Mark Scheme (Results)

January 2023

Pearson Edexcel International GCSE in Physics (4PH1) Paper 1P and Science (Double Award) (4SD0) Paper 1P

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January 2023
Question Paper Log Number P71896A
Publications Code 4PH1_1P_MS_2301

General Marking Guidance

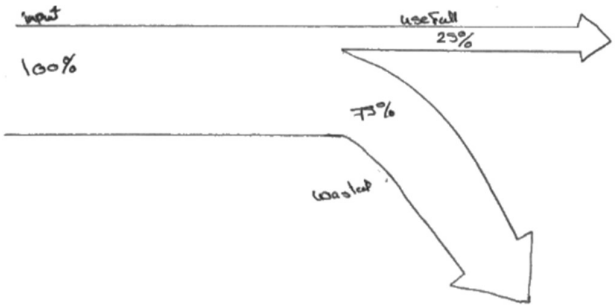
- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should 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)	idea that material returns to its original shape / length; when the load / force is removed;	 condone mass / weight for load	2
(b)	axes labelled “extension” and “load”/”force”; straight line of positive gradient drawn throughout; line passes through origin;	ignore units ignore orientation of axes judge by eye condone curve at end of line if clear indication that Hooke’s law does not apply for that part of the line e.g. limit of proportionality marked at end of straight section allow full marks for axes labelled “length” and “load”/”force” if line intersects length axis above zero	3

Total for question 1 = 5 marks

Question number	Answer	Notes	Marks
2 (a)	N on left pole and S on right pole;	allow north for N and south for S ignore attempt at labelling poles on far sides of magnets	1
(b)	idea that steel is a hard **magnetic** material;	allow steel keeps its magnetism/magnetic field allow steel is hard to demagnetise	1
(c)	any two from: MP1. (field) lines are straight; MP2. (field) lines are evenly spaced; MP3. (field) lines are parallel;	allow equivalent statements	2
(d) (i)	idea that wire cuts magnetic field lines;	allow wire passes through field lines ignore wire interacting with field lines	1
(ii)	any two from: MP1. move wire faster; MP2. move magnets closer together; MP3. use stronger magnets; MP4. turn wire into a coil;	ignore "bigger" magnets ignore more turns on the coil	2

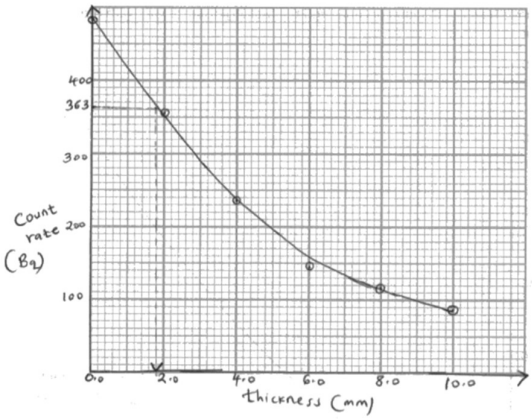
Total for Question 2 = 7 marks

Question number	Answer	Notes	Marks
3 (a) (i)	work (done) = force × distance (moved in direction of force);	allow standard symbols and rearrangements e.g. W = F × s allow d for distance	1
(ii)	substitution; rearrangement; evaluation; e.g. 41000 = force × 15 force = 41000 / 15 (force =) 2700 (N)	ignore units -1 for POT error allow correct answers to more significant figures e.g. 2733.3…(N)	3
(b) (i)	diagram showing one input and two outputs; input and outputs appropriately labelled; approximately correct scale;  	arrows can be in any orientation e.g. both useful and wasted arrows drawn horizontally allow input, total, chemical for initial arrow useful (output), mechanically for narrower output wasted (output), thermal for wider output wasted output must be consistently at least twice as wide as useful output arrow and they should sum to approximately the width of the input	3

(ii)	one mark for each correct row;;;;	reject mark for that row if more than one tick drawn	4

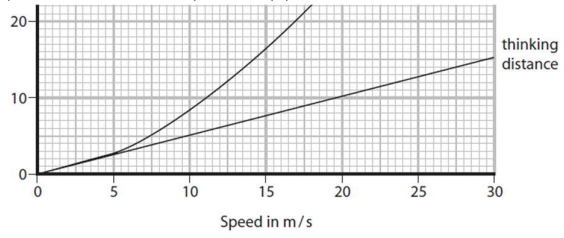
Energy store	Decreases	Increases	Stays the same
chemical store of petrol in winch	✓		
gravitational store of lorry		✓	
kinetic store of lorry			✓
thermal store of surroundings		✓	

Total for Question 3 = 11 marks

Question number	Answer	Notes	Marks
4 (a) (i)	(the) Sun / cosmic rays / rocks / radon (in the air) / weapons testing / food / (named) nuclear disasters / medical equipment;	reject CMBR allow soil	1
(ii)	use of GM tube (and counter, timer); idea of removing source (from room); idea of measuring background count several times and calculating mean; subtract background count from readings;	allow radiation detector, Geiger counter for GM tube e.g. measuring count with source and without source	4
(b) (i)	correctly calculated mean; correctly rounded to 0 decimal places; e.g. (mean =) 147.666… (mean =) 148	 answer of 147 gains 1 mark	2
(ii)	suitable linear scale chosen (>50% of grid used); axes labelled with quantities and unit; plotting correct to nearest half square;	ignore orientation allow ecf from (i) reject if non-linear scale used	3
(iii)	acceptable curve of best fit drawn;  	i.e. smooth curve with points distributed equally either side allow ecf from (ii) ignore curve outside given data range	1
(iv)	calculated value of 75% of initial count rate; correct read-off from candidate's graph; e.g. (count rate =) 363 (Bq) (lead thickness =) 1.8 (mm)	 allow 1 mark max. for correctly reading from 25% of initial count rate allow 1.7 – 1.9 (mm)	2

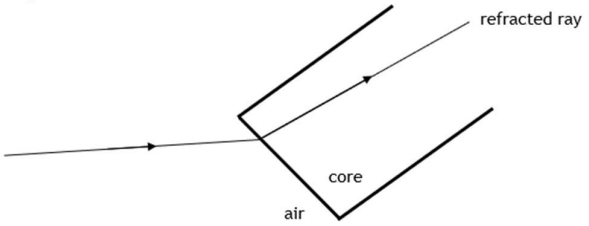
(c)	gamma; idea that all beta/alpha would be absorbed by lead / only gamma can penetrate through (thin) lead;		2

Total for Question 4 = 15 marks

Question number	Answer	Notes	Marks
5 (a)	B (condition of the road); A is incorrect because consumption of alcohol increases reaction time C is incorrect because thinking distance is determined by speed D is incorrect because tiredness increases reaction time		1
(b)	B (ice on the road); A is incorrect because reaction time does not affect braking distance C is incorrect because more powerful brakes would decrease the braking distance D is incorrect because tyres with more grip would decrease the braking distance		1
(c)	idea that stopping distance = thinking distance + braking distance; correct reading of either distance; correct evaluation; e.g. stopping distance = thinking distance + braking distance thinking distance = 10.0 m / braking distance = 26.5 m stopping distance = (10.0 + 26.5) = 36.5 (m)	stated or implied allow 26.0-27.0 (m) for braking distance allow 10.0-10.5 (m) for thinking distance allow 36.0-37.5 (m)	3
(d) (i)	(average) speed = distance (moved) / time (taken);	allow standard symbols and rearrangements e.g. t = s / v allow s or d for distance allow v or s for speed	1
(ii)	suitable pair of readings taken from graph; rearrangement of formula; evaluation; e.g. thinking distance = 15 m when speed = 30 m/s time = distance / speed (time = 15 / 30 =) 0.50 (s)  	i.e. (30,15), (20,10), (10,5) etc. allow any answer in range 0.40-0.60 (s)	3

(e)	correct braking distance reading from graph; substitution into $v^2 = u^2 + 2 \times a \times s$; rearrangement; evaluation; e.g. braking distance = 53 m $0^2 = 30^2 + [2 \times a \times 53]$ $a = (-)900 / 106$ $(a =) (-)8.5$ (m/s^2)	allow 53 seen anywhere in working final answer of 6.6 (m/s^2) (using stopping distance instead of braking distance) scores 3 marks final answer of 30 (m/s^2) (using thinking distance instead of braking distance) scores 3 marks allow 52-53 m allow 8.49-8.65	4

Total for question 5 = 13 marks

Question number	Answer	Notes	Marks
6 (a)	D (waves transfer energy and information without transferring matter); A is incorrect because waves do not transfer matter B is incorrect because waves do transfer energy and information C is incorrect because waves do transfer information		1
(b) (i)	ray drawn such that it shows correct change of direction into the core i.e. bending towards normal; e.g.  	arrow on ray is not required	1
(ii)	refraction;	allow recognisable spelling reject if spelling implies reflection	1
(c)	(total internal) reflection; (because) core has higher refractive index than air; (because) angle (of incidence) is greater than critical angle;	allow core is more (optically) dense than air / light travels from a dense to a less dense medium	3

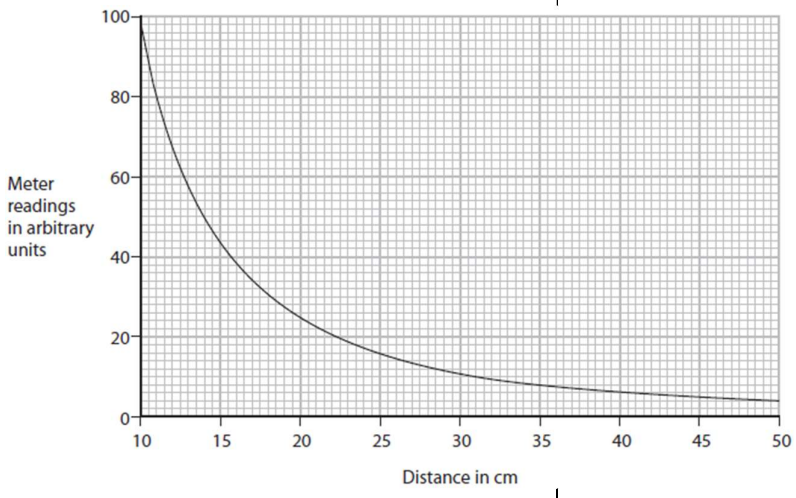
Total for Question 6 = 6 marks

Question number			Answer	Notes	Marks
7	(a)	(i)	variable resistor;	allow rheostat	1
		(ii)	idea that it allows the current / voltage (across lamp) to be **varied**;	ignore references to changing resistance	1
	(b)	(i)	charge = current × time;	allow standard symbols and rearrangements e.g. Q = I × t reject C, c for current and charge	1
		(ii)	0.48 (A);		1
		(iii)	substitution; evaluation; unit; e.g. charge = 0.48 × 30 (charge =) 14 coulombs / C	allow ecf from (ii) mark independently allow 14.4 ignore As	3
		(iv)	substitution into E = V × I × t; rearrangement; evaluation; e.g. 250 = 10 × 0.48 × time time = 250 / 4.8 (time =) 52 (s)	allow ecf from (ii) allow alternative method involving calculating charge transferred, then using Q=It allow 52.08…(s)	3
		(v)	curve drawn of similar shape to existing but through 180° rotation into negative quadrant of graph; curve starts at (0,0) and finishes at (-12,-0.5);	 DOP	2
	(c)		any two from: MP1. idea that current changes direction; MP2. LED only allows current in one direction; MP3. LED will not light up when current in reverse direction;	allow description of electron movement for current allow RA	2

Total for Question 7 = 14 marks

Question number	Answer	Notes	Marks
8 (a)	Rigel; (because) idea that colour depends on surface temperature;	 ignore links between mass and temperature	2
(b)	any six from: **for both stars:** MP1. both stars began in a nebula; MP2. both stars were protostars; MP3. both stars were/are main sequence stars; **for Rigel:** MP4. Rigel is a high mass star; MP5. Rigel is/will become a red supergiant; MP6. Rigel will become a supernova; MP7. Rigel will become a neutron star; **for Sirius:** MP8. Sirius is a low mass star; MP9. Sirius will become a red giant; MP10. Sirius will (eventually) become a white dwarf;	 allow gas/dust cloud for nebula accept blue supergiant condone black hole allow Sirius has mass similar to the Sun	6

Total for Question 8 = 8 marks

Question number			Answer	Notes	Marks
9	(a)	(i)	amplitude in the range of 0.8 – 0.9 (cm);		1
		(ii)	wavelength in the range 3.9 – 4.0 (cm);		1
	(b)	(i)	radio (waves);	allow radio frequency reject radioactive (waves), radiation (waves)	1
		(ii)	substitution; rearrangement; evaluation; e.g. 3.0×10^8 = frequency $\times$ 0.027 (frequency =) 3.0×10^8 / 0.027 (frequency =) 1.1×10^{10} (Hz)	allow wavelength substitution in cm or m -1 if POT error allow 1.11…$\times 10^{10}$ (Hz)	3
	(c)	(i)	68;		1
		(ii)	relationship is not inversely proportional; correct calculation of constant for one pair of readings correct calculation of constant for second pair of readings; statement to show meter reading × distance is not constant;  	allow conclusion is incorrect	4

Total for Question 9 = 11 marks

Question number	Answer	Notes	Marks
10 (a)	line decreases from 70; other line increases from 5; both are correctly curved; lines become asymptotic at an intermediate temperature;	 DOP reject if intermediate temperature closer to 70 than 5	4
(b)	any 4 from: MP1. hot water loses energy / cold water gains energy; MP2. (thermal) energy is transferred from hot to cold water; MP3. by conduction (through the metal); MP4. idea that energy transfer stops when thermal equilibrium is reached; MP5. some (thermal) energy lost (to surroundings) by convection/evaporation/radiation; MP6. little/no (thermal) energy is transferred out through the insulated plastic cup;	 allow cold water gains heat from hot water allow equivalent statements for thermal equilibrium e.g. same temperature	4
(c)	(energy transfer by) convection/radiation decreases; idea that equilibrium temperature will be higher; idea that time taken to cool (to room temperature) will be longer;	allow reference to evaporation condone no change to intermediate temperatures	3

Total for Question 10 = 11 marks

Question number	Answer	Notes	Marks
11 (a) (i)	idea that atoms collide with (all) walls of the container; force is exerted on walls (during each collision); pressure is force on an area;	 allow p=F/A	3
(ii)	any two from: MP1. particles move slower; MP2. particles collide with walls less **frequently**; MP3. force on container decreases;	 allow KE decreases / eq allow less often, less times per second etc. allow particles collide less hard with walls	2
(b)	substitution into KE = ½ × m × v^2; evaluation of KE; rearrangement of given formula; evaluation of kelvin temperature; e.g. KE = 0.5 × 5.0 × 10^{-27} × 73^2 KE = 1.3 × 10^{-23} (J) T = KE / 2.1 × 10^{-23} (T =) 0.63 (K)	 allow ecf from incorrect KE allow 1.33225 × 10^{-23} (J) allow answers in the range of 0.61-0.64 (K)	4

Total for Question 11 = 9 marks

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