

# Mark Scheme (Results)

Summer 2013

International GCSE  
Physics (4PH0) Paper 1P  
Science Double Award (4SC0)  
Paper 1P

Edexcel Level 1/Level 2 Certificate  
Physics (KPH0) Paper 1P  
Science (Double Award) (KSC0)  
Paper 1P

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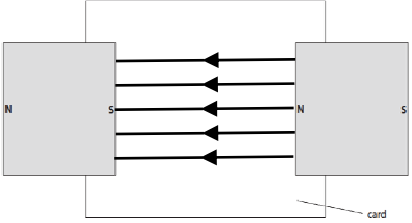
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Question number	Answer	Notes	Marks
1 (a)	(i) B - 1 joule per second (1 J/s)		1
	(ii) C - 1 newton per square metre (1 N/m <sup>2</sup> )		1
(b)	(i) A - the direction of a magnetic field		1
	(ii) A - has uniform strength		1
		Total	4

Question number	Answer	Notes	Marks						
2 (a)	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">longest wavelength</td> <td style="text-align: center;">→</td> <td style="text-align: center;">shortest wavelength</td> </tr> <tr> <td style="text-align: center;">infrared</td> <td style="text-align: center;">visible (light)</td> <td style="text-align: center;">ultraviolet</td> </tr> </table>	longest wavelength	→	shortest wavelength	infrared	visible (light)	ultraviolet	<p>All three must be correct for the mark</p> <p>Allow IR for infrared Allow visible (without light) Allow UV for ultraviolet</p>	1
longest wavelength	→	shortest wavelength							
infrared	visible (light)	ultraviolet							
(b)	<p>Any two of:</p> <p>Radio (waves); Microwave(s); x-rays; Gamma (rays);</p>	<p>Allow T-rays</p> <p><math>\gamma</math> - rays or <math>\gamma</math></p>	2						
(c) (i)	<p>Any two of</p> <ol style="list-style-type: none"> <li>1. killing bacteria e.g. in water purification OR in hand driers in toilets OR sterilisation of equipment;</li> <li>2. medical uses e.g. setting dental fillings OR detection of bacteria OR treatment of (named) skin diseases;</li> <li>3. security markings e.g. for checking banknotes;</li> <li>4. fluorescent lamp e.g. tanning machines, black-light, detecting blood /other body fluids;</li> <li>5. data reading e.g. blu-ray devices</li> </ol>	<p>Must be specific, ignore vague answers such as 'used in a hospital', 'for CSI'</p> <p>Allow other sensible suggestions for each MP</p>	2						

Question number	Answer	Notes	Marks
2 (ii)	Any two of  1. cell damage e.g. (skin) cancer, cell mutation; 2. Sunburn/skin aging; 3. eye damage e.g. cataracts, blindness;	Must be specific, do not allow vague answers such as 'causes burns' 'danger to skin' 'burns skin'	2
		Total	7

Question number	Answer	Notes	Marks
3 (a) (i)	<p>1. at least one arrow showing direction from N to S (right to left);</p> <p>2. one horizontal line between shaded faces;</p> <p>3. minimum of 3 horizontal lines evenly spaced (by eye);</p> <p>e.g.</p>  <p>(ii)</p> <p>1. a method to show shape; e.g. use compass(es) Use of iron filings/ powder</p> <p>2. Use of (plotting) compass to show direction;</p> <p>3. a further method detail; e.g. mark card /move compass/multiple compasses idea of another line or lines added sprinkle (iron filings evenly on card) tap card (to distribute iron filings)</p>	<p>Reject contradictory arrows</p> <p>For MP2,3 ignore any lines outside the rectangle between the shaded faces</p> <p>allow field lines that almost touch the faces</p> <p>Ignore Position of card /Cling film Ignore pour/place/ drop /spill</p>	<p>3</p> <p>3</p>

Question number	Answer	Notes	Marks
(b)	any two of 1. (Fleming's) Left Hand (Motor) rule OR (current generates) magnetic field around the rod; 2. Idea that there is a force (on rod); 3. (translational) movement of rod; 4. Correct direction given, i.e. out of the paper;	allow LHM rule/LH rule/motor rule/ motor effect  Ignore upwards rod is magnetic	2
		Total	8

Question number	Answer	Notes	Marks
4 (a)	Student is right / wrong = no mark Any two of  1. Balance might not be levelled; 2. zero error; 3. mass could be worn; 4. mass could be mislabelled; 5. value could be within acceptable accuracy of the mass (e.g. $\pm 2\text{g}$ ); 6. battery of scales is running down/eq;	Ignore idea of anomaly accept  tare, reset error rusty inaccurate marking it rounds to 500 g	2
(b)	Any two of  MP1 - Measure/find volume; MP2 - Using a displacement method; MP3 - A sensible experimental precaution e.g. tied to thread OR awareness of meniscus OR repeat readings OR average;  <i>PLUS</i>  Any one of MP4 - Formula to use (density = mass $\div$ volume); MP5 - A correct density unit mentioned (e.g. $\text{kg/m}^3$ );	For MP2 Ignore calculation of volume geometry	3
		Total	5



Question number	Answer	Notes	Marks
5	Any 5 of 1. determine / measure distance; 2. determine / measure time; 3. Appropriate measuring instrument for distance OR time; 4. Use a suitable distance /count laps (of known length); 5. repeat experiment/calculate average; 6. Speed = distance / time OR finding the gradient ; 7. Suitable experimental precaution, e.g. reaction time considered, consistent height on track, time from a predetermined consistent point;	Allow idea of published track length use of split times  e.g. 1 lap or circuit  Ignore 'human error'	5
		Total	5



Question number	Answer	Notes	Marks
6 (c) (i)	<p>Working;; e.g.</p> $300\,000 = \frac{170\,000\,000}{t}$ <p>1 working mark (sub ONLY)</p> $t = \frac{170\,000\,000}{300\,000}$ <p>AND rearrange)</p> <p>Calculation; e.g.</p> $= 570 (566.7) (s)$ <p>1 mark (ans to &gt; 1 SF)</p>	<p>'show that' question, working must be shown for full marks</p> <p>REVERSE CALCS: maximum mark =2 (correct calc plus a comparison statement e.g. <math>283\,333 \equiv 300\,000</math> <math>180\,000\,000 \equiv 170\,000\,000</math>)</p> <p>Allow (without the subject of the equation) for 2 marks, <u>170 000 000</u> 300 000</p>	3

Question number	Answer	Notes	Marks
6 (c) (ii)	Any two of 1. IDEA of HOW THE LOW SPEED AFFECTS DRIVING; low speed reduces stopping distance low speed helps to avoid obstacle  2. IDEA of THE EFFECT OF LOW SPEED ON COLLISION; momentum /low speed / low (kinetic) energy reduces damage if in collision  3. IDEA of WHAT THE TIME DELAY DOES; time delay affecting reaction time / stopping distance / steering  4. IDEA of WHAT THE TIME (DELAY) IS; it takes a long time to get the signal (the communication delay is) $\approx 1200$ (s) (we see images which are) 600s delayed light and radio waves travel at the same speed in a vacuum	Allow idea that rover could travel up to 48 m between commands RA           ignore better photos/detail of the planet /eq	2
		Total	10



Question number	Answer	Notes	Marks
7 (c)	<p>Any five of <i>ABOUT A</i></p> <ol style="list-style-type: none"> <li>1. Resistance of A decreases with temperature;</li> <li>2. For A, {largest slope / rate of change} is at lower temperature ORA {smallest slope /rate of change} is at higher temperature;</li> <li>3. A is a thermistor (ntc);</li> </ol> <p><i>ABOUT B</i></p> <ol style="list-style-type: none"> <li>4. Resistance of B increases with temperature;</li> <li>5. For B, {largest slope / rate of change} is at higher temperature(s) ORA {smallest slope /rate of change} is at lower temperature;</li> <li>6. For B, resistance is constant below 50 °C;</li> </ol> <p><i>ABOUT BOTH</i></p> <ol style="list-style-type: none"> <li>7. More results for B/ fewer results for A;</li> <li>8. stated both relationships are non-linear;</li> <li>9. Range of (temperature/resistance) values for both is similar;</li> <li>10.data comparison e.g. both have the same resistance at 80 °C;</li> </ol>	<p>Accept</p> <ul style="list-style-type: none"> <li>• (MP1) for A, when the temperature is low, the resistance is high, ORA</li> <li>• (MP4) for B, when the temperature is low, the resistance is low, ORA</li> </ul> <p>Allow component B is a ptc thermistor ORA</p> <p>Up to 60 °C</p> <p>Ignore: inversely proportional positive/negative correlation</p> <p>Do not take implication of MP8 when MP 1,2,4,5 is given</p>	5
		Total	10

Question number	Answer	Notes	Marks
8 (a) (i)	work done = force x distance moved ;	Accept $W = F \times d$ Allow rearrangements do not accept eqn in units only	1
(ii)	Substitution into correct equation; Calculation; 170 x 110 19 000 (J)		2
(iii)	exactly same as their answer to (ii);	Accept 18 700 (J)	1

Question number	Answer	Notes	Marks
8 (b) (i)	$KE = \frac{1}{2}mv^2$	Accept word equation	1
(ii)	addition of masses before OR addition of energies after; Substitution into correct equation; Calculation;  $1650 + 950 = 2600$ (OR $436\,425 + 251\,275 = 687\,700$ ) $\frac{1}{2} \times 2600 \times 23^2$ 688 000	Accept for 1 mark - either 436 000 or 251 000  accept for 2 marks - both 436 000 and 251 000 Accept for 3 marks- 687 700	3
(c)	Any three of  1. idea that mass and acceleration are inversely related;  2. Idea that (total) mass is less;  3. Idea of less (air) resistance / friction;  4. Idea of less work done/less energy used;  5. Idea of amount work related to amount of (chemical) energy from fuel;	allow  F = m x a mentioned  weight for mass  drag  doesn't have to use energy to pull the caravan	3
		Total	11



Question number	Answer	Notes	Marks
9 (a)	Any two of 1. ruler has a mm scale ; 2. idea of inappropriate precision; 3. paper is (very) thin;	ignore vague statements e.g. the ruler is too big allow  scale is too big paper is thinner than 1 mm	2
(b) (i)	C 0.1 mm		1
(ii)	Any two of 1. parallax error; 2. gap left between ruler and paper; 3. ruler not perpendicular; 4. zero error;	allow • misreading or inaccurate reading of the ruler • damaged ruler • top sheet not flat ignore air gaps between sheets folded paper miscounting sheets different sizes of paper incorrect recording of measurements need for more precise instrument human error	2

Question number	Answer	Notes	Marks
(c) (i)	<p>An explanation including any 2 of</p> <p>1. acceleration needs an unbalanced force;</p> <p>2. (constant velocity means) the aeroplane is not accelerating;</p> <p>3. idea of absence of unbalanced/overall force;</p>	<p>ignore idea that the forces are acting at different points on the plane</p> <p>allow Newton I or Newton II unbalanced forces cause acceleration /deceleration / change of <i>velocity</i></p> <p>flying straight or not changing speed /direction</p> <p>'no resultant force' statement that there is a suitable pair of named balanced forces</p>	2
(ii)	<p>weight arrow vertically down; lift arrow upwards; drag arrow to the left;</p>	<p>allow labelled arrows anywhere on the diagram</p> <p>vertical to 45deg to the right inside the angle of the plane wings</p>	3
(iii)	<p>lost as (/dissipated to) heat, sound etc</p>	<p>allow lost to the surroundings/air absorbed by surroundings/air ignore kinetic energy 'other types of energy'</p>	1
		Total	11

Question number	Answer	Notes	Marks
10 (a)	(i) 42 (m/s)	Allow range 42 - 43	1
	(ii) Attempt to calculate slope; Answer; Unit;  42 ÷ 15  2.8  m/s <sup>2</sup>	Allow value from (i) e.g. 43 m/s → 2.9 m/s <sup>2</sup> 42.5 → 2.83 m/s <sup>2</sup> 45 → 3 m/s <sup>2</sup>  not 42/120 allow 42/20	3
	(iii) Attempt to calculate an area under graph line; Appropriate further working (e.g. adding areas); Answer;  (½ x 15 x 42) + (80 x 42) + (½ x 25 x 42)  315 + 3360 + 525  4200 (m)	Allow value from (i) e.g. 43 m/s → 4300 m  first 2 MP may be gained using the trapezium method, i.e. 42 x (120+80)/2  Bald correct answer scores 3	3

Question number	Answer	Notes	Marks
(b)	Any three from  1. Stopping distance affected by speed or mass;  2. For faster plane, stopping distance greater/ runway too short ;  3. for heavier plane stopping distance greater/ runway too short;  4. Attempt to calculate stopping distance from graph;  5. Data shows most/all of runway already used;	ignore time = $500/40$  Allow a momentum argument for MP1, 2, 3	3
		Total	10

Question number	Answer	Notes	Marks
11 (a)	Idea of (correct) change of speed OR wavelength; (Refractive) index / (optical) density of glass > that of air (ORA);	Allow for 1 mark speed slower in glass OR wavelength shorter in glass (ORA)  allow RI, n for refractive index	2
(b) (i)	$\sin c = 1/n$ ;	Allow rearrangements ( $n = 1/\sin c$ ) in words (incl critical angle)	1

Question number	Answer	Notes	Marks
11	<p>(ii) <math>(n=) 1/\sin 43</math> OR <math>\sin 43^\circ = 0.682</math> ; <math>n = 1.47 (\approx 1.5)</math> ;</p> <p>(iii) Any three of</p> <ol style="list-style-type: none"> <li>1. larger RI means smaller <math>c</math> ;</li> <li>2. TIR when <math>i &gt; c</math>;</li> <li>3. for diamond larger range of angles for TIR ;</li> <li>4. Some appropriate calculation, e.g. for diamond <math>c = 25^\circ</math>;</li> <li>5. <math>43^\circ</math> to <math>90^\circ</math> for TIR in opal;</li> </ol>	<p>(0.68199836) (1.466279) Refractive index must be shown to <math>&gt; 2</math> sig fig Allow truncated values Reverse calculation can score 1 mark Reverse calculation with comparison can score both marks Bald answer can score 1 mark</p> <p>allow</p> <p><math>c</math> is smaller in diamond</p> <p>TIR happens at angles smaller than in opal/<math>43^\circ</math> (<math>1/2.4 = 0.417 \rightarrow c=24.6^\circ</math>)</p> <p>Accept for 2 marks <math>25^\circ</math> to <math>90^\circ</math> for TIR in diamond; (MP2,4)</p> <p>Ignore more of the rays going TIR (repeat of stem) diamond has a higher RI than opal</p>	<p>1</p> <p>2</p> <p>3</p>
		Total	8

Question number	Answer			Notes	Marks
12 (a) (i)	Isotope	Proton number	Neutron number		2
	Uranium-234	92	142		
	Uranium-235	92	143		
	Uranium-238	92	146		
	92 as shown; 146 as show;			Reject for the relevant mark 'half the time' particles molecules 'break down' 'reactivity' nucleus halve in mass to completely/fully decay	2
	(ii) Time taken;  and either of • For half of (radioactive) nuclei / atoms /isotope to decay; For (radio)activity to halve;				
	(iii) any one from:  • Other isotopes have decayed more quickly; • It has the longest half-life;			Allow • reverse arguments • comparative e.g. longer rather than longest  Ignore • number of neutrons purity /concentration	

Question number	Answer	Notes	Marks
12 (b)	any three from 1. Neutrons; 2. (product) nuclei/a named nucleus; 3. Appropriate qualification of either term above(DOP); 4. gamma (radiation)/thermal energy  e.g. of MP3 neutrons - 2, 3, fast, high energy nuclei – daughter, lighter, e.g. for MP2 allowed nuclei include : krypton, barium, xenon,	Allow two correct named nuclei as MP2 & MP3  Ignore extra as a qualifier for neutrons helium alpha beta atoms daughter atoms/cells	3
(c) (i)	Any one of to slow down neutrons/eq; to increase rate of fission; to increase absorption of neutrons by uranium/fuel;	allow reduce the (kinetic) energy of neutrons	1
(ii)	Any two of 1. rate of reaction increases; 2. fewer neutrons absorbed by control rod OR more neutrons collide with uranium; 3. temperature <u>increases</u> ;	allow rate of fission increases control rods absorb neutrons  <u>more</u> heat released (need for comparative) ignore risk of explosion	2

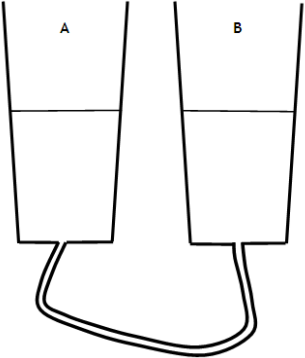


Question number	Answer	Notes	Marks
<p>12</p> <p>(d)</p>	<p>Any five of the following ideas</p> <p><i>facts about radioactivity</i></p> <ol style="list-style-type: none"> <li>1. idea of harmful nature of radiation / danger to life;</li> <li>2. high (activity) levels;</li> <li>3. long half-life / half-lives;</li> </ol> <p><i>consequences</i></p> <ol style="list-style-type: none"> <li>4. difficulties for (emergency) workers to access the area, e.g. short safe working times / need for protective clothing;</li> <li>5. (requirement for) special handling equipment OR difficulty in removing material;</li> <li>6. idea of extensive time OR distance (exclusion/hazardous) zone;</li> </ol> <p><i>environmental effects local and distant</i></p> <ol style="list-style-type: none"> <li>7. idea of radioactive material mixing with the local environment e.g. soil, plants, water, air;</li> </ol> <p>idea of further /more distant spreading of material e.g. by fire, wind, water;</p>	<p>Ignore repeat of the stem, i.e. radioactive material has been spread into the surrounding area can't be seen</p> <p>allow MP1 toxic, can kill, causes mutation, ionises cells</p> <p>MP5 a lot of (contaminated) material to deal with</p> <p>MP6 still radioactive after a long time takes a long time to go away</p>	<p>5</p>
		<p>Total</p>	<p>16</p>

Question number	Answer	Notes	Marks												
13 (a) (i)	A – distance A		1												
(ii)	D – force D		1												
(b) (i)	Force (C) in N; or Force in newtons;	Allow: Reading from newton-meter in N	1												
(ii)	Plotting ;; Line of best fit; <table border="1" data-bbox="1093 595 1283 837"> <tbody> <tr> <td>0</td> <td>5.1</td> </tr> <tr> <td>20</td> <td>4.0</td> </tr> <tr> <td>40</td> <td>2.9</td> </tr> <tr> <td>60</td> <td>2.0</td> </tr> <tr> <td>80</td> <td>1.1</td> </tr> <tr> <td>100</td> <td>0.2</td> </tr> </tbody> </table>	0	5.1	20	4.0	40	2.9	60	2.0	80	1.1	100	0.2	To nearest ½ square, penalise errors up to two marks Suited to candidate's plotting (allow a smooth curve) no double lines judge LoBF by balance of points about the line	3
0	5.1														
20	4.0														
40	2.9														
60	2.0														
80	1.1														
100	0.2														
(iii)	Reading from graph to ± 1 cm;  e.g. 46	To nearest ½ small square	1												

Question number	Answer	Notes	Marks
13 (c)	weight of ruler;	Accept other valid reasons allow force for weight ignore 'it's got a force acting' 'because of gravity'	1
		Total	8

Question number	Answer	Notes	Marks
14 (a) (i)	pressure difference = height x density x g	Accept $P = h\rho g$ $P = h d g$	1
(ii)	Substitution into correct equation; Calculation;  $0.91 \times 1000 \times 10$ 9100 Pa	correct answer with no working scores 2 marks  Accept: <ul style="list-style-type: none"><li>• 9.1 kPa</li><li>• 8918 Pa (from <math>g = 9.8 \text{ m/s}^2</math>)</li><li>• 8927 Pa (from <math>g = 9.81 \text{ m/s}^2</math>)</li><li>• h in cm / 910 000 Pa for a max of 1</li></ul>	2

Question number	Answer	Notes	Marks
14 (b) (i)	 <p>the water level is the same on both sides</p>	allow some wobbles on the B side area shaded	1
	(ii)		3
	<p>Any three of the following ideas</p> <ol style="list-style-type: none"> <li>1. pressure difference (relating to flow);</li> <li>2. pressure equality (relating to flow ending);</li> <li>3. reference to relevant pressure equation ; e.g. pressure causes force on water, pressure = force / area pressure = <math>h\rho g</math>;</li> <li>4. (more) gravitational potential energy (in A) /ORA; (fluid) <u>pressure</u> acts in all directions;</li> </ol>	<p>Allow force or weight instead of pressure for either MP1 OR MP2 but not both</p> <p>MP3 allow 'pressure pushes water' 'height difference pushes water'</p>	
		Total	7
		Total for paper	120



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