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Mark Scheme (Results)

January 2023

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)	A (absolute magnitude); B is incorrect because apparent magnitude is how bright the star appears on Earth, regardless of distance C is incorrect because the H-R diagram requires a specific scalar magnitude D is incorrect because the H-R diagram requires a specific magnitude		1
(b)	P: white dwarfs; Q: main sequence; R: red giants;	reject if more than one given reject if more than one given reject if more than one given	3
(c)	idea of the left-hand side; idea that blue/white stars are hottest / hotter than red/orange stars;	allow 'blue' allow use of letter P to indicate left side ignore 'white' allow white dwarfs are hottest	2

Total for Question 1 = 6 marks

Question number	Answer	Notes	Marks
2 (a)	violet;	reject purple, ultraviolet, UV	1
(b)	idea that UV causes mutations/damage (in cells); (leading to) (skin) cancer/blindness;	allow kills cells/tissue, sunburn, burns skin	2
(c) (i)	speed = frequency × wavelength;	allow standard symbols and rearrangements e.g. $f = v/\lambda$ allow c, v for speed	1
(ii)	substitution OR rearrangement; evaluation; e.g. 300 000 000 = f × 15 OR $f = v/\lambda$ (f =) 20 000 000 (Hz)	-1 for POT error accept 20 MHz, 20 million (Hz), 20×10^6 (Hz), $2(.0) \times 10^7$ (Hz)	2

Total for Question 2 = 6 marks

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Question number	Answer	Notes	Marks
3 (a) (i)	newtonmeter;	allow spring balance, spring scale, dynamometer ignore forcemeter	1
(ii)	independent: material (of the squares); dependent: force;	allow cloth ignore 'squares' on its own	2
(iii)	any one from: • speed (of rotation); • direction of rotation; • temperature (of tumble dryer); • number of squares; • size / thickness / shape of square; • time (of rotation);		1
(b)	any three from: MP1. idea of friction (between pieces of material); MP2. electrons/charge transferred between squares/material; MP3. squares become oppositely charged; MP4. square is negative if electrons gained; MP5. idea that opposite charges attract;	 allow rubbing for friction ignore references to protons allow negative and positive squares/eq allow RA	3
(c)	bar chart; idea that material/data is categoric;	allow bar graph ignore histogram allow discrete, not continuous, discontinuous	2
(d) (i)	charge = current × time (taken);	allow standard symbols and rearrangements e.g. Q = I × t ignore c, C for charge and current	1
(ii)	substitution; evaluation; e.g. $Q = 4.3 \times 10^{-6} \times 2.3 \times 10^{-3}$ (Q =) 9.9×10^{-9} (C)	 -1 for POT error allow use of prefixes e.g. 9.9 nC allow 9.89×10^{-9} (C)	2

Total for Question 3 = 12 marks

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Question number	Answer	Notes	Marks
4 (a) (i)	voltage = current × resistance;	allow standard symbols and rearrangements e.g. V = I × R ignore c, C for current	1
(ii)	conversion of mA to A; substitution; evaluation; e.g. 83 ÷ 1000 = 0.083 V = 0.083 × 17 (V =) 1.4 (V)	 1400, 1410, 1411 (V) scores 2 marks allow 1.41, 1.411 (V)	3
(iii)	1.4 (V)	allow ecf from (ii) allow 1.41, 1.414 1.4136 (V) do not penalise not converting mA to A if already penalised in (ii)	1
(iv)	evidence of addition of the two currents; 311 mA;	 accept 0.311 A	2
(b)	any three from: MP1. current decreases; MP2. (total) resistance increases; MP3. idea that total voltage is the same; MP4. reference to V=IR;	 allow idea that each resistor gets a lower voltage (from cell)	3

Total for Question 4 = 10 marks

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Question number	Answer	Notes	Marks
5 (a)	output voltage is less than input voltage; output current is greater than input current;	allow voltage decreases allow current increases	2
(b)	any attempt to calculate a power; correct calculation of either input or output power; indication that the input and output power are (approximately) equal; e.g. input power = 230 × 0.067 input power = 15(.41) 15(.41) ≈ 15(.5)	allow either product of voltage and current allow idea of calculating an efficiency (percentage) and showing it is (approximately) 100% output power = 5.0 × 3.1 output power = 15(.5) 15(.5)/15(.41) = 1.0… or 100%	3
(c) (i)	$N_p/N_s = V_p/V_s$;	allow any correct rearrangement allow "i(nput) and o(utput)" or "1 and 2" for "p(rimary) and s(econdary)" allow correct word equation ignore 'P' for 'N' condone 'T', 't' or 'n' for 'N' condone 'coils' for 'turns'	1
(ii)	substitution; rearrangement; evaluation to 2 s.f. or more; e.g. $1500/N_s = 230/5.0$ $(N_s =)$ 1500 / (230 / 5.0) $(N_s =)$ 33	32 scores 2 marks only allow 32.6, 32.608…	3

Total for Question 5 = 9 marks

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Question number	Answer	Notes	Marks
6 (a)	any five from: MP1. measure temperature increase; MP2. measure time taken; MP3. allow temperature to rise to maximum after heater switched off; MP4. calculate total energy / use of E = P×t; MP5. measure <u>mass</u> of water; MP6. (by) finding difference between empty beaker and 'beaker + water' MP7. use of E = m × c × Δθ; MP8. plot a temperature-time graph; MP9. use gradient (so c = P/(m × gradient);	 accept measure initial and final temperature allow a stated time period	5
(b) (i)	temperature difference calculated; substitution; evaluation; e.g. (ΔT = 65 – 16 =) 49 (°C) ΔQ = 75 × 4200 × 49 (ΔQ =) 15 000 000 (J)	allow 49, 65-16 seen allow ecf from clear incorrect temperature **difference** allow 15 MJ allow correct answers to other significant figure values i.e. 15 435 000 (J)	3
(ii)	any three from: MP1. idea that energy/heat lost by water is approximately equal to energy gained by air; MP2. (some) thermal energy lost to the surroundings; MP3. air and water have a different specific heat capacity; MP4. air has a smaller heat capacity than water; MP5. valid attempt to show algebraically; MP6. correct algebraic attempt;	 allow (Δ)Q is the same for both allow other named object e.g. radiator, walls etc. also scores MP3	3

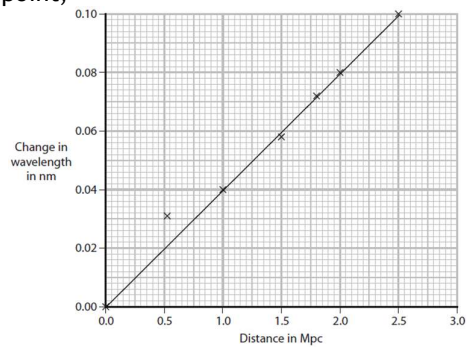
Total for Question 6 = 11 marks

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Question number	Answer	Notes	Marks
7 (a)	substitution into F = (mv − mu) / t; rearrangement; evaluation; e.g. 2.5 = [0.074 × 3.0 (−0.074 × 0.0)] / time time = (0.074 × 3.0) / 2.5 (time =) 0.089 (s)	 0.08 scores 2 marks if supported by valid working allow alternative method using F=ma and a=(v-u)/t allow 0.09, 0.0888 (s) condone 0.088 (s)	3
(b)	magnitude = 4.9 (N); direction = right/opposite to car;	 ignore East	2
(c)	any two from: MP1. (crumple zone) increases the time (taken to stop); MP2. same momentum change (as car 2); MP3. smaller acceleration; MP4. reference to formula force = change in momentum/time;	 allow same velocity change (as car 2) allow deceleration	2

Total for Question 7 = 7 marks

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Question number	Answer	Notes	Marks
8 (a)	increase in wavelength (of wave); due to source/galaxy moving away (from observer)/eq;	allow decrease in frequency allow stretching wavelength allow observer moving away from source/galaxy	2 exp
(b) (i)	point at (0.5,0.03) identified;	reject if more than one point circled	1
(ii)	straight line drawn within 1 small square of each data point;  	allow ecf from (i)	1
(iii)	change in wavelength = 0.03 (nm); substitution OR rearrangement; evaluation; e.g. change in wavelength = 0.03 (nm) 0.03/660 = v/300 000 OR $v = \Delta\lambda/\lambda \times c$ (v =) 14 (km/s)	allow ecf from (ii) correct within ½ small square allow ecf from incorrect reading of $\Delta\lambda$ if clear from working -1 for POT error award if seen anywhere in working allow 13.6… (km/s)	3
(iv)	any two from: MP1. **change in** wavelength increases with distance (from Earth or Milky Way); MP2. idea that (recession) velocity increases with distance (from Earth or Milky Way); MP3. galaxies are all moving away from each other;	allow red-shift for change in wavelength	2

Total for Question 8 = 9 marks

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