

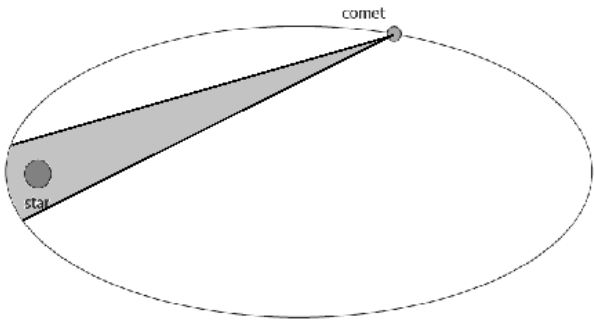


Mark Scheme (Provisional)

Summer 2021

Pearson Edexcel International GCSE

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

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

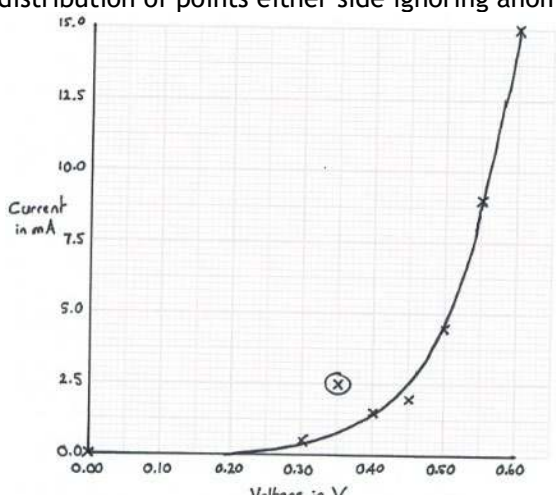
Total for Question 2 = 6 marks

Question number	Answer	Notes	Marks
3 (a)	(i) neutron;		1
	(ii) <u>nucleus/nuclei</u> splitting; releasing (two) daughter nuclei / neutrons / energy;	condone <u>nucleus/nuclei</u> 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 $(-4.8 \text{ to } (-5.0 \text{ m/s}^2))$	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 = $0.5 \times 30 \times 6.2$ (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 $\times$ 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

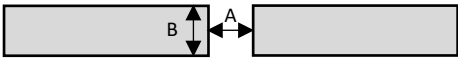
Total for Question 5 = 14 marks

	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;; ${}_{92}^{235}\text{U} \rightarrow {}_{90}^{231}\text{Th} + {}_2^4\alpha$		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 $7 \times 800 = 5600$	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 $mgh = \frac{1}{2}mv^2$ 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. $18\,000 = 4100 \times a$ $a = 18\,000 / 4100$ (a =) 4.4 (m/s²)	-1 for POT error allow 4.39...(m/s²)	3

Total for Question 9 = 8 marks

Question number	Answer	Notes	Marks
10 (a)	use of $p = h \times \text{density} \times g$; conversion of 57 cm into 0.57 m; evaluation; e.g. pressure difference = $57 \times 820 \times 10$ pressure difference = $0.57 \times 820 \times 10$ (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 $W = m \times g$; evaluation; correct unit; e.g. $W = 24 \times 10$ (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. $200 = F / 4.8$ $F = 200 \times 4.8$ (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 +, $\uparrow$ 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 = $\sin(\text{angle of incidence}) / \sin(\text{angle of refraction})$;	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