

Mark Scheme (Results)

November 2024

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

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November 2024
Question Paper Log Number P75953A
Publications Code 4PH1_2P_2411_MS
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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.

Question number	Answer	Notes	Marks
1 (a)	B - electron; A cannot be correct as a beta particle is not an EM wave C cannot be correct as a helium nucleus is the same as an alpha particle D cannot be correct as a beta particle is not a neutron		1
(b)	B - helium nucleus; A cannot be correct as an alpha particle is not an EM wave C cannot be correct as a neutron is merely a constituent particle of an alpha particle D cannot be correct as a proton is merely a constituent particle of an alpha particle		1
(c)	top line: 4; bottom left box: 93 bottom right box: 2;		3

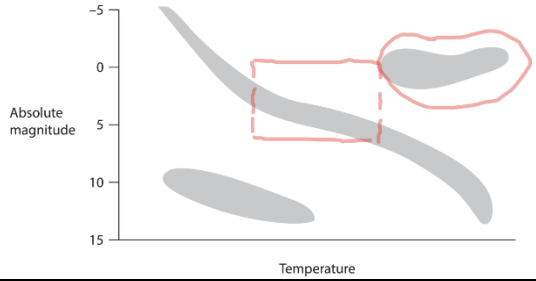
Total for question 1= 5 marks

Question number	Answer	Notes	Marks
2 (a)	idea of negative charge transfer; cloth loses electrons;	 this statement alone scores 2 marks. allow rod takes electrons off the cloth for 2 marks	2
(b) (i)	electrons flow (through metal/towards Earth)/eq ; then stop flowing / eq;	accept 'charge(s)' for 'electrons' accept idea that rod has discharged or has been neutralised	2
(ii)	charge = current × time;	allow standard symbols and rearrangements e.g. 'Q=It' ignore 'C' for current or charge	1
(iii)	conversion of ms to s; substitution; correct evaluation; eg. charge = current × time charge = $6.8 \times 10^{-6} \times 3.7 \times 10^{-3}$ charge = 2.516×10^{-8} (C) correct answer = 2.5×10^{-8} (C)	mark independently allow ECF from missing or wrong conversion accept answer in either decimal or standard form reject evaluation of answer expressed as a fraction allow any incorrect answer that rounds to 2.5×10^{n} for 2 marks	3

Total for question 2 = 8 marks

Question number	Answer	Notes	Marks
3 (a)	(total) momentum before (collision) = (total) momentum after (collision) / eq;	ignore equation i.e. $m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$	1
(b) (i)	39 (kg m/s);	ignore sign	1
(ii)	momentum = mass × velocity;	allow standard symbols and rearrangements e.g. v = p ÷ m	1
(iii)	substitution or rearrangement; correct evaluation; eg. 39 = 8.1 × speed speed = 39 ÷ 8.1 speed = 4.814… (m/s) correct answer: 4.8 (m/s)	 accept any answer that rounds to 4.8 allow 5 (m/s)	2
(iv)	substitution of time and change in momentum into given formula; correct evaluation; eg. force = (change in momentum) ÷ time taken force = 39 ÷ 0.56 force = 69.6…. (N) correct answer = 70 (N)	accept use of F = ma AND a = (v-u) ÷ t with ECF from (iii) ignore sign accept any answer that rounds to 70 (N) for 2 marks	2
(v)	magnitude: candidate's answer to (iv); direction: right / eq;		2

Total for question 3 = 9 marks

Question number			Answer	Notes	Marks
4	(a)	(i)	X drawn anywhere in rectangle on main sequence as shown below;	by eye and use extreme left edge of red giant blob as a guide	1
		(ii)	red giants in top right encircled as shown below;  	allow any loop that overlaps correct area only	1
	(b)		any two from: • hot / high (surface) temperature; • bright/ high luminosity / high power; • white/blue-white/blue; • high mass;	ignore reference to absolute magnitude	2
	(c)	(i)	any attempt at an average over more than one period; answer in range 150 000 - 160 000 (s);	mark independently	2
		(ii)	candidate's answer to (i) substituted into given formula; correct evaluation; eg. frequency = 1 ÷ 155 000 frequency = 6.45… × 10^{-6} (Hz) frequency = 6.5 × 10^{-6} (Hz)	ignore POT for this MP -1 POT penalty i.e. answer in range 6.25 – 6.67 × 10^{-6} (Hz) for correct answer to (i) accept any answer that rounds to 6 or 7 × 10^{-6} (Hz) for 2 marks	2
		(iii)	brightness of an object at a standard distance (from the Earth) / eq;	allow intensity, power, luminosity for brightness AND allow any distance for idea of 'standard distance'	1
		(iv)	idea that the stars are not the same distance away; {star A/ brighter star} is nearer / eq;	allow RA this statement alone scores 2 marks	2

Total for question 4 = 11 marks

Question number	Answer	Notes	Marks
5 (a)	MP1 Mass found on balance; MP2 Time determined using timer/stopwatch/stopclock; MP3 temperature change determined; i.e. temperature change= final temp – initial temp MP4 rearrangement of formula sheet equation; i.e. c = energy /(m x temp change) PLUS ONE from MP5 Energy supplied = voltmeter reading x ammeter reading x time; MP6 Mass of liquid = mass of water + cup – mass of cup; MP7 Entire experiment repeated and averaged; MP8 Liquid stirred (throughout); MP9 Keep taking temperature after heater switched off for max temp;	accept “scales” reject “scale” allow ‘determined time for a given temp change’ accept “E = VIt” for ‘energy supplied’ and for MP5 also accept SHC found using method involving calculating the gradient of a temperature-time graph can be awarded if seen for MP4 allow use of joulemeter to determine energy however expressed i.e. zero balaance when empty cup on balance not just unqualified ‘repeat and average’ ignore reference to insulation or lid	5
(b) (i)	C - boiling;		1

	A cannot be correct because the substance is already a liquid B cannot be correct because the substance is being heated D cannot be correct because the substance is being heated and is not a gas		
(ii)	35 (°C);		1
(iii)		ECF candidate's time taken and temp change	3
	energy supplied = 48 × appropriate time taken in seconds;		
	rearrangement with SHC as subject;	accept dimensionally correct substitution into formula for this mark condone wrong power of ten for any substitution	
	correct evaluation; eg.: energy supplied = 48 × 15 × 60 = 43200 J energy supplied = m × c × (temp change) 43200 = 0.53 × c × 35 c = 43200 ÷ (0.53 × 35) c = 43200 ÷ 18.55 c = 2328.84… (J/kg °C) Correct answer = 2300 (J/kg °C)	allow 39 (J/kg °C) for 2 marks (missed conversion from minutes to seconds) allow answer that rounds to 2.6 for 1 mark allow answer that rounds to 1300 for 3 marks allow answer that rounds to 4700 for 2 marks	

Total for question 5 = 10 marks

Question number	Answer	Notes	Marks
6 (a) (i)	moment = force × (perpendicular) distance	allow standard symbols and rearrangements e.g. 'F = moment/d' condone 'M = F × d'	1
(ii)	substitution into correct formula for one force; attempt to combine two **moments;** correct evaluation; eg. moment of one force = 8.1 × 2.6 (cm) moment of one force = 21.06 (N cm) total moment = 21.06 × 2 = 42.12 (N cm) correct answer = 42 (N cm)	accept however expressed -1 POT error allow answers that round to 84 for 2 marks	3
(b)	arrangement: at least one from closely packed /eq; random/irregular (arrangement); motion: at least one from random (motion); idea of flow of particles;	mark can be scored from a diagram e.g. 'all touching', 'not as closely packed as the solid' e.g. "particles slide over each other" ignore 'move freely'	3

Total for question 6 = 7 marks

Question number			Answer	Notes	Marks
7	(a)	(i)	kinetic energy (store); increases;	accept thermal store reject 'heat' accept 'KE (store) of air/wind to KE (store) of turbine for 2 marks accept '...to KE (store) of turbine for 1 mark	2
		(ii)	thermal (store); increases;	ignore 'heat' DOP	2
	(b)	(i)	efficiency = useful energy (output) ÷ total energy(output) x100%	accept omission of 100% accept power for energy condone input for output in denominator	1
		(ii)	KE = ½ m v^2 seen; evaluation of KE of blades; substitution of candidate's value for blades' KE and wind KE into efficiency equation; evaluation of efficiency; e.g. KE of blades = ½ × 16 000 × $(7.6)^2$ KE of blades = 462 080 (J) efficiency = (KE of blades/KE of wind) x 100% efficiency = (462 080 ÷ 1 200 000) × 100% efficiency = 38.506… % correct answer = 39%	accept substitution correct KE is 462 080 (J) allow correct decimal expression allow correct % expression with % sign ignore fractional final answer	4

Total for question 7 = 9 marks

Question number	Answer	Notes	Marks
8 (a)	suitable instrument e.g. metre wheel, trundle wheel, tape measure, laser (range-finder); repeat and take an average;	ignore any attempt at using speed of sound condone ruler allow idea of a straight/flat tape measure allow idea of measuring perpendicular to wall allow ensuring use of trundle wheel in a straight line	2
(b)	use of average speed = distance ÷ time taken; substitution; evaluation; eg.: speed = distance ÷ time taken speed = 130 (m) ÷ 0.35 (s) speed = 371.428… (m/s) speed = 370 m/s	scores first two MP accept answer that rounds to 190 (m/s) for 2 marks (use of 65 m) accept answer that rounds to 370 (m/s) for 3 marks	3
(c)	any four from: MP1 idea of original method did not repeat (and average) MP2 mention of (human) reaction time; MP3 critique of accuracy of distance measurement; MP4 reference to sound becoming inaudible because of distance; MP5 reference to large distance reducing effect of timing errors; MP6 reference to uncontrolled variables; e.g. temperature, humidity, wind, noise	need to repeat (and average) repeating (and averaging) would improve experiment allow RA	4
(d)		ignore ‘repeat and average’ ignore use of oscilloscope to	2

	any two from: reduction of timing inaccuracy: MP1 idea of datalogging (with a microphone/sound meter); MP2 idea of electronic start and/or stop timing (with a microphone/sound meter); MP3 larger distance (gives larger time); MP4 idea of longer time may reduce effect of reaction time; MP5 produce a regular sound that coincides with echo; improvement of distance measurement: MP6 use a laser-based distance measure/use a map (and scale) to pinpoint start and finish; other: MP7 idea of removing noise/wind; e.g. do the experiment indoors, shielding a microphone, wait for a windless time MP8 drawing a distance-time graph for different distances and finding gradient;	measure wavelength or period ignore unqualified use of microphone	

Total for question 8 = 11 marks

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