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Mark Scheme (Results)

Summer 2024

Pearson Edexcel International GCSE
In Physics (4PH1) Paper 2PR

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

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Question number	Answer	Notes	Marks
1 (a)	y-axis: one from • luminosity; • absolute magnitude; • power; x-axis: one from • temperature; • colour; • spectral class;	ignore brightness allow magnitude absolute 1 mark if both labels correct but on the wrong axes	2
(b)	main sequence;		1
(c)	B; A is incorrect because it is a red giant C is incorrect because it is a hot main sequence star D is incorrect because it is a cool main sequence star		1
(d)	C; A is incorrect because red giants are cooler than the Sun B is incorrect because white dwarf stars are fainter than the Sun D is incorrect because this star is both cooler and fainter than the Sun		1

Total for Question 1 = 5 marks

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<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>2 (a)</td><td>one mark for each correct row;;;
<table><tr><th>Statement</th><th>Nuclear fission</th><th>Nuclear fusion</th></tr><tr><td>requires high pressure and high temperature</td><td></td><td>✓</td></tr><tr><td>energy is released</td><td>✓</td><td>✓</td></tr><tr><td>radioactive daughter nuclei are produced</td><td>✓</td><td></td></tr></table></td><td></td><td>3</td></tr>
<tr><td>(b)</td><td>control rods absorb <u>neutron</u>(s);

moderator reduces speed of <u>neutron</u>(s);</td><td>ignore controls rate of reaction
condone stops <u>neutron</u>(s)
allow reduces kinetic energy of <u>neutron</u>(s)
ignore controls speed</td><td>2</td></tr>
</table>

Total for Question 2 = 5 marks

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Question number	Answer	Notes	Marks
3 (a)	**liquid arrangement:** attempt to draw most particles in contact with each other; random arrangement; **solid arrangement:** attempt to draw particles in contact with each other; regular arrangement;	ignore if particles don't fill entire box reject if gap large enough to draw another particle ignore if particles don't fill entire box reject if gap large enough to draw another particle	4
(b)	line drawn decreasing from any high temperature to any low temperature; single constant temperature stage drawn in the middle of the cooling (to show freezing); temperature axis labelled with suitable values e.g. line starts at 80, flat stage at 30 and line ends at 20;	allow straight lines and curves DOP ignore constant temperature at the end of the process all three temperatures required ignore scale	3

Total for Question 3 = 7 marks

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Question number	Answer	Notes	Marks
4 (a)	at least one transformer drawn in the space between power station and school; second similar object drawn in the space between power station and school; transformer/object nearest power station labelled "step-up" and transformer/object nearest school labelled "step-down";	drawing must be clearly recognisable as a transformer (e.g. two coils) or correctly labelled ignore pylons and transmission lines allow if transformers drawn accurately i.e. more turns on secondary coil for step-up etc.	3
(b)	(because) current causes **wires/cables** to heat up; idea of low/decreased/less current; reduces <u>energy</u> loss (to the surroundings);	link between current and heating must be clear allow reduces <u>energy</u> dissipated/wasted ignore heat loss	3

Total for Question 4 = 6 marks

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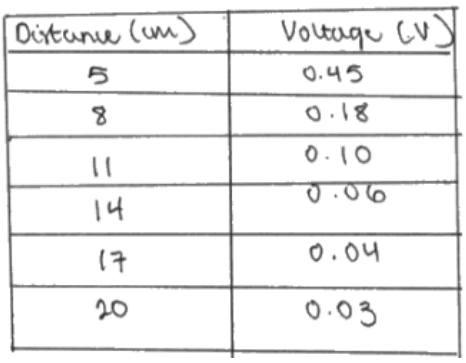
Question number	Answer	Notes	Marks
5 (a)	both forces are the same size/magnitude/equal; forces are in opposite **directions**;	ignore same force allow one (force) is left and the other (force) is right "forces are equal and opposite" / "every action has an equal and opposite reaction" scores 1 mark if no other marks awarded	2
(b)	substitution into $p = m \times v$; evaluation; e.g. (momentum =) 0.018×4.9 (momentum =) 0.088 (kg m/s)	 -1 for POT error from incorrectly converting kg to g allow 0.09, 0.0882 (kg m/s)	2
(c)	use of conservation of momentum; setting up equation to be solved; rearrangement; evaluation to 2 or more significant figures; e.g. momentum is conserved $0.088 = 0.018 \times -3.5 + 0.265 \times v$ $v = [0.088 + 0.063]/0.265$ $v = 0.57$ (m/s)	seen explicitly or implied from working allow ecf from (b) ignore 0.6 as given in question answer of 0.095… scores 3 marks allow any answer rounding to 0.57	4
(d)	use of KE = ½ × m × v^2; evaluation of KE before collision; evaluation of KE after collision; comparison with correct conclusion that collision is not elastic/inelastic;	seen explicitly or implied from working allow 0.2, 0.22, 0.216, 0.216… (J) allow 0.15-0.16 (J) OR 0.110 AND 0.043 seen in working DOP allow ecf from KE calculations	4

Total for Question 5 = 12 marks

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Question number	Answer	Notes	Marks
6 (a)	any **one** advantage for solar: • produces no noise; • available in all locations; • no greenhouse/polluting/harmful gases produced; any **one** disadvantage for solar: • dependent on amount of sun(light); • requires large area of panels; any **one** advantage for geothermal: • can be used all day; • requires small amount of space; • produces very little/no noise; any **one** disadvantage for geothermal: • not available in all locations; • releases some greenhouse/polluting/harmful gases; • possible pollution of ground water;	ignore renewable ignore statements relating to cost allow doesn't work at night, depends on the weather allow takes up lots of space, idea that it takes away land for farming/agriculture etc. ignore renewable allow it is reliable, does not depend on the weather ignore statements relating to cost allow other named gases e.g. ammonia etc.	4

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(b)	(i)	two columns/rows with headings of "distance" and "voltage"; units included correctly in both column headings; all data recorded correctly to the same number of decimal places as originally presented; e.g.  	ignore additional column for experiment number reject if units included with data in the body of the table	3
	(ii)	any one of: • power/luminosity (of lamp); • (amount of) background light; • brightness <u>of lamp</u>; • light intensity <u>of lamp;</u>	condone same lamp ignore amount of light, light intensity, brightness, same solar cell etc.	1
	(iii)	any two from: MP1. idea that lamp / solar cell is not 100% efficient; MP2. not all light produced by lamp is received by solar cell; MP3. energy losses {in connecting wires / to surroundings / as heat};	allow light spreads out in all directions allow energy wasted/dissipated for energy losses	2

Total for Question 6 = 10 marks

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Question number	Answer	Notes	Marks
7 (a)	idea that time (between hits) is too short / reaction/thinking time is an issue;	ignore thinking distance, human error	1
(b) (i)	11.18 circled;		1
(ii)	idea that student miscounted the number of block hits;	ignore "reaction time", human error allow idea that timer was started late / stopped early allow idea that distance to wall is different	1
(iii)	evaluation of a mean value; evaluation of a mean value excluding anomaly; final answer correctly given to 2 decimal places; e.g. mean = 11.642 (s) mean = 11.7575 (s) mean = 11.76 (s)	allow even if anomaly included allow ecf from (i) independent mark 11.642 scores 1 mark 11.64 scores 2 marks 11.75 scores 2 marks	3
(iv)	substitution into given formula; evidence of doubling distance OR dividing time by 20; evaluation; e.g. speed = (2×) 100 / 11.76(÷20) distance = 200m OR time = 0.59s speed = (200 / 0.59) = 340 (m/s)	allow ecf from (iii) condone lack of ×2 and ÷20 8.5 (m/s) scores 1 mark 17, 170 (m/s) scores 2 marks allow 340.2…, 340.1… (m/s)	3

Total for Question 7 = 9 marks

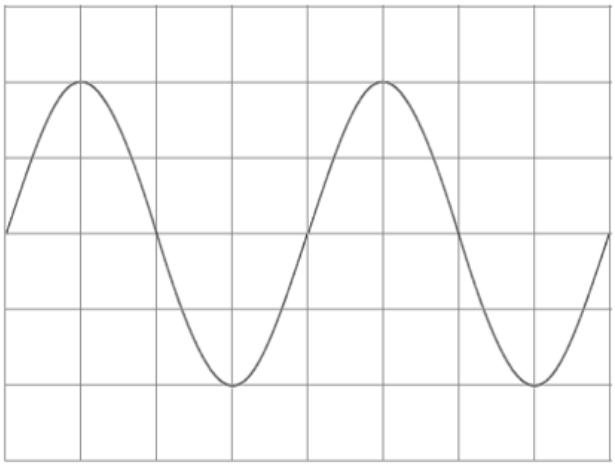
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Question number	Answer	Notes	Marks
8 (a) (i)	idea that proton and plate have opposite charges;	allow proton is positive ignore different charges	1
(ii)	substitution into a = (v-u)/t; rearrangement; evaluation to 2 s.f. or more; e.g. $1.90 \times 10^{11} = 1.38 \times 10^{5} / t$ $t = 1.38 \times 10^{5} / 1.90 \times 10^{11}$ $t = 7.26\ldots \times 10^{-7}$ (s)	award full marks for using given time to calculate either acceleration or speed to 4 s.f. or more allow 0.000 000 73, 7.3×10^{-7} (s) condone 0.000 000 72, 7.2×10^{-7} (s)	3
(b) (i)	into the page / eq;	allow ⊗	1
(ii)	any two from: idea that force increases; acceleration increases; proton moves in tighter circle / hits detector further to the left;	ignore (proton) speed increases allow hits detector closer to hole allow path of proton is shorter allow if seen on diagram	2

Total for Question 8 = 7 marks

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Question number		Answer	Notes	Marks
9	(a)	microphone;		1

	(b)	any roughly sine-shaped wave drawn on the screen;
		amplitude of trace = 2 squares;
		substitution into f = 1 / T;
		
		evaluation of time period = 0.004 (s);
		trace drawn on oscilloscope has period of 4 squares;
		
		e.g.
		
			allow triangle wave
			
			e.g. 250 = 1/T
			or T = 1/250
			
			automatically scores last three marking points
				5

	(c)	single use of data from graph to show that frequency × wavelength = constant; second use of data from graph to show that frequency × wavelength = constant; clear comparison of constants to show they are (approximately) equal AND conclusion that the relationship is inversely proportional;	constant should be between 320 and 360 depending on data used	3

Total for Question 9 = 9 marks

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