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Mark Scheme (Results)

Summer 2024

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

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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.

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Question number	Answer	Notes	Marks
1 (a) (i)	labelled diagram showing a moon in circular orbit around Earth; Earth approximately at the centre of the path;	allow planet for Earth judge circular by eye ignore attempts at 3D drawing allow planet for Earth	2
(ii)	gravitational (force);	allow gravity ignore weight, centripetal, centrifugal reject gravitational potential, gravitational field strength	1
(iii)	satellite / space station;	allow other suitable object e.g. (rocket) debris etc. reject comet	1
(b)	planet's orbit is circular/slightly elliptical but comet's orbit is elliptical/oval; OR planet has constant speed but comet has variable speed;	clear comparison needed allow comet orbit is more elliptical ignore references to period/length of orbits allow idea that planet has constant orbital radius but comet has variable orbital radius	1

Total for Question 1 = 5 marks

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Question number	Answer	Marks
2 (a)	**A (6 protons, 6 neutrons);** B is not the answer because it is the same isotope C is not the answer because it is a different element D is not the answer because it is a different element	1
(b)	**B (beta);** A is not the answer because alpha is a helium nucleus C is not the answer because gamma is a high frequency EM wave D is not the answer because it is not an electron	1
(c)	**D (neutron);** A is not the answer because this would decrease the atomic number and decrease the mass number B is not the answer because this would increase the atomic number and keep the mass number the same C is not the answer because this would keep the atomic number and mass number the same	1
(d)	**A (90);** B is not the answer because this is a neutral atom C is not the answer because it is a negatively charged ion D is not the answer because it is a negatively charged ion	1
(e)	**C (100 Bq);** A is not the answer because this is 4 half-lives B is not the answer because this is 3 half-lives D is not the answer because this is 1 half-life	1

Total for Question 2 = 5 marks

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Question number	Answer	Notes	Marks
3 (a)	{skin / eye / tissue} burns;	allow damage to surface cells, skin damage reject skin cancer, cell mutation, sunburn	1
(b) (i)	any two from: • both electromagnetic waves; • both transfer energy; • both transverse waves; • both are non-ionising; • both can travel through vacuum; • both have same speed (in a vacuum);	 allow EM waves allow both part of EM spectrum allow both can be reflected / refracted / diffracted	2
(ii)	• infrared has longer/higher wavelength; • infrared has lower frequency;	allow RA allow RA condone infrared has lower energy	2
(c)	substitution into speed = distance / time; rearrangement; evaluation; e.g. $3.0 \times 10^8 = 1.5$ / time time = $1.5 / 3.0 \times 10^8$ (time =) 5.0×10^{-9} (s)	 -1 for POT error allow 5×10^{-9} (s), 0.000 000 005 (s)	3
(d)	black is a better/good **absorber** (of infrared radiation); idea that more energy/heat transferred to black car (in the same time);	allow RA e.g. white is a poor **absorber** allow white is a better/good **reflector** (of infrared radiation) allow RA e.g. less energy/heat transferred to white car allow black car warms up quicker black car absorbs more energy/heat scores 2 marks	2

Total for Question 3 = 10 marks

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<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>4 (a)</td><td>one mark for each correct row;;;;

<table><tr><th>Energy store</th><th>Increases</th><th>Decreases</th><th>Stays the same</th></tr><tr><td>Chemical</td><td></td><td></td><td>✓</td></tr><tr><td>Gravitational potential</td><td></td><td>✓</td><td></td></tr><tr><td>Nuclear</td><td></td><td></td><td>✓</td></tr><tr><td>Thermal</td><td>✓</td><td></td><td></td></tr></table></td><td>reject mark for row if more than one tick given</td><td>4</td></tr>
<tr><td>(b)</td><td>mass;</td><td>ignore size, weight</td><td>1</td></tr>
<tr><td>(c)</td><td>any four from:

MP1. red giant has greater brightness than white dwarf;

MP2. (nuclear) fusion takes place in red giant (core) but not in white dwarf (core);
MP3. red giant is larger than white dwarf;

MP4. red giant has lower (surface) temperature than white dwarf;
MP5. white dwarf is denser than a red giant;
MP6. white dwarf has a planetary nebula but a red giant does not;</td><td>allow RA for all marking points
allow absolute magnitude, luminosity, power for brightness
allow red giant emits more light
allow red giant has more hydrogen
condone red giant has more mass than white dwarf
allow red giant is cooler</td><td>4</td></tr>
</table>

Total for Question 4 = 9 marks

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Question number	Answer	Notes	Marks
5 (a)	axes labelled "extension"/"elongation" and "load"/"force"/"weight"; straight line of positive gradient drawn throughout; line passes through origin;	ignore units allow "distance/length stretched" for extension 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 ignore "elastic limit" allow full marks for axes labelled "length" and "load"/"force"/"weight" if line intersects length axis above zero	3
(b) (i)	magnitude = 1.2 (N); direction = up(wards);	 allow arrow pointing up ignore unqualified "north"	2
(ii)	substitution into F = m × a; rearrangement; evaluation; e.g. 1.2 = 0.20 × a a = 1.2 / 0.20 (a =) 6.0 (m/s^2)	allow ecf from (i) -1 for POT error allow 6 (m/s^2)	3
(iii)	acceleration decreases (to zero); with any two from: • spring extension decreases; • force from spring / elastic force / upwards force decreases; • weight (of object) stays the same; • resultant force decreases (to zero);	ignore decelerates allow spring becomes less stretched ignore other irrelevant forces e.g. upthrust, air resistance etc. allow forces are balanced if clear that this only applies when the mass is at its initial resting position	3

Total for Question 5 = 11 marks

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Question number	Answer	Notes	Marks
6 (a)	arrows drawn on at least two field lines pointing towards the south pole;	condone if arrows are not drawn on the existing field lines reject if any arrows point away from the south pole	1
(b)	**B (nickel);** A is incorrect because copper is not a magnetic material C is incorrect because plastic is not a magnetic material D is incorrect because zinc is not a magnetic material		1
(c)	field line spacing/density changes (with distance from south pole); further apart field lines shows weaker field strength;	allow field lines aren't parallel scores both marks allow RA ignore references to forces	2
(d) (i)	idea that a north pole is induced on the side of the iron nearest the bar magnet; idea that opposite poles attract;	allow if shown on diagram allow north attracted to south ignore references to charge	2
(ii)	iron is a soft **magnetic** material; iron loses its magnetism (when it is removed from the magnetic field);	ignore iron is a soft magnet ignore iron is a temporary magnet allow iron is (easily) demagnetised allow iron is only magnetic when it is in a field	2

Total for Question 6 = 8 marks

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Question number	Answer	Notes	Marks
7 (a)	idea that lamps can be controlled independently; (because) circuit is a parallel circuit;	allow some lights on whilst others off / if one lamp blows the others still work etc. allow all lamps get full voltage / 230V allow idea that lamps are on (three) separate paths/branches of the circuit	2
(b) (i)	electron(s);	allow ion(s), cation(s), anion(s)	1
(ii)	substitution into formula; conversion from mA to A; evaluation to 2 or more s.f.; e.g. power = 230 × 22(×10^{-3}) power = 230 × 0.022 power = 5.1 (W)	ignore units allow if 0.022 or ÷1000 seen anywhere in working condone a calculation of current or voltage given to at least 3 s.f. using a power of 5 W for full marks allow 5.06 (W)	3
(iii)	substitution into P = E/t; rearrangement; evaluation; e.g. 5 = E / 30 E = 5 × 30 E = 150 (J)	allow ecf from (ii) allow use of E = V×I×t or other valid methods -1 for POT error allow E = 230 × 22(×10^{-3}) × 30 allow 151.8, 152, 153	3
(c) (i)	energy (transferred) per unit charge (passed);	allow V = E/Q only if all terms defined allow work done for energy transferred allow coulomb for unit charge	1
(ii)	any attempt to add any currents together; (current =) 39 (mA);	 60, 65, 82 (mA) scores 1 mark	2

Total for Question 7 = 12 marks

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Question number	Answer	Notes	Marks
8	any six from: MP1. ray A is refracted and changes direction; MP2. ray B is refracted and changes direction; MP3. correctly measured angle of incidence for either ray; MP4. correctly calculated angle of refraction for either ray A or ray B; MP5. water and air have different (optical) densities; MP6. light travels slower in water than air; MP7. TIR does not happen because water is more (optically) dense than air;	 may be shown on diagram by ray passing through boundary ignore reflected rays allow 1 mark max. from MP1 and MP2 if either ray is refracted in the wrong direction allow 34°-38° for ray A, 58°-62° for ray B may be shown on diagram allow ecf from angles of incidence expect 24°-28° for A and 39°-42° for B condone air having a higher (optical) density than water allow RA ignore calculated values of the critical angle as not relevant	6

Total for Question 8 = 6 marks

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Question number	Answer	Notes	Marks
9 (a)	80 (kPa);		1
(b)	any two from: MP1. pressure (in aeroplane) increases; MP2. (resultant) force (inwards) on bottle; MP3. idea that decreasing volume (in bottle) increases pressure (in bottle);	 allow idea that pressure outside bottle is greater than inside bottle	2
(c)	any three from: MP1. (direction of) movement of molecules is random; MP2. molecules collide with the (bottle) surface; MP3. exert a force (on the surface); MP4. pressure is force on an area;	allow particles / atoms for molecules allow equivalent words for collide e.g. bounce, hit etc. ignore 'molecules collide' (with each other) allow if given in formula format	3

Total for Question 9 = 6 marks

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Question number	Answer	Notes	Marks
10 (a)	substitution into formula; evaluation; e.g. weight = 250 (÷1000) × 10 (weight =) 2.5 (N)	ignore units -1 for clear POT error in units of mass allow use of g = 9.8, 9.81 allow 2.45, 2.4525	2

(b) (i)	independent variable = length (extending beyond table);
	
	dependent variable = height;
		allow L/l
		condone length of wood(en strip)
		
		allow H/h
			2

(ii)	any two from: • mass/weight of load; • position of load (on wooden strip); • thickness of wood(en strip); • material/type of wood(en strip);	 ignore "same load" on its own allow "same wood(en strip)" in the absence of either of these marks	2
(iii)	any two from: MP1. use of (metre) rule; MP2. fixed in place at end of wooden strip; MP3. 0 on rule placed at original height of wooden strip; MP4. method to ensure measurement is vertical e.g. using a plumb line, set square etc.; MP5. measure at eye level;	 allow tape measure condone metre stick allow alternative valid methods e.g. distance measured up from the ground with and without load ignore unqualified references to parallax error	2

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<table>
<tr>
<td>(c) (i)</td>
<td>correct measurement from diagram = 3.1 (cm);
use of scale factor gives 31 (cm);</td>
<td>allow between 3(.0) and 3.2 (cm)
allow ×10 seen in working

answer between 30 and 32 (cm) scores both marks</td>
<td>2</td>
</tr>
<tr>
<td>(ii)</td>
<td>suitable linear scale chosen (>50% of grid used);
plotting correct to nearest half square;</td>
<td>allow use of false origin
allow ecf from (i)
reject if non-linear scale used
<table>
<tr><th>Length (L) in cm</th><th>Height (h) in cm</th></tr>
<tr><td>20</td><td>2</td></tr>
<tr><td>40</td><td>8</td></tr>
<tr><td>60</td><td>18</td></tr>
<tr><td>80</td><td>31</td></tr>
<tr><td>100</td><td>53</td></tr>
<tr><td>120</td><td>71</td></tr>
</table>
</td>
<td>2</td>
</tr>
<tr>
<td>(iii)</td>
<td>acceptable curve of best fit drawn for data between 20cm and 120cm;</td>
<td>i.e. smooth curve with points distributed equally either side

all points should be at least 1 small square from curve unless there is a plotting error in (ii) or a measurement error in (i), in which case apply ecf</td>
<td>1</td>
</tr>
<tr>
<td>(iv)</td>
<td>idea that proportionality requires a straight line (through the origin);

(graph does not show this so) conclusion/student is incorrect;</td>
<td>allow idea that relationship is not linear / gradient is not constant
allow idea that h/L should be constant
DOP

score 0 marks if any indication that the response is proportional or directly proportional</td>
<td>2</td>
</tr>
</table>

Total for Question 10 = 15 marks

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Question number	Answer	Notes	Marks
11 (a)	conversion of hours into seconds; evaluation; e.g. 1 hour = (60 × 60 =) 3600 (s) (charge = 1 × 3600 =) 3600 (C)	allow 3600 or 60×60 seen in working	2
(b) (i)	substitution OR rearrangement; evaluation in seconds; conversion to minutes; e.g. $3.8 \times 10^3 = 2.4 \times t$ OR $t = Q/I$ (t =) 1600 (s) (t =) 26 (minutes)	 mark independently and apply ecf allow 1580, 1583… allow 26-27 (minutes)	3
(ii)	idea that longer cable has more resistance; (so) charging current will be less AND time taken will increase;	ignore longer distance both ideas needed for the mark	2
(c)	any four from: MP1. determination of total charge needed for the week; MP2. quantitative comparison to power bank charge; MP3. idea that power bank cannot recharge all devices (from completely flat); MP4. idea that devices will not always be completely empty when recharged; MP5. idea that devices could be used less (which would make them last longer before recharging); MP6. idea that other charging facilities might be available;	 27.8 (Ah) or 100 080 C allow 27.8 is greater than 26.8 allow power bank is 1 Ah less than needed allow ecf from MP1 allow power bank is not suitable/enough allow idea that devices could be partially charged allow idea that power bank could be recharged during trip	4

Total for Question 11 = 11 marks

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Question number	Answer	Notes	Marks
12 (a)	appropriate attempt to draw tangent at 20s on the graph; acceleration = gradient; acceleration in the range 1.00-1.20 (m/s^2); acceleration in the range 1.05-1.15 (m/s^2);	 allow if seen explicitly or from a clear attempt to calculate a gradient scores 3 marks total scores 4 marks total	4
(b)	distance = area under line; suitable method used; distance in the range = 3200-4200 (m); distance in the range = 3500-4000 (m); distance in the range = 3700-3800 (m);	seen explicitly or implied by working allow • use of trapeziums • rectangles and triangles • counting squares estimation scores 3 marks total scores 4 marks total scores 5 marks total	5
(c)	speed/velocity is constant; idea that driving force of car = air resistance; resultant force is zero;	allow terminal velocity allow forces are balanced allow acceleration is zero	3

Total for Question 12 = 12 marks

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