PEARSON EDEXCEL GCSE PHYSICS (HIGHER) · 1PH0

PHYSICS



MARK SCHEME

TOPIC 4: WAVES (PACK 2)

SCORE	PERCENTAGE
/68	%

STEMUP

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Mark Scheme

Q1.

Question number	Answer	Additional guidance	Mark
	explanation linking: wave P refracts (towards the normal) (1) because P slows down (1) AND wave Q is reflected (at an equal angle from the boundary) (1) without change of speed of Q (1)	 accept 'upper layer' for 'P' accept 'wavelength decreases' accept 'bends' for 'refracts' in this instance accept 'lower layer' for 'Q' accept 'wavelength unchanged' accept 'wave Q bounces off' (at an equal angle) allow one mark for refraction and reflection if no other mark awarded	**(4)**

Q2.

Question Number	Answer	Additional guidance	Mark
	substitution (1) $\frac{3.0 (\times 10^{8})}{5.8 (\times 10^{-7})}$ evaluation (1) 5.2×10^{14} unit (1) Hz	 answers that round to 5.2×10^{14} award 2 marks for a correct answer without working allow 1 mark for answers that round to 5.2 to any power of ten independent mark accept hz or s^{-1} or per sec(ond) or hertz accept kHz, MHz etc with correct power (10^{11} kHz, 10^{8} MHz)	**(3)** AO 2 1

Q3.

Question Number:	Answer	Mark
(i)	☒ C a neutron **The only correct answer is C (neutron causes U-235 fission)** **A** is not correct – incorrect particle **B** is not correct – incorrect particle **D** is not correct – incorrect particle	**(1)**

Question Number	Answer	Additional guidance	Mark
(ii)	recall and substitution (1) $1.2 \times 10^{-11} = ½ \times 1.4 \times 10^{-25} \times v^2$ rearrangement (1) $v^2 = \frac{2 \times 1.2 \times 10^{-11}}{1.4 \times 10^{-25}}$ evaluation (1) (v=) 1.3×10^7 (m/s)	accept rearrangement and substitution in either order ignore POT until evaluation $v^2 = 1.71 \times 10^{14}$ allow numbers that round to 1.3×10^7 (m/s) 1.3 to any other power of ten scores 2 marks award full marks for the correct answer without working	**(3)**

Q4.

Question Number	Answer	Additional Guidance	Mark
(i)	recall (1) (ΔPE) = mgh substitution and rearrangement (1) $h = \frac{1300}{7 \times 10}$ evaluation (1) 19 (m)	 1300 = 7 x 10 x h work done = force x distance accept answers that round up to 19 (m) (e.g. 18.57 (m)) award full marks for the correct answer with no working	**(3)** AO 1 1 AO 2 1

Question Number	Answer	Additional guidance	Mark
(ii)	recall (1) KE = ½ m v^2 substitution and rearrangement (1) v =√(2 x 1100÷8) evaluation (1) 17 (m/s)	 $v^2 = \frac{2 \times 1100}{8}$ accept answers that round up to 17 (m/s) (e.g. 16.58 (m/s)) award full marks for the correct answer with no working	**(3)** AO 1 1 AO 2 1

Q5.

Question Number	Answer	Additional guidance	Mark
	reading energies from graph (1) 5.2 and 3.9 (kJ) substitution (1) e.g. $\frac{1.3 \times (100)}{5.2}$ evaluation (1) 25(%)	accept 5.0 to 5.4 and 3.7 to 4.1 0.18 to 0.32 18 to 32 (%) award full marks for the correct answer with no working	**(3)** AO 2 1

Q6.

	Answer	Additional guidance	Mark
i	**Two** from: falling water/hydro (1) tides (1) sun/solar (1) geothermal (1) biomass (1)		**(2)** **AO1**

	Answer	Additional guidance	Mark
(ii)	recall and substitution (1) (%) efficiency = $\frac{2.2 \ (\times 100)}{6.2}$ evaluation (1) 0.35 (1)	 allow numbers that round to 0.35 e.g. 0.3548 accept 35(%) for full marks award full marks for correct answer without working.	**(2)** **AO2**

	Answer	Additional guidance	Mark
(iii)	**One** from: air (has to be) moving on the other side of the blades (1) not all of the air hits the blade (1) friction within the turbine/generator (1) some energy (always) transferred to thermal (1) it is fitted with a speed limiter (1)		**(1)** **AO3**

Q7.

Question Number	Answer	Mark
	B natural gas **is the only correct answer** *A geothermal is not a non-renewable source of energy* *C tidal is not a non-renewable source of energy* *D solar is not a non-renewable source of energy*	**(1)** AO 1 1

Q8.

Question Number	Answer	Additional guidance	Mark
	an explanation linking: increased use of renewables/decrease use of nonrenewables (1) reason (1)	 accept "them" as renewable accept reason why renewables are beneficial accept reason why non-renewable(s) are not beneficial	**(2)** AO 1 1

Q9.

Question Number	Answer	Additional guidance	Mark
	an explanation linking: (the colours have) different wavelengths (1) different wavelengths / colours travel at different speeds (1) so refract by different amounts (1)	 allow the word frequencies for wavelengths for refract allow bend/change direction/follow different path	**(3)** AO 2 1

Q10.

Question number	Answer	Additional guidance	Mark
	(original) GPE – KE (at bottom) (1)	allow (idea of) input – output allow wrong way round (eg output-input)	**(1)**

Q11.

Question Number	Answer	Additional guidance	Mark
	An answer that includes: (measure) mass of the trolley (1) (measure) (vertical) height / h (1) repeat for a range of masses (1) plus **any one** from: method of identifying / measuring h (1) OR repeat firing with same mass (1)	 weigh the trolley NOT measure height of ramp e.g. use of reference mark accept "use ruler to measure height/h" for 2 marks NOT "use ruler to measure height of ramp"	**(4)**

Q12.

Question number	Answer	Additional guidance	Mark
	(vertical) height of slope (1) mass (of the toy car) (1)	 allow (in this context) weight if no other mark scored allow 1 mark for quoting either equation (Δ)GPE =mgh OR KE = ½ mv²	**(2)**

Q13.

Question number	Answer	Mark
(i)	Any three of • sound waves are longitudinal but radio waves are transverse. • sound waves need a medium but radio waves travel through a vacuum. • sound waves have (much) lower velocity than radio waves. • sound waves have lower frequency / greater wavelength than radio waves • sound waves are vibrations but radio waves are electromagnetic waves.	**(3)**

Q14.

Question Number	Answer	Additional Guidance	Mark
	one from causes heating of the surroundings (1) transferred to thermal energy of surroundings (1) increases the kinetic energy of molecules in the brake pads (1)	must include destination of final energy increases thermal energy of brake pads / wheels	**(1)**

Q15.

Question Number	Answer	Additional guidance	Mark
	Any **two** advantages such as: nuclear fuel • does not contribute to global warming • does not use up fossil fuels • occupies less space • does not involve a supply of air • gives less reason to surface/refuel • lasts longer	accept reverse arguments does not produce carbon dioxide / greenhouse gases ignore cheaper, cleaner, greener, pollutes the sea, more efficient, unqualified safety, renewable	(2)

Q16.

Question number	Answer	Acceptable	Mark
(i)	An explanation that combines identification - understanding (1 mark) and reasoning/justification - understanding (2 marks): • white light is a mixture of different wavelengths (1) • each wavelength / colour is refracted by a different amount (1) • short <u>wavelengths</u> are refracted more / ORA (1)	ignore colours	(3)

Question number	Answer	Acceptable	Mark
(ii)	An answer that combines the following points to provide a logical description of the method: • Place a thermometer (with blackened bulb) beyond position of red light (1) • Look for rise in temperature (measured by thermometer) (1)		(2)

Q17.

Question Number	Answer	Additional guidance	Mark
	reference to ΔPE = mg(Δ)h (1) relevant values from graph and one calculation to find energy (1) repeated with 2nd set of values (1)	can be seen in calculations e.g. 0.6 x 10 x 0.230 ≈ 1.4 (J) e.g. 1.0 x (10) x 0.138 ≈ 1.4 (J) must see calculations for mp2 and 3 1 mark for 2 calculations of mh with 'g' omitted (MP3)	**(3)**

Q18.

Question Number	Answer	Additional guidance	Mark
	using cold row: evaluate (K=)376 (1) using warm row: substitute K and ρ $\frac{376}{\sqrt{1.16}}$ OR 349.10.... (1) 349 (m/s) to 3 sig figs (1)	$\frac{\text{other K from earlier calculation}}{\sqrt{1.16}}$ any answer to 3 sig figs 349.10... scores MP1 and MP2 award full marks for the correct answer without working	**(3)**

Q19.

Question Number	Answer	Additional guidance	Mark
(i)	evidence of use of scale on horizontal distance axis only (1) 12 (cm) (1)	may be seen on the diagram range 11.5 to 12.5 (cm) award full marks for the correct answer without working 6 (cm) or 30(cm) scores 1 mark (evidence of use)	**(2)**

Question Number	Answer	Additional guidance	Mark
(ii)	a description to include: moves up and down (1) at right angles / normal / perpendicular to (direction of) wave / travel (1)	independent marking points vertical (oscillations) not in the (direction of) wave / travel accept 'transverse wave' for 2nd MP	**(2)**

Q20.

	Answer	Acceptable answers	Mark
(a)	**light**→ electrical → **chemical** energy energy energy	These answers must be in the correct order	**(2)**

	(1) (1)		
(b)(i)	350 (J)	400 – 50 (J)	**(1)**
(b)(ii)	Substitution 50 ÷ 400 (1) or $^{50 \times 100}/_{400}$ (%) Evaluation 13(%) (1)	 12.5(%), 0.125, 0.13 or 1/8 Give full marks for correct answer, no working	**(2)**
(c)(i)	An explanation linking the following points: black (1) (because) (good) absorber (of thermal radiation) (1)	 {absorbs / takes in} heat radiation **ignore**references to: attract good emitter light dark / darker	**(2)**
(c)(ii)	an explanation linking any **three**of the following points: • (bag / water) absorbs {thermal energy / heat / radiation} (1) • (bag / water) {radiates / emits} {thermal energy / heat / radiation} (1) • more heat radiated at higher temperature (1) • input and output are balanced (at steady temperature) (1)	 idea of energy input e.g. "sun heats the bag up" idea of energy output idea of more heat lost (to surroundings)at higher temperature "absorbing heat at same rate as radiating heat" (3) **ignore**(sun) light / rays	**(3)**

Q21.

Question Number	Answer	Additional guidance	Mark
	a description to include: (the prong makes the) air vibrate/oscillate (1) in the same direction as /parallel to the wave travels (1)	causes compressions and rarefactions in air transfers ke to air longitudinal credit can be given for a labelled diagram	**(2)** AO 1 1

Q22.

Question number	Answer	Additional guidance	Mark
(i)	a description to include count the number of waves(1) (arriving/passing a point) in a specific time(1) use frequency = number of waves / time (1)	 ignore in one second count the number of waves in one second scores 2 marks (MP1 and MP3) find the time between one wave and the next scores 2 marks (MP1 and MP2)	**(3)** **AO1**

Question number	Answer	Additional guidance	Mark
(ii)	substitution (1) $1.5 = 0.7 \times \lambda$ rearrangement and evaluation 2.1(4) m	 $\frac{1.5}{0.7}$ allow $\frac{0.7}{1.5}$ for 1 mark award full marks for correct answer without working. $\lambda = v/f$ scores 1 mark	**(2)** **AO2**

Question number	Answer	Additional guidance	Mark
(iii)	A description to include: mention of oscillations/vibrations (1) EITHER transverse – (oscillations) perpendicular to direction of wave (travel) (1) OR longitudinal - (oscillations) in same direction as wave (travel) (1)	 up and down OR side to side (movements) OR back and forth transverse movement up and down but longitudinal is side to side (1 mark only)	**(2)** **AO1**

Q23.

Question Number		Indicative Content	Mark
QWC	*	An explanation including some of the following points • Longitudinal {vibrations/oscillations} are {along/parallel to/in the same direction as} the direction of {travel/energy transfer} • Transverse {vibrations/oscillations} are {across/perpendicular to/90° to/right angles to} the direction of {travel/energy transfer} • Ultraviolet waves are transverse • Ultrasound waves are longitudinal (ignore sound – not on list) • Some seismic waves are longitudinal and some are transverse • P waves are longitudinal • S waves are transverse • Longitudinal waves need a material for the vibrations whereas electromagnetic waves can pass through a vacuum **IGNORE** irrelevant material	**(6)**

Level	**0**	No rewardable content
1	**1 - 2**	• a limited explanation of: EITHER the {vibration/movement} direction and direction of {travel/movement} for transverse or longitudinal wave OR correctly identifying the wave type for at least one example from the list, e.g. ○ Longitudinal waves move in the same direction as the wave moves ○ Ultraviolet waves are transverse • the answer communicates ideas using simple language and uses limited scientific terminology
2	**3 - 4**	• a simple explanation linking: EITHER directions of {vibration/oscillation} and wave travel for both types of wave OR direction of {vibration/oscillation} and wave travel of one type of wave with at least one example of a wave from the list OR the direction of 'movement' and direction of {travel/movement} for transverse AND longitudinal waves AND correctly identifying the wave type for at least one example from the list e.g. ○ In longitudinal waves the vibrations are in the same direction as the wave travels. In transverse waves the vibrations are at right angles to the direction the wave travels. ○ In longitudinal waves the vibrations are in the same direction as the wave travels. Ultraviolet waves are transverse. ○ Longitudinal waves move in the same direction as the wave moves. Transverse waves move at right angles to the direction the wave moves. Ultrasound waves are longitudinal. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy

3	**5 - 6**	• a detailed explanation clearly differentiating between the directions of {vibration/oscillation} for longitudinal AND transverse waves AND at least one example of each type of wave from the list, e.g. o In longitudinal waves the vibrations are in the same direction as the wave travels. In transverse waves the vibrations are at right angles to the direction the wave travels. Ultrasound waves are longitudinal and ultraviolet waves are transverse. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

Q24.

Question Number	Answer	Acceptable answers	Mark
	Substitution (1) (Speed =) $6.67 \times 10^{14} \times 4.5 \times 10^{-7}$ Transposition AND substitution (1) (time =) $\frac{4 \times 10^{16}}{(6.67 \times 10^{14} \times 4.5 \times 10^{-7})}$ Evaluation (1) 1.33×10^{8} (s)	Award full marks for correct answer with no working 3×10^{8} (m/s) seen anywhere $\frac{4 \times 10^{16}}{3 \times 10^{8}}$ ECF candidate's speed maximum 2 marks Allow answers which round to 130 000 000 IGNORE Power of Ten error until evaluation	**(3)**