Pearson Edexcel

Mark Scheme (Results)

November 2020

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.

Question number	Answer	Notes	Marks
1 (a) (i)	idea of rubbing / friction; with another insulator;	 allow **suitable** named insulator e.g. duster, cloth, hair etc.	2
(ii)	C (-0.0052 C); A is incorrect because this is equivalent to -520 mC B is incorrect because this is equivalent to -52 mC D is incorrect because this is equivalent to -0.52 mC		1
(iii)	A (the rod has gained negatively charged electrons); B is incorrect because electrons are not positively charged C is incorrect because this would make the rod positively charged D is incorrect because electrons are not positively charged		1
(iv)	suitable method of demonstrating; correct observation;	e.g. • place rod on electroscope • place rod near stream of water from a tap • place rod near hair • place rod above small pieces of paper • place rod near another (charged) rod e.g. • leaf on electroscope deflects • water moves towards rod • hair moves towards rod • paper moves towards rod • rods move towards/away from each other	2
(b) (i)	photocopiers / inkjet printers / smoke precipitators / (electrostatic) spray painting;	allow any correct use	1
(ii)	risk of a spark; (causing) explosion / fire;		2

Total for Question 1 = 9 marks

Question number	Answer	Notes	Marks
2 (a)	substitution OR rearrangement; evaluation; e.g. $1.25 \times 10^{18} = 1 / T$ OR $T = 1/f$ (T =) 8.00×10^{-19} (s)	 -1 for POT error allow 8×10^{-19} (s)	2
(b)	use of $v = f \times \lambda$; substitution OR rearrangement; evaluation; e.g. $v = f \times \lambda$ $3.00 \times 10^{8} = 1.25 \times 10^{18} \times \lambda$ OR $\lambda = v / f$ (λ =) 2.40×10^{-10} (m)	seen as a formula or implied by working allow v, c, s for speed allow λ for wavelength -1 for POT error allow 2.4×10^{-10} (m)	3

Total for Question 2 = 5 marks

Question number	Answer	Notes	Marks
3 (a) (i)	X drawn at the base of the weight arrow;	judge by eye	1
(ii)	weight = mass × gravitational field strength;	allow standard symbols and rearrangements e.g. W = m × *g* ignore 'gravity' for *g*	1
(iii)	substitution; evaluation; e.g. (W =) 130 × 10 (W =) 1300 (N)	 -1 for POT error only e.g. from incorrectly converting kg to g allow *g* = 9.8, 9.81 allow 1274, 1275.3	2
(b) (i)	in equilibrium / when balanced; (sum of) clockwise moment(s) = (sum of) anti-clockwise moment(s);	 allow idea that net moment is zero	2
(ii)	correct expression for either moment; correct use of principle of moments; evaluation of distance X; e.g. 1300 × 0.30 OR 520 × X 1300 × 0.30 = 520 × X X = 0.75 (m)	allow ecf from (a)(iii)	3
(iii)	(length of plank =) 1.5 (m);	allow ecf from (b)(ii)	1

Total for Question 3 = 10 marks

Question number	Answer	Notes	Marks
4 (a) (i)	measure the distance between microphones; suitable instrument to measure distance; use of speed = distance ÷ time;	 e.g. ruler / tape measure	3
(ii)	idea that time will be very small / too hard to measure by a human;	allow idea that human reaction time is an issue ignore speed of sound is very fast / eq.	1
(b) (i)	idea that air needs to be same temperature at all points between microphones;	allow idea that speed will change if temperature not constant ignore 'fair test'	1
(ii)	correctly calculate average; given to 1 decimal place; e.g. 59.97 = 1 mark 60.0 = 2 marks	 DOP 59.9 scores 1 mark allow 59.96, 60	2
(iii)	point at (40, 358) circled;		1
(iv)	repeat it / discard it;	allow repeat experiment condone 'ignore it'	1
(v)	line graph suitable for continuous data; **both** variables are continuous;	allow 'data is continuous'	2
(vi)	idea that speed increases as temperature increases; idea of a linear relationship;	ignore positive correlation reject mark if relationship described as directly proportional	2

Total for Question 4 = 13 marks

Question number	Answer	Notes	Marks
5 (a) (i)	C (nuclear); A is incorrect because chemical reactions do not happen in the Sun B is incorrect because the kinetic store of particles increases during nuclear fusion D is incorrect because the thermal store of the Sun remains constant whilst fusion is taking place		1
(ii)	B (by radiation); A is incorrect because transfers by heating cannot happen in a vacuum C is incorrect because there is no electrical circuit or flow of ions D is incorrect because the transfer does not happen due to forces		1
(b) (i)	evaluation of total power / conversion of hours to seconds; evaluation of energy in J; evaluation of energy in MJ; e.g. power = (1000 × 15 =) 15 000 (m^2) OR time = (2 × 60 × 60 =) 7200 (s) energy = (15 000 × 7200 =) 108 000 000 (J) energy = (108 000 000 ÷ 1 000 000 =) 108 (MJ)	allow ×3600 seen anywhere in working	3
(ii)	substitution into $\Delta Q = m \times c \times \Delta T$; rearrangement; evaluation of ΔT; evaluation of final temperature; e.g. 100 000 000 = 1100 × 4200 × ΔT ΔT = 100 000 000 / (1100 × 4200) (ΔT =) 22 (°C) T = (20 + 22 =) 42 (°C)	-1 for POT error allow ECF from incorrect ΔT allow 23.3…, 21.6… allow 41.6-43.8 (°C)	4
(iii)	any sensible suggestion; e.g. • heating process is not 100% efficient • energy also heats up pipes / not all energy is transferred to water • some energy is transferred to the surroundings • power of Sun may change	allow energy transferred to (solar) panel ignore 'heat is lost'	1

Total for Question 5 = 10 marks

Question number	Answer	Notes	Marks
6 (a) (i)	(in solids) particles vibrate only; (in liquids) particles slide over each other; (in gases) particles move freely / randomly;		3
(b) (i)	energy starts in a chemical store (in the fuel); energy is transferred by heating; to a thermal store (in the water);	 allow transfer by convection / radiation allow kinetic store of water allow heat energy for thermal energy	3
(ii)	horizontal line shows the change of state; (because) temperature remains constant during change of state;	can be shown on graph	2

Total for Question 6 = 8 marks

Question number	Answer	Notes	Marks
7 (a)	coil of wire; current in the wire; iron core;	 current may be inferred from diagram	3
(b)	down;	allow force arrow drawn pointing down on diagram	1
(c) (i)	time taken; for {activity / number of (radioactive) nuclei / amount of isotope / count rate} to halve;	 allow atoms for nuclei	2
(ii)	any two from: MP1. radiation unlikely to penetrate out of walls; MP2. (more than) two half-lives have passed; MP3. amount of barium-133 remaining is less (than 25%); MP4. visitors exposed to radiation for very short time;	 allow idea that activity / amount of radiation is (much) less than before	2

Total for Question 7 = 8 marks

Question number	Answer	Notes	Marks
8 (a)	Universe began as hot / dense point; Universe has expanded since the Big Bang; Universe has cooled since the Big Bang;	allow idea that Universe started as a single point	3
(b)	any four from: MP1. presence of cosmic microwave background radiation; MP2. CMBR comes from all directions; MP3. CMBR (began as gamma radiation and) wavelength increased (as Universe expanded); MP4. red-shift of galaxies; MP5. further/faster galaxies show a greater red-shift; MP6. red-shift indicates that galaxies are moving away from each other; MP7. relative abundance of helium; MP8. helium formed when Universe was hot enough to fuse protons;	 allow CMBR allow CMBR is uniform allow large amount of helium	4

Total for Question 8 = 7 marks

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