Pearson Edexcel

Mark Scheme (Provisional)

Summer 2021

Pearson Edexcel International GCSE

In Physics (4PH1) Paper 1P and Science (Double Award) (4SD0) Paper 1P

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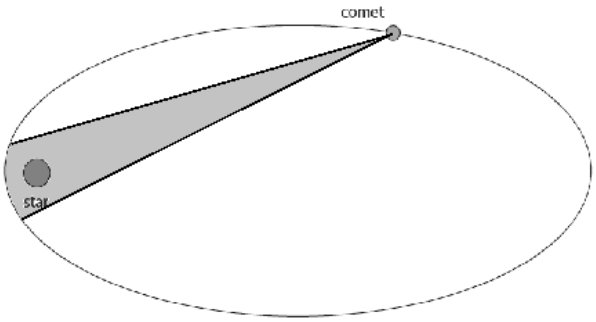
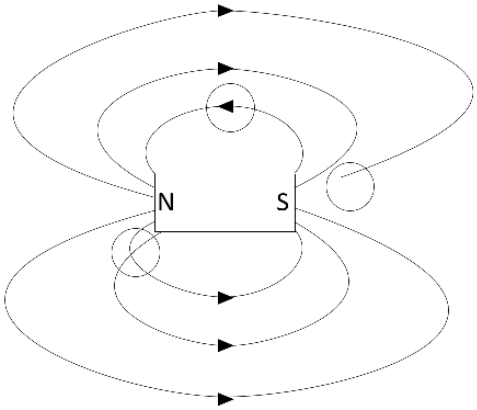
Summer 2021
Question Paper Log Number 67159
Publications Code 4SD0_1P_2106_MS

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)	C (white); A is incorrect because its temperature is the second lowest B is incorrect because its temperature is the lowest D is incorrect because its temperature is the second highest		1
(ii)	D (white dwarf); A is incorrect because the Sun is not massive enough to form a black hole B is incorrect because the Sun is not massive enough to form a neutron star C is incorrect because the Sun is not massive enough to form a supernova		1
(iii)	C (supernova); A is incorrect because this is during the middle of the life cycle B is incorrect because this is an early stage of the life cycle D is incorrect because this is a late stage in the life cycle of stars like our Sun		1
(b)	arrow pointing from the comet to the star; force labelled 'gravitational';  	accept any arrow pointing from comet to star within shaded area ignore starting position of arrow allow 'gravity' or 'weight'	2

Total for Question 1 = 5 marks

Question number	Answer	Notes	Marks
2 (a)	(plotting) compass(es);	allow **suspended** magnet, magnetometer allow higher level responses e.g. Hall probe, search coil	1
(b)	one mark for each correct indication;;;  	2 marks max. if more than three indications given	3
(c)	any two from: difficult to magnetise; difficult to demagnetise; idea that it retains its magnetism;	allow idea of taking a long time to magnetise allow idea of taking a long time to demagnetise	2

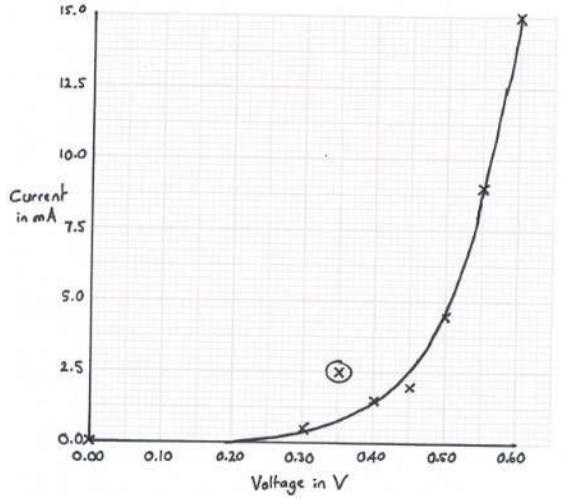
Total for Question 2 = 6 marks

Question number	Answer	Notes	Marks
3 (a) (i)	neutron;		1
(ii)	nucleus/nuclei splitting; releasing (two) daughter nuclei / neutrons / energy;	condone nucleus/nuclei breaking apart ignore daughter cells allow smaller/lighter nuclei for daughter nuclei	2
(iii)	neutrons released (by fission) are absorbed by **other** (uranium) nuclei; causing fission/splitting in **other** (uranium) nuclei;	condone atoms for nuclei condone atoms for nuclei	2
(b)	concrete / lead / (thick) steel;		1
(c)	graphite; slow; boron; absorb;		4

Total for Question 3 = 10 marks

Question number	Answer	Notes	Marks
4 (a) (i)	use of acceleration = change in velocity / time; substitution; evaluation; e.g. acceleration = change in velocity / time acceleration = (-)30 / 6.2 (acceleration =) (-)4.8 (m/s^2)	seen anywhere in working allow clear indication that acceleration is gradient ignore minus sign allow (-)4.8 to (-)5.0 (m/s^2)	3
(ii)	clear indication that distance is area under line; understanding braking distance is area of triangle section only; evaluation; e.g. distance = area distance = 0.5 × 30 × 6.2 (distance =) 93 (m)	 54 (m) = 1 mark 147 (m) = 2 marks accept alternative method using ecf answer from (a)(i) and $v^2 = u^2 + 2as$ giving 93.75 (m)	3
(iii)	thinking distance: increase in thinking distance; (due to) increased reaction time; braking distance: no effect on braking distance; (due to) no effect on braking time / braking force;	 allow idea that braking distance does not depend on human factors	4
(b)	A; B is incorrect because it does not show deceleration C is incorrect because the distance cannot change abruptly and the car is moving throughout D is incorrect because the first portion shows that the car is not moving		1

Total for Question 4 = 11 marks

Question number	Answer	Notes	Marks
5 (a)	both ammeter and voltmeter symbols correct; ammeter drawn in series with LED; voltmeter drawn in parallel with LED;		3
(b) (i)	axes scales cover 50% of the grid in both directions and have a sensible, continuous scale; both axes labelled with quantities and units; all data plotted correctly;	reject if either scale uses multiples of 3, 7 or 9 or if discontinuous ignore orientation reject if either scale is discontinuous data should be plotted to within half a small square	3
(ii)	(0.35,2.5) circled;		1
(iii)	smooth curve drawn with approximately even distribution of points either side ignoring anomaly;  	allow ecf from (i) so judge curve for the student's plotting	1
(iv)	(data are) continuous/not discrete;		1
(v)	voltage = current × resistance;	allow standard symbols and rearrangements reject C, c for current	1
(vi)	MP1. voltage across resistor = 0.015 × 270; MP2. voltage across resistor is 4.05 (V); MP3. voltage across power supply = voltage across LED + voltage across resistor; MP4. voltage across power supply is (4.05 + 0.60 =) 4.7 (V);	allow 15 × 270 for this mark allow 4.0, 4.1 (V) scores MP1 and MP2 allow 4.65, 4.6 (V) V = 4050.6 (V) = 3 marks allow alternative method of calculating resistance of LED to find total resistance of circuit	4

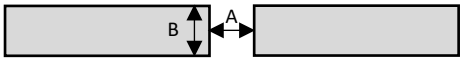
Total for Question 5 = 14 marks

	Answer	Notes	Marks
6 (a)	any four from: MP1. water near heater is heated; MP2. (heated) water expands; MP3. density of (heated) water decreases; MP4. lower density / warm water rises; MP5. cooler / denser water sinks; MP6. process repeats / is continuous;	allow clear annotations on diagram accept 'particles move apart from each other'/'particles spread out' reject particles expand	4
(b) (i)	temperature increases with time; idea that rate of temperature increase reduces;	 allow 'temperature increases at a decreasing rate'/ EQ for 2 marks	2
(ii)	temperature rise is quicker when container is empty; with any two explanations from: • particles move around quicker/have more KE in gases; • convection current is faster in gases; • energy transfer (by convection) is quicker; • mass of air in empty container less than mass of water in full container; • specific heat capacity of air is lower than water;	allow empty container reaches higher temperature ignore comments about conduction allow particles in gases are more free to move allow less particles in empty container allow RA	3

Total for Question 6 = 9 marks

Question number	Answer	Notes	Marks
7 (a)	any two from: MP1. alphas do not penetrate as far; MP2. alphas are more ionizing; MP3. alphas are more likely to collide (with material); MP4. alphas have more mass / move slower;	 allow RA allow RA allow RA allow RA	2
(b) (i)	(nuclei with) same numbers of protons; (nuclei with) different numbers of neutrons;	allow (nuclei with) same atomic number allow (nuclei with) different mass number	2
(ii)	one mark for each correct number;; $^{235}_{92}U \rightarrow {}^{231}_{\boxed{90}}Th + {}^{\boxed{4}}_{2}\alpha$		2
(iii)	any indication that 2100 million years is 3 half-lives; evaluation of number of uranium nuclei after 1 half-life; (after 2100 million years) there are 800 million uranium nuclei; (after 2100 million years) there are 5600 million thorium nuclei; 5600 (million) / 800 (million) = 7;	 3200 (million) uranium nuclei after one half-life scores first three marks allow total number of nuclei is constant allow 7 × 800 = 5600	5

Total for Question 7 = 11 marks

Question number	Answer	Notes	Marks
8 (a)	two magnets with opposite poles facing; poles brought close to each other;  	accept annotated diagram for either mark accept from diagram if magnets drawn closer together than the thickness of their poles i.e. A < B (on diagram)	2
(b) (i)	any three from: MP1. ammeter displays a current/reading (in one direction); MP2. (because) a voltage is induced; MP3. induced voltage gives a current; MP4. ammeter reading goes negative / shows current in opposite direction; MP5. (because) wire changes direction;	 allow 'an alternating current / a.c. is produced'	3
(ii)	any four from: MP1. ammeter reading / current is greater (than before); MP2. because wire moving quicker; MP3. more field lines cut (per second); MP4. gives a larger induced voltage; MP5. frequency of alternating current increases;	 allow idea that direction of current changes more frequently	4

Total for Question 8 = 9 marks

Question number	Answer	Notes	Marks
9 (a)	use of $v^2 = u^2 + 2as$; substitution; rearrangement; evaluation; e.g. $v^2 = u^2 + 2as$ $v^2 = (0) + 2 \times 10 \times 2.2$ $v = \sqrt{44}$ (v =) 6.6 (m/s)	seen anywhere in working allow use of g=9.8, 9.81 allow alternative method using $mgh = {}^1/_2mv^2$ final answer of 44 (m/s) is 2 marks only allow 6.63…(m/s), 6.56…(m/s) 6.5 scores 3 marks only	4
(b) (i)	vertical arrow drawn upwards;	ignore labels reject if more than one arrow drawn unless resultant force is clearly labelled	1
(ii)	substitution into F = ma; rearrangement; evaluation; e.g. 18 000 = 4100 × a a = 18 000 / 4100 (a =) 4.4 (m/s^2)	 -1 for POT error allow 4.39…(m/s^2)	3

Total for Question 9 = 8 marks

Question number	Answer	Notes	Marks
10 (a)	use of p = h × density × *g*; conversion of 57 cm into 0.57 m; evaluation; e.g. pressure difference = 57 × 820 × 10 pressure difference = 0.57 × 820 × 10 (pressure difference =) 4700 (Pa)	allow mark if formula on its own is seen in working allow use of *g* = 9.8, 9.81 470 000, 467 000, 467 400, 458 052, 458 519.4 etc. score 2 marks allow 4670, 4674, 4580.52, 4585.194 etc.	3
(b) (i)	substitution into W = m × g; evaluation; correct unit; e.g. W = 24 × 10 (W =) 240 newtons / N	no mark for formula on its own allow use of *g* = 9.8, 9.81 -1 for POT error e.g. incorrectly changing kg to g mark independently allow 235.2, 235.44	3
(ii)	substitution into p = F/A; evaluation; e.g. p = 240 / 1.2 (p =) 200 (Pa)	no mark for formula on its own allow ecf from (i)	2
(iii)	substitution into p = F/A; rearrangement; evaluation; e.g. 200 = F / 4.8 F = 200 × 4.8 (F =) 960 (N)	no mark for formula on its own allow ecf from (ii)	3
(c)	GPE of piston X = decrease; GPE of piston Y = increase; chemical energy of piston Y = no change; kinetic energy of piston Y = no change;	allow marks if the meaning is clear e.g. allow +, ↑ for increase etc.	4

Total for Question 10 = 15 marks

Question number	Answer	Notes	Marks
11 (a) (i)	line drawn in top-right quadrant; correct angle by eye;	accept if drawn on diagram 1 instead of diagram 2 DOP	2
(ii)	32 (degrees);	allow in range 31-33 (degrees)	1
(iii)	refractive index = sin(angle of incidence) / sin(angle of refraction);	allow standard symbols and rearrangements e.g. 'i' for angle of incidence 'r' for angle of refraction 'n' for refractive index	1
(iv)	substitution; evaluation to at least 3s.f.; e.g. n = sin(64) / sin (32) n = 1.70	allow ecf from (ii) allow 1.696…	2
(v)	sin(c) = 1 / n;	allow standard symbols and rearrangements	1
(vi)	substitution OR rearrangement; evaluation; e.g. sin(c) = 1/1.7 OR c = $\sin^{-1}(1/n)$ (c =) 36 (degrees)	allow ecf from (iv) allow 36.03…(degrees)	2
(b)	light undergoes total internal reflection; angle of incidence is above the critical angle; light (would be) going from more (optically) dense to less (optically) dense;	allow TIR for 'total internal reflection' allow idea that light would speed up if it travelled through the boundary / light travels faster in air than in material	3

Total for Question 11 = 12 marks

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