PMT Education

GCSE

COMBINED SCIENCE: TRILOGY

8464/P/1H

Physics Paper 1H

Mark scheme

Predicted Paper 2026 (Based on AQA)

Question	Answers	Extra information	Mark	Main topic(s) tested
1.1	Rutherford's gold foil experiment	allow alpha scattering experiment/ Geiger–Marsden experiment	**1**	Atomic structure
1.2	+2	allow positive/ 2+	**1**	Atomic structure
1.3	• most alpha particles passed straight through the foil with little or no deflection • this proved that the atom is **mostly** empty space.		**1** **1**	Atomic structure
1.4	• atom is a sphere of positive charge • electrons are embedded within the positive charge • overall atom is neutral	allow total positive charge = total negative charge	**1** **1** **1**	Atomic structure
1.5	Any **two** from: • Mass is spread **evenly** throughout the entire atom in plum pudding whereas most of the mass is **concentrated** in a tiny, central nucleus in nuclear model • Positive charge is a **diffuse "cloud"** or sphere in plum pudding while in nuclear model, the positive charge is concentrated in the **nucleus** • There is **no empty space**; the atom is a solid ball in plum pudding whereas atom is **mostly empty space**, with electrons orbiting the nucleus in nuclear model		**2**	Atomic structure

Question	Answers	Extra information	Mark	Main topic(s) tested
1.6	26 number of protons = 26 number of electrons = 26 number of neutrons = 30		**1** **1**	Atomic structure

1.7	time taken for the number of radioactive nuclei to halve	*allow activity / count on a Geiger-Muller tube / mass in place of 'number of radioactive nuclei'*	**1**	Radioactive decay

Question	Answers	Extra information	Mark	Main topic(s) tested
2.1	direct potential difference is always in the same direction alternating potential difference changes direction		**1** **1**	National Grid
2.2	230 V		**1**	National Grid
2.3	any **three** from: • Cell/ battery • Switch • Variable resistor • Ammeter • Voltmeter • Resistor		**3**	Electrical circuits
2.4	measures the potential difference (voltage) across the resistor	allow measures voltage across component	**1**	Electrical circuits
2.5	current		**1**	Electrical circuits

Question	Answers	Extra information	Mark	Main topic(s) tested
2.6	**Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced		**5-6**	Resistance Current–potential difference
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced		**3-4**	
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear		**1-2**	
	No relevant content		**0**	
	Indicative content • set up a circuit with a power supply, ammeter in series and voltmeter in parallel across the wire • include a variable resistor to change the potential difference • change the variable resistor to vary the potential difference • record the potential difference from the voltmeter • record the current from the ammeter • repeat for a range of potential differences • calculate resistance using R = V / I • plot a graph of potential difference against current (or calculate resistance for each reading) • control variables: temperature, material and thickness of the wire used • repeat readings and calculate a mean *Accept circuit diagram set up if correctly*			

Question	Answers	Extra information	Mark	Main topic(s) tested
3.1	gravitational potential energy		**1**	Energy stores

3.2	2 minutes = 120s P = E/t P = 2400 ÷ 120 P = 20 W		**1** **1** **1**	Power

3.3	an object or group of objects any valid example e.g. a falling object / a car and its surroundings / a pendulum		**1** **1**	Energy stores and systems

Question	Answers	Extra information	Mark	Main topic(s) tested
3.4	**Level 3:** The explanation is clear, coherent and logically structured. Links between energy transfer methods and energy waste are clear		4	Energy transfers by heating
	Level 2: Some relevant points are made but not fully linked or developed		2-3	
	Level 1: Limited relevant points with little clarity		1	
	No relevant content		0	
	Indicative content			
	• energy is transferred electrically to the heater • energy is transferred by heating to the surrounding air • convection currents form as warm air rises and cooler air sinks • infrared radiation transfers energy from the heater to objects in the room • some energy is transferred to the surroundings outside the room • energy is lost through walls / windows / floor • energy spreads to the surroundings so is less useful			

3.5	efficiency $= \frac{\textit{useful energy output}}{\textit{total energy input}}$ useful energy = 0.30 × 50 000 useful energy = 15 000 J	allow 15 kJ	1 1 1	Energy stores and systems

Question	Answers	Extra information	Mark	Main topic(s) tested
4.1	particles are far apart / randomly arranged particles move randomly in all directions	 allow move freely / move quickly	1 1	Particle model of matter

4.2	volume = 65 − 50 = 15 cm³ ρ = m / V density = 120 ÷ 15 density = 8 g/cm³	 allow 8000 kg/m³	1 1 1	Waves Frequency

4.3	Any **two** from: • reading error (meniscus/ parallax error) • air bubbles attached to object • water splashes/ not all object submerged		2	Waves Frequency

Question	Answers	Extra information	Mark	Main topic(s) tested
4.4	**Level 3:** Clear explanation of randomness and valid use of the graph to support the idea. Logical and coherent		**4**	Radioactive decay
	Level 2: Some correct points about randomness or graph but not fully linked		**2-3**	
	Level 1: Limited relevant statements		**1**	
	No relevant content		**0**	
	Indicative content			
	• radioactive decay is random because you cannot predict when an individual nucleus will decay • decay is spontaneous / unaffected by external conditions • graph shows a smooth exponential decrease in activity • activity halves at regular intervals (constant half-life) • this shows behaviour is predictable for large numbers but not individual nuclei			

Question	Answers	Extra information	Mark	Main topic(s) tested
5.1	ratio of useful energy output to total energy input	allow useful energy out ÷ total energy in	**1**	Efficiency

5.2	**Level 3:** Clear comparison with at least one advantage and one disadvantage of both renewable and non-renewable resources. Correct example of both given. Logical and coherent	**4**	Energy resources
	Level 2: Some correct comparisons but may be incomplete or lack balance	**2-3**	
	Level 1: Limited relevant points	**1**	
	No relevant content	**0**	
	Indicative content		
	• renewable energy resources are naturally replenished / will not run out • non-renewable energy resources are finite / will run out • examples of renewable energy: solar / the Sun, wind, hydroelectricity, geothermal, the tides, water waves • examples of non-renewable energy: fossil fuels (coal, oil and gas), nuclear fuel, bio-fuel • advantages of renewable: low / no greenhouse gas emissions / less pollution *(accept any correct advantages for specific examples given e.g solar has low maintenance, can be installed almost anywhere)* • disadvantage of renewable: unreliable / dependent on weather *(accept any correct disadvantages for specific examples given e.g solar panels cannot generate electricity at night)* • advantage of non-renewable: reliable / can generate electricity on demand *(accept any correct advantages for specific examples given e.g coal is cheap and abundant)* • disadvantage of non-renewable: produces greenhouse gases / causes pollution *(accept any correct disadvantages for specific examples given e.g coal releases high carbon dioxide emission when burned)*		

Question	Answers	Extra information	Mark	Main topic(s) tested
5.3	using a high voltage means the electricity can be transmitted at a much lower current a lower current significantly reduces the energy dissipated as heat in the transmission cables reduced heat loss makes transmission process more efficient over long distances, ensuring more energy reaches the consumer.	allow reduces heating effect	1 1 1	The National Grid

5.4	insulation reduces energy transfer by conduction (by trapping air) reduces energy/heat loss to the surroundings less energy needed to heat the building / reduces energy bills / reduces environmental impact	allow reduce heat transfer by convection allow more efficient / reduces waste	1 1 1	Energy transfers by heating

Question	Answers	Extra information	Mark	Main topic(s) tested
6.1	internal energy increases		**1**	Internal energy
6.2	any **one** from: • mass of the water • same heater power		**1**	Specific heat capacity
6.3	2.5 MJ = 2 500 000 J E = mcΔθ E = 1 x 4200 x 25 = 105 000 J -> Energy used to reach 100 ℃ E = mL E = 1 x 2.26 x 10^6 E = 2.26 x 10^6 J Energy left = 2 500 000 – (105 000 + 2.26 x 10^6) Energy left = 135 000 J E = mcΔθ 135 000 = 1 x 2100 x Δθ Δθ = 64.3 ℃ Final temperature = 100 + 64.3 = 164.3 ℃ Final state = gas		**1** **1** **1** **1** **1** **1**	SHC calculations
6.4	Any **one** of the following: • The heater absorbed some energy • The beaker absorbed some energy • Some water evaporated before 100 ℃, so the mass decreased		**1**	SHC