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Mark Scheme (Results)

January 2022

Pearson Edexcel International GCSE

In Physics (4PH1) Paper 2P

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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)	A; B cannot be correct as it measures distance C cannot be correct as it measures temperature D cannot be correct as it measures voltage		1
(b) (i)	momentum = mass × velocity;	accept standard symbols e.g. p for momentum reject m or M for momentum	1
(ii)	72 × 13 = 936;		1
(iii)	substitution into given equation; correct evaluation; correct answer: 3200 (N) e.g. force = change in momentum ÷ time taken = 936 ÷ 0.29 = 3200 (N)	accept use of Δp of 900, 936 or 940 expect values of 3103, 3228 and 3241	2
(iv)	A cannot be correct as increasing the force does not protect the driver C cannot be correct as they would both increase the force on the person D cannot be correct as the airbag decreases the momentum		1

Total for question 1: 6 marks

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Question number	Answer	Notes	Marks
2 (a)	idea of regular pattern/tightly packed; particles vibrating; (about) fixed positions / eq;	allow diagram condone molecules or atoms for particles ignore reference to force	3
(b)	increases continuously from -40 to 44 °C ; remains constant (at 44 °C); increases continuously from 44 to 80 °C;	 ECF incorrect plateau responses with no period of time at 44 score max 1 mark accept any gradient, straight lines or curves for the increasing temperature parts ignore any numbers on the time axis ignore second plateau after 44 if drawn	3

Total for question 2: 6 marks

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Question number	Answer	Notes	Marks
3 (a)	D; A cannot be correct as this is a description of fission B cannot be correct as this is a description of gamma decay C cannot be correct as this is a description of beta decay		1
(b)	(nuclei are) positively charged; like charges repel;	reject idea of charged atoms	2
(c)	high temperature; high pressure;	'high temperature and pressure' scores 2 marks	2

Total for question 3: 5 marks

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Question number	Answer	Notes	Marks
4 (a)	Any FIVE from: MP1: ruler; MP2: idea of measuring mag field at different distances; MP3: idea of repeat and average; MP4: distance is independent variable; MP5: mag field strength is dependent variable; MP6: current is a control variable; MP7: reference to suitable second control variable e.g. coil (spacing or turns), the rest of the apparatus;	marks may be awarded from a suitable labelled diagram condone tape measure or metre stick condone voltage accept idea of ammeter use to monitor current	5
(b)	any pair of readings from the graph; correct substitution into formula and constant found; different pair of readings used correctly to find a constant; statement that the results do not agree with the conclusion; e.g. when distance = 10 cm , magnetic field strength = 17 $17 \times 10^3 = 17000$ when distance = 50 cm ,magnetic field strength = 4 $4 \times 50^3 = 500000$ constants are different so results disagree with conclusion	 DOP allow idea that the constants are the same so that the results agree with the conclusion	4

Total for question 4: 9 marks

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Question number	Answer	Notes	Marks
5 (a)	GPE = mass × gravitational field strength × height;	Accept *g* for gravitational field strength allow standard symbols e.g. m for mass, h for height reject 'gravity' for *g*	1
(b)	substitution; conversion of mass to kg and height to m; correct evaluation to at least 2 sf; e.g. GPE = 0.014 × 10 × 0.29 = 0.041 (J)	allow use of 9.8, 9.81 0.0406 (J) to 3sf reject responses that do not use 'g' reject incorrect physics i.e. 14/29 = 0.48... which with a POT error gives 0.048 correct substitution with POT error scores 2 marks	3
(c)	recall of KE= 1/2 mv^2; substitution and rearrangement to v^2 as subject; evaluation; correct answer: 2.7 (m/s) e.g. KE= 1/2 mv^2 $5.1 \times 10^{-2} = ½ \times 0.014 \times v^2$ $v^2 = 2 \times 5.1 \times 10^{-2} \div 0.014 = 7.2857….$ v = 2.6992…. v = 2.7 (m/s)	 treat answer of 8.53.. × 10^n as a POT error, 1 mark penalty	3
(d)	idea of conservation of energy; idea that KE lost = GPE gained + WD;	accept idea that without friction KE (lost) = GPE (gained) i.e. idea that KE lost is greater than GPE gained condone 'friction reduces KE as wasted heat'	2

Total for question 5: 9 marks

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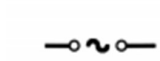
Question number	Answer	Notes	Marks
6 (a)	reference to a coil or solenoid; reference to a core; reference to a current; reference to a named magnetic material; i.e. (soft) iron or steel	all marks can be scored by a labelled diagram(s) allow reference to 'material that magnetises and demagnetises easily'	4
(b) (i)	period given as 4 squares; correct use of *x* scale; subsequent correct evaluation of period; correct answer: 0.002 (s) e.g. period is 4 squares period = 4 x (0.50 ÷ 1000) = 2(.0) × 10^{-3} (s)	 ECF candidate's reading of period in squares -1 for POT error Accept 2(.0) ms	3
(ii)	substitution into given equation; evaluation; correct answer: 500 Hz e.g. frequency = 1/0.002 frequency = 500 (Hz)	allow ECF from (i) -1 for POT error from candidate's answer from (i)	2
(iii)	statement of at least one frequency boundary of human hearing; valid comparison of answer to (ii) with relevant frequency boundary;	condone 25 Hz for lower boundary	2
(iv)	(trace) goes both positive and negative/eq; frequently/continuously/eq;		2
(v)	symbol with two clear terminals and (sine) wave; 		1

Total for question 6: 12 marks

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Question number	Answer	Notes	Marks
7 (a)	any FOUR from: Advantages: MP1: can respond to changes in demand; MP2: larger output for installation; MP3: less space required (for same output); MP4: not weather dependent; Disadvantages: MP5: may require a mountainous region; MP6: may require a large dam; MP7: installations are permanent;	accept RA where clear accept idea of continuity accept idea of flooding large areas ignore cost of installation ignore maintenance ignore global warming /greenhouse effect	4
(b)	any THREE from: MP1. reduction in GPE store of water; MP2. mechanical work done on turbine; MP3. increase in KE store of turbine; MP4. mechanical work done on generator; MP5. increase in KE store of generator; MP6. idea of electrical work done on grid;	 accept GPE of water converted to KE accept KE of water converted to KE of turbine accept KE of turbine converted to KE of generator accept KE of generator converted to electrical energy	3

Total for question 7: 7 marks

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Question number	Answer	Notes	Marks
8 (a) (i)	substitution into given equation; rearrangement; correct evaluation of wavelength change;	 -1 POT error condone 1 sf	3
	correct answer: 8.1×10^{-8} (m)	8.06×10^{-8} to 3sf	
	e.g. (change in wavelength/6.2×10^{-7})= ($3.9 \times 10^{4}/3.0 \times 10^{5}$) change in wavelength = $6.2 \times 10^{-7} \times$ ($3.9 \times 10^{4}/3.0 \times 10^{5}$) change in wavelength = 8.1×10^{-8} (m)		
(ii)	candidate's answer to (i) + 6.2×10^{-7} (m); e.g. $8.1 \times 10^{-8} + 6.2 \times 10^{-7} = 7.0 \times 10^{-7}$(m)	ECF wavelength change condone 1sf	1
(b)	Any THREE from: MP1: the further the galaxy is from Earth, the greater the red-shift; MP2: the greater the red-shift, the faster the galaxy is moving away; MP3: speed of galaxies increases with increased distance; MP4: the speed and distance are directly proportional; MP5: relationship between speed and distance implies expansion; MP6: expansion implies there was a single point in the past;	condone "star" for "galaxy" allow "galaxies moving apart from each other" condone RA for MP6	3

Total for question 8: 7 marks

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Question number	Answer	Notes	Marks
9 (a)	goggles/safety spectacles/tongs/gloves/hair tied back		1
(b) (i)	substitution of 'water' data into given equation; correct energy gain of water to more than 1sf; e.g. energy gain by water = 0.138 × 4200 × 5 = 2898 (J)	 -1 POT error	2
(ii)	evidence that the energy loss by nail=energy gain by water; rearrangement to find temperature change of nail; correct evaluation of temperature change for nail; correct answer: 1300 (°C) (using 2898) or 1400 (°C) (using 3000) e.g. 2898 = 0.0048 × 450 × ΔT ΔT = 2898 ÷ (0.0048 × 450) ΔT = 1342 (°C)	e.g. 3000 = 0.048 x 450 x temp change allow correctly rounded 1388.8… for 3 marks	3
(iii)	{heat / energy} lost to surroundings (by water)	accept {heat / energy} lost by nail during transfer from flame to water	1

Total for question 9: 7 marks

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