Mark Scheme (Results)

Summer 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.

Question number	Answer	Notes	Marks
1 (a)	rate of doing work / rate of energy transfer;	condone "amount of energy transferred each second" accept "energy transferred per second" allow correct formula allow correct word equation reject idea of P = IV reject "amount of energy **in** a given time"	1
(b)	results table constructed with appliance column and power column; power column heading to include correct unit;	allow alternative orientation with two rows condone power in 1st column ignore names given to non-power heading reject if units given with raw data	2
(c) (i)	213 W identified;		1
(ii)	omission of anomalous result; mean calculated; candidate's mean correctly rounded and expressed to 3 significant figures; e.g. mean power = [199 + 202 + 200 + 201 + 201] ÷ 5 mean power = 200.6 (W) mean power = 201 (W)	allow ECF from (c)(i) 203 (W) scores 2 marks 202.667…(W) scores 1 mark	3

Total for Question 1 = 7 marks

Question number	Answer	Notes	Marks
2 (a)	D (kg m/s); A is incorrect because this would be from mass / velocity B is incorrect because this would be from mass^2 × velocity C is incorrect because this would be from mass × velocity^2		1
(b) (i)	idea that (total) momentum before (collision) = (total) momentum after (collision) (in the absence of external forces);	allow references to explosion/event, rather than collision 'momentum is conserved' is insufficient	1
(ii)	setting up equation using conservation of momentum; rearrangement; evaluation; e.g. 0 = [1.9 × 3.7] + [2.9 × v] v = -7.03 / 2.9 (v =) -2.4 (m/s)	using either substitution of correct values or algebraically allow [1.9 × 3.7] = [2.9 × v] allow 2.42… (m/s) ignore sign of final answer correct evaluation of object Q's momentum i.e. (-)7.03 (kg m/s) scores 1 mark if no other mark scored	3
(c)	idea of carpet increases impact time; carpet reduces rate of change of momentum (for the same speed or momentum of egg); (carpet) reduces force;	ignore references to hard/soft floors ignore references to absorbing force or reduction in 'impact' ignore references to energy allow RA allow RA allow reference to given equation or word equation allow reduces deceleration or acceleration allow RA	3

Total for Question 2 = 8 marks

Question number	Answer	Notes	Marks
3 (a) (i)	substitution; evaluation; e.g. (P =) 1.2 × 5.0 (P =) 6.0 (W)	 allow 6 (W)	2
(ii)	substitution using same power as (a)(ii); rearrangement; evaluation; e.g. 6.0 = I × 230 (I =) 6.0 / 230 (I =) 0.026 (A)	allow ECF from (a)(i) allow 0.03 (A)	3
(b) (i)	charge = current × time;	allow rearrangements and standard symbols e.g. Q = I × t reject c, C for current, charge	1
(ii)	substitution of 1.2 A for current; correct evaluation in seconds; evaluation in minutes; e.g. 10500 = 1.2 × time OR t = 10 500 / 1.2 (t =) 8750 (s) (t =) 150 minutes	 -1 POT error mark independently allow 146, 145.83… 145 minutes gets 2 marks only condone fractional minutes i.e. 145 5/6 min)or combined minutes & seconds i.e. 145:50	3
(iii)	time will be less / eq; (because) current is greater;	 allow numerical statement e.g. “current is now 2.1A” reject reference to input current	2

(c)	any four from:	accept input/output for primary/secondary	4
	MP1. (step-down) transformer decreases voltage;	allow idea of fewer turns on secondary (than primary) including on the diagram (e.g. clearly more turns drawn and P/S coils labelled)	
	MP2. current in (primary) coil produces magnetic field;	allow (primary) coil becomes an electromagnet	
	MP3. current is changing / alternating;	allow 'current is a.c.'	
	MP4. causing a (changing) magnetic field in the core;	allow reference to magnetise and demagnetise	
	MP5. the core strengthens the field (at the secondary coil) /eq;		
	MP6. field lines interact with secondary coil;	allow field lines cutting secondary coil	
	MP7. which **induces** a voltage in the secondary coil;	allow **induces** a current in the secondary coil	
	MP8. transformers won't work with (constant) d.c.;		

Total for Question 3 = 15 marks

Question number	Answer	Notes	Marks
4 (a)	20 (Hz); to 20 000 (Hz);	units (if given) must be consistent with data i.e. 20 Hz - 20kHz max 1 mark if non-frequency unit given	2
(b) (i)	microphone;	ignore sound sensor, ultrasound detector	1
(ii)	any three from: MP1. idea of adjusting oscilloscope to obtain steady trace /eq; MP2. idea of adjusting time base to display (at least) one cycle on screen /eq; MP3. Idea of evaluating number of squares for full cycle /eq; MP4. multiply number of squares (for full cycle) by time base /eq;	e.g. "freeze the screen" condone reference to a wavelength rather than a time period or full cycle	3
(c) (i)	number of squares for full cycle; correct evaluation of time period from candidate's number of squares; e.g. one full cycle = 6 squares time period = $(6 \times 5 \times 10^{-6}) = 3 \times 10^{-5}$ (s)	reject answer that clearly uses the amplitude scale for 0 marks allow 30×10^{-6} (s)	2
(ii)	substitution into f = 1/T; evaluation; e.g. f = 1 / 3×10^{-5} (f =) 3.3×10^{4} (Hz)	allow ECF from (c)(i) allow 33 333.3…, 33 300, 33 000 etc (Hz) allow 30 000	2

Total for question 4 = 10 marks

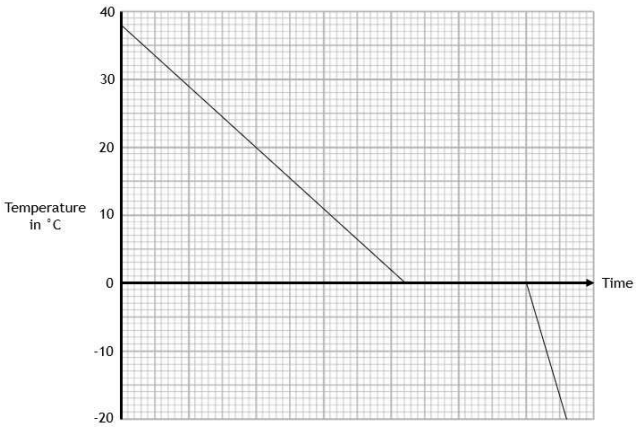
Question number	Answer	Notes	Marks
5 (a)	all ticks correct = 3 marks 3-4 ticks correct = 2 marks 1-2 ticks correct = 1 mark **Moderator** / **Control rod** absorbs excess neutrons: Control rod ✓ can be made of boron: Control rod ✓ can be made of water or graphite: Moderator ✓ is lowered into or raised from the reactor core to adjust the rate of reaction: Control rod ✓ reduces the speed of neutrons so they are more likely to cause fission: Moderator ✓		3
(b)	prevents radiation escaping (the reactor core) /eq ; by absorbing (high energy) neutrons/fission products/gamma;	ignore references to structural integrity of reactor allow absorbs radiation allow idea of protecting workers outside the core ignore imprecise technical language e.g. can't pass through, is stopped by etc. condone "can't penetrate"	2
(c) (i)	evaluation of total mass of U-235; evaluation of number of U-235 atoms; e.g. mass = $3.0\% \times 0.0088 = 2.64 \times 10^{-4}$ kg number = $(2.64 \times 10^{-4} / 3.90 \times 10^{-25}) = 6.8 \times 10^{20}$	-1 for POT error allow ECF from non-use of 3% i.e. $\{2.3/2.25/ 2.26\} \times 10^{22}$ allow 6.77×10^{20}	2
(ii)	use of energy ratio; correct evaluation; e.g. energy = $2.17 \times 10^{10} / 6.77 \times 10^{20}$ energy = 3.2×10^{-11} (J)	allow ECF from (c)(i) giving 9.6×10^{-13} allow 3.21×10^{-11} allow $9.6(4\ldots) \times 10^{-13}$ (ECF 2.25 or 2.3 x 10^{22} from (i))	2

Total for question 5 = 9 marks

Question number	Answer	Notes	Marks
6 (a)	idea that universe is expanding / getting larger; idea that universe is cooling;		2
(b)	MAX four from: MP1. identification of cosmic (microwave) background radiation (CMBR); MP2. CMBR appears to be the same in all directions/is everywhere; MP3. which implies all parts of the Universe were in contact a long time ago; MP4. wavelength has increased as the universe has expanded; MP5. universe was (significantly) hotter long ago; MAX four from: MP6. identification of red shift **of galaxies**; MP7. the further the galaxy is (from Earth), the greater the red-shift; MP8. larger redshift means faster movement of galaxies; MP9. (therefore) the further away, the faster the galaxy moves away; MP10. galaxies moving apart from each other implies expansion from a single point **or** since the Big Bang;	 allow idea of coming from single point or singularity allow 'frequency has decreased as the universe has expanded' allow RA condone “star” for “galaxy” for MP7-10 accept speed of galaxies increases (is directly proportional to) with increased distance; accept ‘relationship between speed and distance’ for ‘galaxies moving apart from each other’ allow singularity for single point	6

Total for question 6 = 8 marks

Question number	Answer	Notes	Marks
7 (a)	energy to change temperature by 1 °C; per kilogram of mass;	accept 1 K DOP	2
(b)	any two from: MP1. leave block in oven for longer / check it is definitely at 220 °C; MP2. idea of transferring block from oven to water as quickly as possible; MP3. adding insulation to the container (of water); MP4. place a lid on container (of water); MP5. use container (of water) with low (specific) heat capacity or low thermal conductivity; MP6. idea of repeating **and** {average/remove anomalies};	 e.g. wrap it in wool e.g. use a polystyrene cup	2
(c) (i)	38 (°C);		1
(ii)	(38 – 20 =) 18 °C;		1
(iii)	substitution; rearrangement of $\Delta Q = m \times c \times \Delta T$; evaluation; e.g. $190\,000 = 2.3 \times c \times 18$ $c = 190\,000 \ / \ (2.3 \times 18)$ $(c =) = 4600$ (J/kg °C)	allow ECF from (c)(ii) -1 for POT allow 4589.37…, 4590 etc	3

(d)	line has two downward sloping sections of different gradient; horizontal line at 0 °C in between downward sloping sections; line starts at 38 oC and finishes at -20 °C; initial downward sloping line has smaller gradient than final downward sloping line;  	ignore where lines intersect the time axis throughout sections do not need to be straight, but one must be clearly steeper than the other reject this MP if there is more than one horizontal line lower than 38 and higher than -20 ignore start/finish time by eye note: responses with initial downward section and final downward section parallel (by eye) can only score MP2 and MP3	4	exp

Total for Question 7 = 13 marks

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