

Combined Science - Physics Paper 1 Higher Tier Personal Learning Checklist (PLC)

P1 Energy

Learning Objectives:	Confidence		
	R	A	G
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: [$E_k = \frac{1}{2}mv^2$]			
Calculate the amount of elastic potential energy stored in a stretched spring by applying, but not recalling, the equation: [$E_e = \frac{1}{2}ke^2$]			
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 1: 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			
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			

Required practical 2: investigate the effectiveness of different materials as thermal insulators and the factors that may affect the thermal insulation properties of a material.			
Calculate efficiency by recalling and applying the equation: [efficiency = useful power output / total power input]			
Suggest and explain ways to increase the efficiency of an intended energy transfer			
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			

P2 Electricity

Learning Objectives:	Confidence		
	R	A	G
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 3: 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 4: use circuit diagrams to construct appropriate circuits to investigate the I–V			

characteristics of a variety of circuit elements			
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: [$R_{\text{total}} = R_1 + R_2$]			
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			
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			
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			

P3 Particle Model of Matter

Learning Objectives:	Confidence		
	R	A	G
Calculate the density of a material by recalling and applying the equation: [$\rho = m/V$]			
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 5: 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			
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 $[\Delta E = m c \Delta \theta]$			
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 heat			
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			

P4 Atoms and Radiation

Learning Objectives:	Confidence		
	R	A	G
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)			
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			
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			