



Mark Scheme (Results)

January 2023

Pearson Edexcel International GCSE
In Physics (4PH1)
Paper 1PR

Question number	Answer	Notes	Marks
1 (a)	C; A cannot be correct as the angle of reflection is not equal to the angle of reflection. B and D cannot be correct as the ray penetrates into the mirror rather than reflects.		1
(b)	protractor;		1
(c) (i)	attempt at measuring the (time) difference between the two peaks; 2.5 s;	award both marks if correct answer on answer line	2
(ii)	substitution and rearrangement into given eqn; evaluation; correct answer: 750 000 (km) e.g. distance = speed $\times$ time distance = $300\,000 \times 2.5$ distance = 750 000 (km)	ECF from (c)(i) accept answer given in standard form	2
(iii)	division of candidate's answer for (ii) by 2; correct answer: 375 000 (km)		1

Total for Question 1 = 7 marks

Question number	Answer	Notes	Marks
2 (a)	(i) any orbit around Earth; circular orbit centred on Earth;		2
	(ii) any elliptical orbit around Sun; with focus at Sun;	accept incomplete or full orbit; accept parabolic/hyperbolic path with Sun at focus for 2 marks	2
(b)	evidence of correct conversion from days to seconds; substitution into given formula; correct evaluation; Correct answer: 30 km/s e.g. $365 \times 24 \times 60 \times 60 = 31.5 \times 10^6 \text{ s}$ Orbital speed = $(2 \pi r) \div T$ Orbital speed = $(2 \times \pi \times 150\,000\,000) / 31.5 \times 10^6 \text{ s}$ Orbital speed = 29.9 km/s		3
(c)	B - gravitational; A, C and D cannot be correct as only the gravitational force is responsible for keeping planets in orbit around their star.		1
(d)	starts as nebula/cloud (of gas); reference to main sequence; finishes as white dwarf; PLUS at least ONE, in the correct place, from protostar/red (super) giant/planetary nebula; e.g. nebula → protostar → main sequence → red giant → white dwarf and planetary nebula	ignore black dwarf reject supernova for this mark	4

Total for Question 2 = 12 marks

Question number	Answer	Notes	Marks
3 (a) (i)	8.2 (m/s) ;		1
(ii)	any TWO from: MP1. reference to weight and drag; MP2. weight greater than drag; MP3. resultant force causes acceleration; MP4. drag increases with speed; PLUS weight = drag at terminal velocity/eq;	ignore reference to upthrust accept water friction or water resistance for "drag" accept 'gravitational force' for 'weight' "F=ma" is insufficient by itself	3
(b) (i)	pressure difference = height $\times$ density $\times$ g ;	accept depth for height accept accepted symbols e.g. p, h, d (for height), d or ρ (for density), accept any correct rearrangement reject 'gravity' for 'g'	1
(ii)	substitution; evaluation; correct answer: 250 000 (Pa) e.g. pressure difference = height $\times$ density $\times$ g pressure difference = $25 \times 1000 \times 10$ pressure difference = 250 000 (Pa)	accept use of 9.8(1) for 'g' giving 245 000 (Pa) POT error gives -1 except if no evidence of use of 'g'	2
(iii)	addition of 1.0×10^5 to candidate's answer to (ii); correct answer: 3.5×10^5 (Pa)	accept answer not given in standard form	1
(iv)	substitution into given equation; rearrangement; correct evaluation; correct answer: 0.13(14) (m ³) e.g. $p_1 \times V_1 = p_2 \times V_2$ $1.0 \times 10^5 \times 0.46 = 3.5 \times 10^5 \times V_2$ $V_2 = (1.0 \times 10^5 \times 0.46) \div (3.5 \times 10^5)$ $V_2 = 0.1314$ (m ³)	subs and rearrange can be in either order; condone use of 2.5×10^5 Pa giving $V = 0.18...$ (m ³) for 2 marks condone use of 2.45×10^5 Pa giving $V = 0.188...$ (m ³) for 2 marks	3

Total for Question 3 = 11 marks

Question number	Answer	Notes	Marks
4 (a)	correct symbols for all components; components connected in a series circuit; ammeter in series with lamp; voltmeter in parallel with lamp;	ignore ammeter and voltmeter	4
(b) (i)	all points plotted correctly;	within half a small square	1
(ii)	curve passes within half a small square of all points;	by eye	1
(c) (i)	idea of taking more data at different voltages;		1
(ii)	any TWO from: MP1. current (in filament) heats up the filament; MP2. resistance changes with temperature; MP3. idea that change of resistance affects gradient (of graph);	allow idea that higher voltage will increase the temperature of the filament condone 'lamp' for filament allow 'increasing resistance decreases current for the same voltage' for MP2 and MP3	2

Total for Question 4 = 9 marks

Question number	Answer	Notes	Marks
5 (a)	fission is the splitting of a <u>nucleus</u> ; fusion is the joining of (two) <u>nuclei</u> ;	allow “breaking down”, “dividing” for splitting allow “fusing”, “combining” for joining reject “atom” for “nucleus”	2
(b) (i)	mass number = 1; atomic number = 0;		2
(ii)	any THREE from: MP1. idea that reactants are not (as) hazardous for fusion; MP2. idea that products of fusion are not radioactive; MP3. (so) no {mutations/damage to cells/tissue/cancer} ; MP4. (so) no long-term storage problems; MP5. idea that no shielding is required; MP6. idea of lower or no risk of meltdown for fusion; MP7. idea that there is no runaway chain reaction for fusion;	accept RA allow reference to no gamma radiation from fusion	3
(c)	evidence of activity halved; evidence of activity halved four times only; correct evaluation; correct answer: 7.5 (kBq) e.g. $120 \div 2 = 60$ $60 \div 2 = 30$ $30 \div 2 = 15$ $15 \div 2 = 7.5$	allow reference to 4 half lives, including showing that $48/12 = 4$	3

Total for Question 5 = 10 marks

Question number	Answer	Notes	Marks
6 (a)	any THREE from: MP1. correct reference to convection; MP2. fan aids convection; MP3. reference to conduction not being the main method; MP4. (since) {plastic/air} is a poor conductor/good insulator; MP5. white (materials) are poor at emitting /eq;	allow idea of heat reflecting back / not absorbing well from this interior white surface	3
(b)	any THREE from: MP1. correct reference to conduction; MP2. since {metals/aluminium} conducts well; MP3. reference to convection not being the main method; MP4. as hot air particles can't circulate (from inside to outside); MP5. black (materials) are good at emitting/eq;	allow idea of heat being absorbed well from the interior black surface	3
(c) (i)	power = voltage $\times$ current;	accept 'P = IV' accept any correct rearrangement	1
(ii)	substitution; evaluation; watt or W as the unit; correct answer: 15 watts e.g. power = voltage $\times$ current power = 5.1×2.9 power = 14.8 watts	accept 14.8, 14.79 W	3

Total for Question 6 = 10 marks

Question number	Answer	Notes	Marks
7 (a) (i)	C - 51°; Angle should be measured and cannot be either A, B or D.		1
(ii)	refractive index = $\sin(i)/\sin(r)$;	allow n, n for refractive index	1
(iii)	substitution; rearrangement; correct evaluation; correct answer: 31 degrees e.g. refractive index = $\sin(i)/\sin(r)$ $1.52 = \sin(51)/\sin(r)$ $\sin(r) = \sin(51)/1.52$ $\sin(r) = 0.511...$ $r = \sin^{-1}(0.511...) = 30.7... \text{ degrees}$	allow ECF from (i) answers of 26.66..., 28.76..., 32.06... all score 3 marks ECF	3
(b) (i)	use of formula $\sin c = 1/n$; substitution; correct evaluation; correct answer: 41 (degrees) e.g. $\sin c = 1/n$ $\sin c = 1/1.52$ $c = \sin^{-1}(1/1.52) = 41.1 \text{ (degrees)}$		3
(ii)	total internal reflection (TIR) / angle of incidence is above the critical angle and so reflects;		1

Total for Question 7 = 9 marks

Question number	Answer	Notes	Marks
8 (a)	(i) balance;	condone scales reject scale	1
	(ii) take repeats and either find mean, identify or remove anomalies;		1
(b)	mass of air is 0.61 g; correct use of formula: density = mass/volume; correct evaluation to 2 sf; appropriate unit i.e. g/cm³; correct answer = 0.0012 g/cm³ e.g. mass of air = 15.61 – 15.00 = 0.61 density = mass ÷ volume density = 0.61 ÷ 490 density = 0.00124 g/cm³ density = 0.0012 g/cm³ to 2 sf	–1 POT error accept use of standard form i.e. $1.2(4) \times 10^{-3}$ g/cm³	4
(c)	any THREE from: MP1. any reference to displacement method; MP2. measure original volume of water; MP3. (fully) submerge balloon; MP4. re-measure volume of water; MP5. subtract one volume from the other;	allow reference to displacement to a different vessel and use of measuring cylinder or beaker for three marks	3

Total for Question 8 = 9 marks

Question number	Answer	Notes	Marks																			
9 (a)	(i) any ONE from: wear gloves; use tongs; do not point source at anyone; keep source at arm's length; keep source in lead-lined box; keep exposure time short; wear goggles; lead apron;	accept use of remote control i.e. a robot i.e. only have the source out for as long as is necessary	1																			
	(ii) Geiger-Muller tube (and counter);	allow GM tube/counter/detector condone 'photographic film'	1																			
(b)	;;; <table border="1"> <thead> <tr> <th rowspan="2">Type of radiation</th><th colspan="3">Material</th></tr> <tr> <th>10 mm of air</th><th>2 cm of aluminium</th><th>10 cm of lead</th></tr> </thead> <tbody> <tr> <td>alpha</td><td>X</td><td>X</td><td>X</td></tr> <tr> <td>beta</td><td></td><td>X</td><td>X</td></tr> <tr> <td>gamma</td><td></td><td></td><td>X</td></tr> </tbody> </table>	Type of radiation	Material			10 mm of air	2 cm of aluminium	10 cm of lead	alpha	X	X	X	beta		X	X	gamma			X	each correct row scores 1 mark	3
Type of radiation	Material																					
	10 mm of air	2 cm of aluminium	10 cm of lead																			
alpha	X	X	X																			
beta		X	X																			
gamma			X																			
(c)	(i) recall of $KE = \frac{1}{2} m v^2$; substitution; correct evaluation; correct answer: 1.5×10^{-12} (J) e.g. $KE = \frac{1}{2} m v^2$ $KE = \frac{1}{2} \times (6.6 \times 10^{-27}) \times (2.1 \times 10^7)^2$ $KE = 1.4553 \times 10^{-12}$ (J)	-1 POT error	3																			
	(ii) candidate's answer for (i) e.g. 1.5×10^{-12} (J)		1																			
	(iii) thermal;		1																			

Total for Question 9 = 10 marks

Question number	Answer	Notes	Marks
10 (a) (i)	26(.4) (N) ;		1
(ii)	(resultant) force = mass $\times$ acceleration;	allow acceptable symbols e.g. F, f, m, M, a, A allow any correct rearrangement;	1
(iii)	conversion of 160 g to 0.16 kg; rearrangement or substitution; correct evaluation; correct answer: 165 (m/s ²) e.g. acceleration = resultant force $\div$ mass acceleration = 26.4 $\div$ 0.16 acceleration = 165 (m/s ²)	allow ECF for incorrect resultant force Condone rounding to 160 or 170.	3
(iv)	any THREE from: MP1. weight decreases; MP2. air resistance increases; MP3. consistent inference of changing resultant force; MP4. (therefore) changing acceleration;	ignore references to running out of fuel reducing thrust/eq ignore references to energy DOP consistent with MP3	3
(b)	any FOUR from: MP1. (observed) frequency decreases; MP2. speed of waves constant; MP3. wavefronts behind firework spread out/eq; MP4. causing an increased wavelength (at the observer); MP5. reference to $f = \text{speed} \div \text{wavelength}$;	ignore references to region in front of rocket or an approaching rocket allow any rearrangement	4

Total for Question 10 = 12 marks

Question number	Answer	Notes	Marks
11 (a) (i)	current provides a magnetic field/eq; magnets in a magnetic field experience a force/magnets line up along a field line/eq;		2
	(ii) (circular) field line through all of the compass needles; arrow clockwise;	allow any circle concentric with the wire	2
	(iii) changes direction / eq;		1
(b)	vertical; upwards;		2
(c) (i)	up / down; idea of cutting field lines;	allow any inference of up/down	2
	(ii) cutting field lines induces a voltage across the wire; complete circuit so voltage gives a current;	allow emf or potential difference or p.d. for voltage allow idea of a force on electron(s) causing them to move	2

Total for Question 11 = 11 marks