

Mark Scheme (Results)

Summer 2015

Pearson Edexcel International GCSE  
Physics (4PH0) Paper 1PR

Pearson Edexcel International GCSE  
Science Double Award (4SC0) Paper  
1PR

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Summer 2015

Publications Code UG042405

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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.

Question number	Answer	Notes	Marks
1 (a)	any 3 of:  MP1. neutron absorbed by (U) nucleus;  MP2. (U nucleus) splits;  MP3. (producing 2) daughter nuclei;  MP4. extra neutrons released;	accept collides with/hits/bombards/eq n for neutron  condone breaks up  must be plural reject 'daughter cells' for MP3  must be plural	3
(b)	kinetic (energy)	accept phonetic spellings e.g. 'kenetic'	1

Total 4 marks

Question number	Answer	Notes	Marks
2 (a)	any 2 of:  MP1. so that lamps work independently;  MP2. so that they all get mains/same voltage/230V;  MP3. so that different areas/rooms can have different brightness/power/light intensities of lamps;	so that can light some rooms without all being on or off/each lamp has its own switch/if 1 lamp blows the others will still work  allow no reduction in light output for main voltage  allow different currents	2
(b)	D 1.38 A;		1
(c)	any 3 of:  MP1. <b>current</b> increases over max value of fuse;  MP2. fuse wire melts;  MP3. cuts off current;  MP4. prevents wire(s) in circuit from overheating;	allow <b>current</b> gets too high  blows/breaks  breaks circuit ignore 'stops electricity' ignore electric shocks	3
(d) (i)	power = voltage x current	allow in standard symbols or in words	1
(ii)	substitution into correct equation; evaluation;  e.g. 0.26 X 230 60 (W)	allow 240 V for mains but not incorrect current (62.4 W)  allow 59.8 (W)  condone 317(.4) (W) for 1 mark	2
(iii)	answer from (d)(ii) x <b>180</b> ; evaluation; unit; e.g.  60 X 180 11000 joules/J	accept correct use of $E = V \times I \times t$  allow ecf from (d)(ii) mark independently  allow 10800, 10764	3

2 (e) (i)	<table border="1" data-bbox="419 197 887 521"> <thead> <tr> <th>S<sub>1</sub> position</th> <th>S<sub>2</sub> position</th> <th>lamp is lit</th> </tr> </thead> <tbody> <tr> <td>W</td> <td>X</td> <td>(yes)✓</td> </tr> <tr> <td>W</td> <td>Y</td> <td>(no) ×</td> </tr> <tr> <td>Z</td> <td>X</td> <td>(no) ×</td> </tr> <tr> <td>Z</td> <td>Y</td> <td>(yes)✓</td> </tr> </tbody> </table> <p>any three correct; all 4 correct;;</p>	S <sub>1</sub> position	S <sub>2</sub> position	lamp is lit	W	X	(yes)✓	W	Y	(no) ×	Z	X	(no) ×	Z	Y	(yes)✓	<p>allow 1 mark when middle two rows blank, but otherwise correct</p> <p>allow 1 mark when top and bottom rows blank but otherwise correct</p>	2
S <sub>1</sub> position	S <sub>2</sub> position	lamp is lit																
W	X	(yes)✓																
W	Y	(no) ×																
Z	X	(no) ×																
Z	Y	(yes)✓																
(ii)	<p>any sensible suggestion of 2 way switching; e.g. on a corridor on stairs basement/cellar bedroom/kitchen light room with 2 doorways</p>	<p>allow clear description of 2 switches controlling the same light</p>	1															

Total 15 marks

Question number	Answer	Notes	Marks
3 (a) (i)	D refraction;		1
(ii)	any 2 of: MP1. waves <b>slow down</b> ; MP2. waves change direction/bend/angle; MP3. wavelength <b>decreases</b> ;	allow 'light' for waves  do not allow 'curved'  allow wavefronts closer together	2
(b) (i)	line at 90° to the surface at point of contact;	judge by eye label not required	1
(ii)	angle between normal and incident ray clearly indicated;	allow ecf from normal line drawn in (b)(i)  allow measured value in degrees	1

Total 5 marks

Question number	Answer	Notes	Marks
4 (a) (i)	C (ultra violet);		1
(ii)	A (longitudinal);		1
(iii)	C (internal structure of objects);		1
(b) (i)	<p>any sensible use further detail e.g.</p> <p>sterilising medical equipment; gamma kills bacteria;</p> <p>OR</p> <p>treating cancer/mutates cancer cells; radiotherapy/focused gamma rays;</p> <p>OR</p> <p>detecting cancer; PET scanner/(radioactive) tracers/gamma camera;</p>	<p>ignore CT scan, CAT scan, MRI scan</p> <p>allow kills cancer/cells</p> <p>allow scintillation counter</p>	2
(ii)	<p>any 2 of:</p> <p>MP1. any one sensible comment about risk for either; e.g. increased risk of cancer/mutation of cells damage to neighbouring/good/healthy cells</p> <p>MP2. a further detail of the risk; e.g. radiation is ionising gamma has high/highest energy</p> <p>MP3. statement about the relative risk/exposure of doctor or patient; e.g. patient is only exposed for a short period of time doctor has continual (low level) exposure</p>		2
(iii)	<p>any one sensible method; e.g.</p> <p>(use for a) limited time idea of working at a distance/in another room</p>	ignore protective clothing, lead shielding, lead apron etc.	1

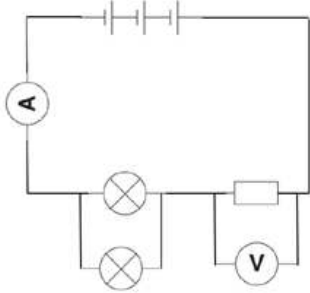
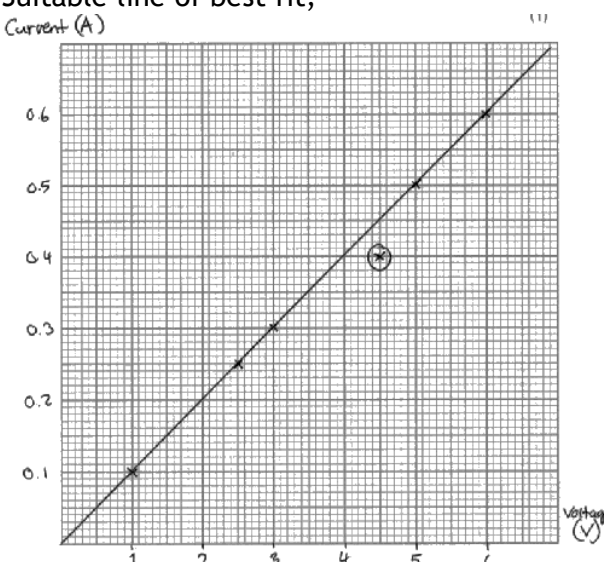
Total 8 marks



Question number	Answer	Notes	Marks														
5 (a) (i)	weight (of toy car);	allow mass	1														
	(ii) speed (of toy car);	allow: velocity time (to go down the slope)	1														
(b)	any 2 of:  MP1. angle/gradient/incline/steepness/height of slope;  MP2. same car/eq;  MP3. surface of slope;  MP4. force at launch;  MP5. initial speed;  MP6. starting height/position/point (of car);  MP7. distance travelled/length of slope;	ignore weather conditions	2														
(c)	<table border="1" style="margin-left: auto; margin-right: auto;"> <tbody> <tr><td>battery</td><td></td></tr> <tr><td>joulemeter</td><td></td></tr> <tr><td>micrometer</td><td></td></tr> <tr><td>newtonmeter</td><td>✓</td></tr> <tr><td>ruler</td><td>(✓)</td></tr> <tr><td>stopwatch</td><td>✓</td></tr> <tr><td>thermometer</td><td></td></tr> </tbody> </table> <p>one correct tick; two correct ticks;;</p>	battery		joulemeter		micrometer		newtonmeter	✓	ruler	(✓)	stopwatch	✓	thermometer		<p>allow clear alternative indications e.g. - crosses - shading</p> <p>if more than 2 ticks, -1 for each incorrect tick</p>	2
battery																	
joulemeter																	
micrometer																	
newtonmeter	✓																
ruler	(✓)																
stopwatch	✓																
thermometer																	

(d)	<p>any 5 of:</p> <p>MP1. measure weight/mass;</p> <p>MP2. measure distance (down slope)/start from same point;</p> <p>MP3. measure time/speed (with light gate);</p> <p>MP4. equation seen or described in words: speed = distance / time;</p> <p>MP5. idea that different weights used;</p> <p>MP6. repeat experiment AND average/remove anomalies;</p> <p>MP7. method to improve accuracy, e.g. use of light gates, reaction time considered;</p>	<p>Allow</p> <p>'find out' for measure</p>	5
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Total 11 marks

Question number	Answer	Notes	Marks														
6 (a)	<p>mark each of these independently:</p> <p>MP1. a resistor in series with the lamp only;</p> <p>MP2. a second lamp in parallel with the first lamp;</p> <p>MP3. a voltmeter that measures the voltage across the resistor;</p> <p>MP4. an ammeter that measures the total current in the circuit;</p>	<p>circuit symbols used must be correct (no square voltmeter/ammeter etc.)</p> 	4														
(b) (i)	<p>labels on axes including units;</p> <p>scales on axes;</p> <p>plotting;;</p>	<p>axes can be either way round</p> <p>must occupy &gt;50% in each direction</p> <p>-1 for each error</p>	4														
(ii)	I = 0.4, V = 4.5 clearly indicated;		1														
(iii)	<p>Suitable line of best fit;</p> 	<table border="1"> <thead> <tr> <th>Voltage in V</th> <th>Current in A</th> </tr> </thead> <tbody> <tr> <td>1.0</td> <td>0.10</td> </tr> <tr> <td>2.5</td> <td>0.25</td> </tr> <tr> <td>3.0</td> <td>0.30</td> </tr> <tr> <td>4.5</td> <td>0.40</td> </tr> <tr> <td>5.0</td> <td>0.50</td> </tr> <tr> <td>6.0</td> <td>0.60</td> </tr> </tbody> </table>	Voltage in V	Current in A	1.0	0.10	2.5	0.25	3.0	0.30	4.5	0.40	5.0	0.50	6.0	0.60	1
Voltage in V	Current in A																
1.0	0.10																
2.5	0.25																
3.0	0.30																
4.5	0.40																
5.0	0.50																
6.0	0.60																
(iv)	voltage = current x resistance;	in words or standard symbols	1														
(v)	<p>substitution into correct equation using any suitable pair of values taken from the graph line or table;</p> <p>evaluation of R = 10 (<math>\Omega</math>);</p>	allow (0.1,1), (0.6,6) etc	2														

Total 13 marks

Question number	Answer	Notes	Marks
7 (a) (i)	force = mass x acceleration;	in words or in accepted symbols e.g. $F=ma$	1
(ii)	substitution; evaluation;  e.g. $38 \times 1.5$ 57 (N)	57000 (N) scores 1 mark	2
(iii)	any suitable suggestion; e.g. friction between snow/ground and sledge ground is not level towing rope/direction at an angle to the ground/direction of movement	allow  air resistance/drag	1
(b) (i)	acceleration = <u>change in velocity</u> ; time (taken)	in words or in accepted symbols e.g. $a = \frac{\Delta v}{t}$ $a = \frac{v-u}{t}$ not 's' for 'v'	1
(ii)	<i>working must be shown</i> rearrangement of equation OR substitution; evaluation to at least 2SF;  e.g. $t = \frac{2.8}{1.5}$ = 1.9 (s)	Calculation of velocity or acceleration scores 1 mark max.  allow 1.87 no unit required	2

(c) (i)	<p>MP1. statement of total distance = area under graph;</p> <p>MP2. any 1 correct distance for a segment of journey;  e.g.  calculation of distance during acceleration  (<math>\frac{1}{2} \times 3.25 \times 2.5 = 4.1</math> m)  calculation of distance during constant speed  (<math>3.25 \times 8 = 26</math> m)  calculation of distance during deceleration  (<math>\frac{1}{2} \times 3.25 \times 4 = 6.5</math> m)</p> <p>MP3. correct total distance 36.6 (m);</p>	<p>may be assumed by an attempt at sum of the areas</p> <p>allow range of 36-37 (m)</p>	3
(ii)	<p>(average) speed = <math>\frac{\text{distance (moved)}}{\text{time (taken)}}</math> ;</p>	<p>in words or in accepted symbols  e.g.  <math>v=s/t</math>  condone <math>s=d/t</math></p>	1
(iii)	<p>substitution;  evaluation;</p> <p>e.g.  <math>36.6/14.5</math>  <math>2.52</math> (m/s)</p>	<p>allow ecf from (c)(i) for distance</p> <p>ignore s.f.  allow answers that round to 2.5 or 2.6 (m/s)</p>	2

Total 13 marks

Question number	Answer	Notes	Marks
8 (a) (i)	-273 (°C)		1
(ii)	any 3 of: MP1. idea of (continuous) <b>random</b> motion; MP2. collide/impacts/eq; MP3. with walls (of container); MP4. idea that force is produced (by bombarding molecules); MP5. idea of pressure as force on an area;	bombard, hit, impact upon  allow Newton's 2 <sup>nd</sup> Law momentum argument  $p = F/A$	3
(b) (i)	pressure = density x g x height;	in words or accepted symbols e.g. $p = \rho gh$  not 'gravity' for g	1
(ii)	use of correct pressure; substitution; rearrangement; evaluation;  e.g. $104 - 100 = 4 \text{ kPa}$ $4000 = 1000 \times 10 \times h$ $h = 4000 / (1000 \times 10)$ 0.4 (m)	sub and rearrange in either order  deduct 1 mark for each of the following: <ul style="list-style-type: none"> <li>conversion error from kPa to Pa</li> <li>use of wrong pressure</li> </ul> e.g. use of 104 or 100 kPa and not changing to Pa gets 2 marks max	4

Total 9 marks

Question number	Answer	Notes	Marks
9 (a) (i)	MP1. minimum of 3 straight lines evenly spaced (by eye);  MP2. at least one arrow showing direction from N to S;	ignore field outside the rectangle defined by the magnets	2
(b) (i)	any sensible suggestion;  e.g. otherwise large heat loss/overheating thin wire would melt to reduce the resistance so it does not sag/bend/eq		1
(ii)	any 3 of:  MP1. magnetic field of wire/current; MP2. interacts with; MP3. magnetic field of (2) magnets; MP4. Fleming's left hand rule;	For MP1 and MP3 must refer to what is causing the magnetic field	3
(iii)	MP1. reduce current;  MP2. use less powerful magnets/greater separation of magnets;	ACCEPT Use thinner wire, switch off, reduce voltage  not 'smaller' magnets  allow rotate the wire so that the angle with the magnetic field is smaller	2

Total 8 marks

Question number	Answer	Notes	Marks
10 (a)	Venus;		1
(b)	because it has the largest mass;	ignore references to diameter/size	1
(c) (i)	density = $\frac{\text{mass}}{\text{volume}}$ ;	in words or accepted symbols e.g. $\rho = m/V$  condone D for density	1
(ii)	changing diameter to radius; substitution; evaluation;  e.g. $\rho = \frac{100 \times 10^{24}}{[4/3 \times 3.14 \times 25000^3]}$  $1.5 \times 10^{12} \text{ (kg/km}^3\text{)}$	if diameter used instead of radius (gives $1.9 \times 10^{11}$ ) max 2  -1 for POT error  allow answers rounding down to $1.5 \times 10^{12} \text{ (kg/km}^3\text{)}$	3
(d)	change of time into seconds (seen anywhere); use of orbital radius as $150 \times 10^6 \text{ km}$ ; evaluation; e.g.  $v = \frac{2 \times 3.14 \times (150 \times 10^6)}{365 \times 24 \times 60 \times 60}$  $29.9 \text{ (km/s)}$	no mark for eqn as this is given      allow 30 (km/s)	3
(e)	an evaluation to include 3 of:  MP1. identifying period as time of orbit;  MP2. correct <b>detail</b> of why statement is right/wrong;  MP3. correct use of data comparing 2 planets;  MP4. period depends on distance from the Sun;	can refer to either mass or diameter of planet for 'size'  must name planets  must name planets	3

Total 12 marks



Question number	Answer	Notes	Marks
11	<p>any six points from the following 2 groups:</p> <p><b><u>Relating to energy and position</u></b>  MP1 statement re KE values e.g. KE is zero at top and bottom OR KE is greatest/4J in the middle;</p> <p>MP2 statement re GPE values e.g. GPE is greatest/25J at the top OR GPE is least/5J at the bottom;</p> <p>MP3 statement re EPE values e.g. EPE is greatest/21J at the bottom OR EPE is least/1J at the top;</p> <p>MP4 the change in GPE/EPE is 20J OR the change in KE is 4J;</p> <p>MP5 change in GPE/EPE &gt; change in KE;</p> <p>MP6 total energy is constant (in all three charts)/eq;</p> <p><b><u>Relating to speed and position</u></b>  MP7 in the middle speed is greatest;</p> <p>MP8 in the middle <math>v = 2.8</math> (m/s);</p> <p>MP9 ball is stationary at the top/bottom;</p>	<p>allow GPE decreases as the ball moves down</p> <p>allow EPE increases as the ball moves down</p> <p>allow ball moves through height of 2 metres</p>	6

Total 6 marks

Question number	Answer	Notes	Marks																								
12 (a) (i)	<table border="1" data-bbox="320 297 959 958"> <thead> <tr> <th data-bbox="320 297 635 376">safety precaution</th> <th data-bbox="635 297 810 376">needed</th> <th data-bbox="810 297 959 376">not needed</th> </tr> </thead> <tbody> <tr> <td data-bbox="320 376 635 465">not touch the source with bare hands</td> <td data-bbox="635 376 810 465">(✓)</td> <td data-bbox="810 376 959 465"></td> </tr> <tr> <td data-bbox="320 465 635 544">use tongs</td> <td data-bbox="635 465 810 544">✓</td> <td data-bbox="810 465 959 544"></td> </tr> <tr> <td data-bbox="320 544 635 622">wear gloves</td> <td data-bbox="635 544 810 622"></td> <td data-bbox="810 544 959 622">(✓)</td> </tr> <tr> <td data-bbox="320 622 635 701">wear goggles</td> <td data-bbox="635 622 810 701"></td> <td data-bbox="810 622 959 701">✓</td> </tr> <tr> <td data-bbox="320 701 635 790">students sit at least two metres away</td> <td data-bbox="635 701 810 790">✓</td> <td data-bbox="810 701 959 790"></td> </tr> <tr> <td data-bbox="320 790 635 869">wear a lead apron</td> <td data-bbox="635 790 810 869"></td> <td data-bbox="810 790 959 869">✓</td> </tr> <tr> <td data-bbox="320 869 635 958">store source in a lead box</td> <td data-bbox="635 869 810 958">✓</td> <td data-bbox="810 869 959 958"></td> </tr> </tbody> </table> <p data-bbox="320 992 691 1093">3 ticks correct in first column; 2 ticks correct in second column;</p>	safety precaution	needed	not needed	not touch the source with bare hands	(✓)		use tongs	✓		wear gloves		(✓)	wear goggles		✓	students sit at least two metres away	✓		wear a lead apron		✓	store source in a lead box	✓		<p data-bbox="978 947 1297 1093">Ignore incorrect ticks in first column (award 1 mark as long as the three correct boxes are ticked)</p>	2
safety precaution	needed	not needed																									
not touch the source with bare hands	(✓)																										
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wear a lead apron		✓																									
store source in a lead box	✓																										
(b) (i)	(because distance is a) controlled variable;	<p data-bbox="978 1160 1281 1227">allow idea of fair test/affecting results</p> <p data-bbox="978 1261 1265 1361">ignore comments relating to accuracy, reliability</p>	1																								
(ii)	<p data-bbox="304 1429 810 1462">MP1. idea of background radiation;</p> <p data-bbox="304 1529 746 1731">MP2. any ONE sensible source; e.g. cosmic rays rocks/Earth/buildings some foodstuffs (coffee) radon</p>	<p data-bbox="978 1429 1297 1597">allow 'sources of radiation all around us' allow nuclear weapons testing/disasters</p>	2																								

(iii)	<p>MP1. lead;</p> <p>MP2. idea of best absorber giving lowest count rate;</p> <p>MP3. for Ba-133/can't evaluate using Sr-90 data;</p>	<p>dependent on MP1</p> <p>dependent on MP1</p>	3
(iv)	<p>any 3 of:</p> <p>MP1. stone absorbs better than {plastic / wood / paper} for Sr-90/beta;</p> <p>MP2. stone worst absorber for Ba-133/gamma;</p> <p>MP3. use of data to justify MP1 or MP2;</p> <p>MP4. may not be worse absorber than paper as paper much thinner/not tested for Ba-133;</p>	<p>no mark for 'I agree with this conclusion /OWTTE'</p> <p>allow stone best absorber for Sr-90</p> <p>e.g. the count rate for plastic is about half that of stone for Ba-133</p>	3
(v)	<p>MP1. beta;</p> <p>MP2. it's not alpha <i>because</i> {alpha would not reach the detector at this distance/ alpha would not go through paper};</p> <p>MP3. it's not gamma <i>because</i> gamma is not stopped by metals ;</p>	<p>allow 'beta and gamma'</p> <p>allow 'it goes through paper'</p> <p>allow 'it doesn't go through metals'</p> <p>MP2 and MP3 dependent on MP1</p>	3
(vi)	reading would be too high/eq;		1
(vii)	idea that count rate needs to be constant during the investigation/ORAs;	<p>allow either</p> <p>idea that would not need to replace the source often/ORAs;</p> <p>or</p> <p>idea that shorter half-life has higher activity and therefore is more hazardous;</p>	1

Total 16 marks

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