energy and energy transfers	State that the internal energy of a system is stored in the atoms and molecules that make up the system			
	Explain that internal energy is the total kinetic energy and potential energy of all the particles in a system			
	Calculate the change in thermal energy by applying but not recalling the equation ***[ΔE =m c Δθ]***			
	Calculate the specific latent heat of fusion/vaporisation by applying, but not recalling, the equation: ***[E = mL]***			
	Interpret and draw heating and cooling graphs that include changes of state			
	Distinguish between specific heat capacity and specific latent hea			
6.3.3 Particle model and	Explain why the molecules of a gas are in constant random motion and that the higher the temperature of a gas, the greater the particles' average kinetic energy			
	Explain, with reference to the particle model, the effect of changing the temperature of a gas held at constant volume on its pressure			

	Calculate the change in the pressure of a gas or the volume of a gas (a fixed mass held at constant temperature) when either the pressure or volume is increased or decreased			
AQA TRILOGY Physics (8464) from 2016 Topics T6.4. Atomic structure (Paper 1)				
TOPIC	**Student Checklist**	**R**	**A**	**G**
T6.4.1 Atoms and isotopes	Describe the basic structure of an atom and how the distance of the charged particles vary with the absorption or emission of electromagnetic radiation			
	Define electrons, neutrons, protons, isotopes and ions			
	Relate differences between isotopes to differences in conventional representations of their identities, charges and masses			
	Describe how the atomic model has changed over time due to new experimental evidence, inc discovery of the atom and scattering experiments (inc the work of James Chadwick)			
T6.4.2 Atoms and nuclear radiation	Describe and apply the idea that the activity of a radioactive source is the rate at which its unstable nuclei decay, measured in Becquerel (Bq) by a Geiger-Muller tube			
	Describe the penetration through materials, the range in air and the ionising power for alpha particles, beta particles and gamma rays			
	Apply knowledge of the uses of radiation to evaluate the best sources of radiation to use in a given situation			
	Use the names and symbols of common nuclei and particles to complete balanced nuclear equations, by balancing the atomic numbers and mass numbers			
	Define half-life of a radioactive isotope			
	HT ONLY: Determine the half-life of a radioactive isotope from given information and calculate the net decline, expressed as a ratio, in a radioactive emission after a given number of half-lives			
	Compare the hazards associated with contamination and irradiation and outline suitable precautions taken to protect against any hazard the radioactive sources may present			
	Discuss the importance of publishing the findings of studies into the effects of radiation on humans and sharing findings with other scientists so that they can be checked by peer review			
AQA TRILOGY Physics (8464) from 2016 Topics T6.5. Forces (Paper 2)				
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: ***[$E_e = ½ke^2$]***			
	Required practical 18: investigate the relationship between force and extension for a spring			
6.5.4 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: ***[$v^2 - u^2 = 2as$]***			
	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 effect a drivers reations 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			
6.5.5 Mom	**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			

AQA TRILOGY Physics (8464) from 2016 Topics T6.6. Waves (Paper 2)

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*			
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 21: *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			

AQA TRILOGY Physics (8464) from 2016 Topics T6.7. Magnetism and electromagnetism (Paper 2)				
TOPIC	**Student Checklist**	**R**	**A**	**G**
6.7.1 Permanent and induced magnetism,	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)			
	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			