

Mark Scheme (Results)

Summer 2013

International GCSE
Physics (4PH0) Paper 1PR

Science Double Award (4SC0)
Paper 1PR

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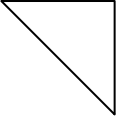
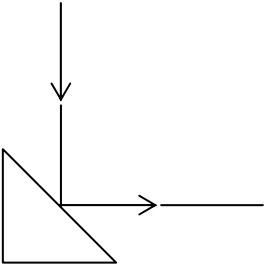
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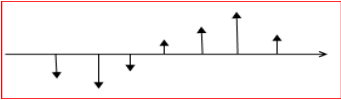

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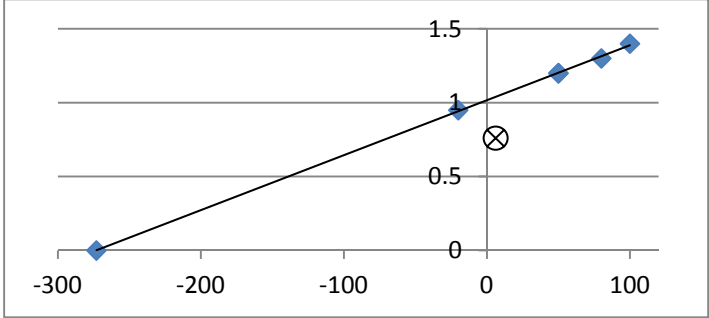
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Question number	Answer	Notes	Marks
1 (a)	total internal reflection	Accept TIR	1
1 (b) (i)	prism drawn in correct orientation (by eye)  correct reflection of rays (by eye):	Accept a freehand sketch of the triangular prism Size of prism unimportant, e.g. can fill the entire square, but horizontal and vertical edges must be drawn	1 1
(ii)		Accept freehand sketch Accept correct external reflection e.g. reflection as shown below gets 1 mark for 1(b)(ii) despite the error in the 1(b)(i) response 	
		Total	3

Question number	Answer	Notes	Marks
2 (a) (i)	B- 2 cm		1
	(ii) C- 8 cm		1
(b)	<p>Idea that in a transverse wave the direction of vibration is perpendicular to the direction of the wave; (May be shown with labels on the diagram) Idea that longitudinal wave the direction of vibration is parallel to the direction of the wave; (May be shown with labels on the diagram) A named freehand sketch of either wave indicating the two directions; e.g.</p> <div data-bbox="427 895 766 994" style="border: 1px solid red; padding: 5px; margin-bottom: 5px;">  </div> <p>transverse</p> <div data-bbox="427 1038 866 1153" style="border: 1px solid red; padding: 5px; margin-bottom: 5px;">  </div> <p>Longitudinal</p>	<p>Allow (for vibration) oscillation / displacement / disturbance (for direction of wave) direction of travel / energy / transfer (for perpendicular) at right angles, is \perp to (for parallel) the same as, //</p> <p>the minimum labeling is to name of the type of wave they have drawn.</p> <p>Allow sine waves with appropriate arrows</p> <p>Allow diagrams indicating compression and rarefaction e.g. in a spring</p> <p>Allow for 1 mark (but only if other mark is scored) a comparison of the directions of vibration of both waves without relating them to the direction of the wave</p> <p>e.g. transverse vibrates up and down but longitudinal vibrates back and forward</p>	3

Question number	Answer	Notes	Marks
(c)	any two of MP2 speed (in a vacuum) OR speed = 3×10^8 (m/s); MP3 obeys laws of reflection / refraction; MP4 obeys wave equation OR speed = frequency \times wavelength; MP5 carries energy/ information; MP6 they are transverse	MP1 can travel through vacuum OR needs no medium; "speed in a vacuum" where seen, scores 2 marks (MP1 and MP2) Accept reflect, refract, diffract	2
(d) (i)	D - X-rays		1
(ii)	A – absorbed by the bone		2
(iii)	X-rays OR gamma rays idea of causing damage to cancer cells e.g. cells killed/mutated/ionised/destroys;	allow symbol γ do not allow UV Independent mark	
		Total	11

Question number	Answer	Notes	Marks									
3 (a)	<table border="1" data-bbox="483 233 1057 512"> <tr> <td data-bbox="483 233 701 379">temperature</td> <td data-bbox="701 233 882 379">boiling point of nitrogen</td> <td data-bbox="882 233 1057 379">boiling point of water</td> </tr> <tr> <td data-bbox="483 379 701 445">in °C</td> <td data-bbox="701 379 882 445">-196</td> <td data-bbox="882 379 1057 445"></td> </tr> <tr> <td data-bbox="483 445 701 512">in Kelvin</td> <td data-bbox="701 445 882 512"></td> <td data-bbox="882 445 1057 512">373</td> </tr> </table> <p data-bbox="383 619 792 651">one mark for each correct;;</p>	temperature	boiling point of nitrogen	boiling point of water	in °C	-196		in Kelvin		373	ignore -273	2
temperature	boiling point of nitrogen	boiling point of water										
in °C	-196											
in Kelvin		373										

Question number	Answer	Notes	Marks												
3 (b) (i)	<p>Plotting to nearest half-square (minus one for each plotting error, up to max 2 marks) ;;</p> <p>(ii) line of best fit that intersects x-axis between -250 and -300;</p> <p>point (0, 0.85) circled or otherwise indicated;</p> 	<table border="1" data-bbox="1205 351 1610 719"> <thead> <tr> <th>Temperature in °C</th> <th>Volume in litres</th> </tr> </thead> <tbody> <tr> <td>-20</td> <td>0.95</td> </tr> <tr> <td>0</td> <td>0.85</td> </tr> <tr> <td>50</td> <td>1.20</td> </tr> <tr> <td>80</td> <td>1.30</td> </tr> <tr> <td>100</td> <td>1.40</td> </tr> </tbody> </table>	Temperature in °C	Volume in litres	-20	0.95	0	0.85	50	1.20	80	1.30	100	1.40	3
Temperature in °C	Volume in litres														
-20	0.95														
0	0.85														
50	1.20														
80	1.30														
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(b) (iii)	Reading from graph to nearest small square (± 5 degrees);		1												
Total			7												

Question number	Answer	Notes	Marks
4 (a)	any three of MP1 idea that there is current (in the wire/coil); MP2 idea that (the coil has) a magnetic field ; MP3 idea that coil's magnetic field interacts with field of permanent magnet; MP4 idea that there is a force on the coil/wire; MP5 Idea that current or force reverses every half turn;	Allow ideas of electromagnetic field, electromagnet Allow - 'magnetic fields touch / overlap' Ignore - 'cutting of magnetic fields' Allow ideas of LHM rule, Fleming's LHR, catapult field, attraction, repulsion Allow action of a commutator described	3

Question number	Answer	Notes	Marks
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4	(b)	(i)	<p>any two of</p> <p>MP1 increase magnetic field(e.g. stronger magnets or magnets closer or magnets curved round coil);</p> <p>MP2 increase current OR voltage Or more cells;</p> <p>MP3 increase number of turns (on coil);</p> <p>MP4 a sensible alternative suggestion e.g. use two or more sets of coils at angles, lubricate axle;</p>	<p>Allow "use thicker wire"</p> <p>Ignore "stronger battery"</p> <p>Allow idea of 3 phase supply, iron stator</p>	2
		(ii)	<p>Suggestion that clearly results in reversal of the current OR the cell connections OR the magnet's field;</p>		1

Question number	Answer	Notes	Marks
4 (c)	any two of MP1 Idea that force is increased (by stronger field); MP2 Idea of radial magnetic field (rather than a uniform one); MP3 Coil remains in the field for a longer time;	Allow idea that iron is magnetised Allow idea that magnetic field acts "all the way around" Allow idea that force acts over a larger part of a cycle	2
		Total	8

Question number	Answer	Notes	Marks
(d)	<p>Correct equation shown ; e.g. (average speed) = distance (moved) / time (taken)</p> <p>Substitution of correct distance and suitable time; Correct evaluation ; e.g. 106.5/27 3.94 (m/s)</p>	<p>Allow d/t</p> <p>Allow (ecf) max 2 4.26 (m/s) (use of time = 25 s) 3.55 (m/s) (use of time = 30 s) Allow reverse argument max 2 e.g. $106.5 \div 4 = 26.6$ (s)</p>	3
		Total	10

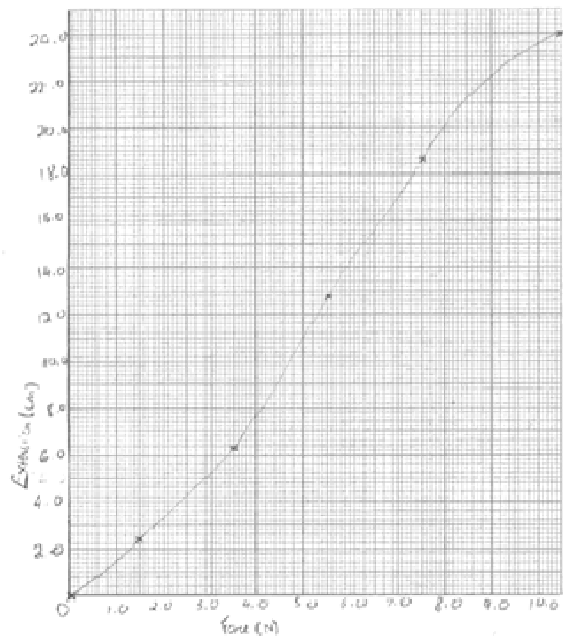
Question number	Answer	Notes	Marks
6 (a) (i)	any three of Idea of collisions / impact (with walls); Continuous bombardment; force produced;	Ignore collisions between particles Allow idea of momentum changing	3
(ii)	Pressure = force ÷ area; Idea that the student is right OR the pressure decreases; AND any two of The number(or mass) of molecules stays the same; The gas volume increases; Pressure is inversely proportional to volume; Particles collide with the wall less frequently;	Both marks depend on previous correct response (e.g. pressure decreases) Allow idea that area of can in contact with gas increases OR gas particles have more space Allow mention of $p_1V_1 = p_2V_2$ in this context Allow "longer time between collisions"	3
(b)	(Average speed) increases;		1
		Total	7

Question number	Answer	Notes	Marks
7 (a) (i)	pressure difference = height (or depth) x density x g ;	Allow $h \times \rho \times g$ (and rearrangements) Reject "gravity" for g in 7(a)(i) Allow standard form	1
(ii)	substitution into correct equation; evaluation; e.g. $1028 \times 10 \times 700$ $7\,196\,000$ (Pa)	Allow use of $g = 9.8(1) \rightarrow 7\,059\,276$ or $7\,052\,080$	2
(iii)	(total pressure =) $72 \times 10^5 + 1 \times 10^5$ (Pa);	Allow $7\,296\,000$ (Pa) OR answer to 7(a)(ii) + $100\,000$	1
(b) (i)	pressure = force/area	Allow $p = F/A$	1
(ii)	Substitution into correct equation; Transformation; Evaluation; e.g. $41 \times 10^5 = F/3.1$ $F = 41 \times 10^5 \times 3.1$ 1.271×10^7 (N)	Substitution and transposition either order $12\,710\,000, 127.1 \times 10^5, 1.3 \times 10^7$	3
(c)	because fresh water has a lower density than sea water OR reverse argument;		1

Question number	Answer	Notes	Marks
7 (d)	any five of MP1 suitable measuring instruments mentioned; e.g. measuring cylinder and (electronic) balance MP2 method of obtaining correct mass; e.g. subtract mass of container, use of tare MP3 detail to ensure accuracy of liquid volume; e.g. burette, pipette, density bottle, account taken of meniscus MP4 equation stated - density = mass ÷ volume; MP5 suitable units used, e.g. g for mass and cm ³ for volume MP6 Idea of appropriate repeating or averaging at any stage	Allow scales Ignore newtonmeter, weighing machine Ignore weight Allow keep temperature constant Allow $\rho = m/V$ Allow ml, l Allow "discard anomalous results"	5

Question number	Answer	Notes	Marks																		
8 (a)	<p>all 3 for both marks;;</p> <p>any two for 1 mark ;</p> <table border="1" data-bbox="398 344 1030 852"> <thead> <tr> <th data-bbox="398 344 763 411">item</th> <th data-bbox="763 344 1030 411">Tick if needed</th> </tr> </thead> <tbody> <tr> <td data-bbox="398 411 763 469">ammeter</td> <td data-bbox="763 411 1030 469"></td> </tr> <tr> <td data-bbox="398 469 763 523">steel spring</td> <td data-bbox="763 469 1030 523"></td> </tr> <tr> <td data-bbox="398 523 763 577">retort stand and</td> <td data-bbox="763 523 1030 577" style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td data-bbox="398 577 763 632">rubber band</td> <td data-bbox="763 577 1030 632" style="text-align: center;">given <input type="checkbox"/><input type="checkbox"/><input type="checkbox"/><input type="checkbox"/></td> </tr> <tr> <td data-bbox="398 632 763 686">ruler</td> <td data-bbox="763 632 1030 686" style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td data-bbox="398 686 763 740">thermometer</td> <td data-bbox="763 686 1030 740"></td> </tr> <tr> <td data-bbox="398 740 763 794">mass hanger</td> <td data-bbox="763 740 1030 794" style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td data-bbox="398 794 763 852">mass</td> <td data-bbox="763 794 1030 852" style="text-align: center;">given <input type="checkbox"/><input type="checkbox"/><input type="checkbox"/><input type="checkbox"/></td> </tr> </tbody> </table>	item	Tick if needed	ammeter		steel spring		retort stand and	<input type="checkbox"/>	rubber band	given <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	ruler	<input type="checkbox"/>	thermometer		mass hanger	<input type="checkbox"/>	mass	given <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	each incorrect tick = -1	2
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Question number	Answer	Notes	Marks
8 (b) (i)	5.5 (in the table)		1
(ii)	suitable scale for axes; axes labelled with units; points plotted to nearest mm square (minus one for each plotting, up to max 2 marks);; Line (curve) of best fit acceptable;	-1 for each incorrect plot Allow (ecf) a balanced straight line of best fit that takes account of any plotting errors and indicated anomalies	5



Mass in g	Force in N	Extension in cm
0	0	0.0
150	1.5	2.4
350	3.5	6.3
550		12.8
750	7.5	18.6
1050	10.5	24.0

Question number	Answer	Notes	Marks
8 b (iii)	<p>No / yes (no mark)</p> <p>Idea that Hooke's law should show (direct) proportionality;</p> <p>Use of data (from the table or graph) to explain that the results do not show this; e.g. 'line is a curve', '(table shows) rubber band extends unevenly'</p>	<p>Allow (ecf) - converse from <u>straight</u> drawn line, using data from their graph (not the table) e.g. 'Yes' AND 'line is a straight'</p>	2
		Total	10

Question number	Answer	Notes	Marks
9 (a) (i)	0.45;	no unit penalty	1
(ii)	Power = current \times voltage;	Allow $P = I \times V$ and rearrangements	1
(iii)	Substitution; Evaluation; e.g. $1.5 = I \times 0.45$ $I = 3.3 \text{ (A)}$ (answer to at least 2 s.f.)	Allow reverse argument yielding <u>1.35</u> (W) for 1mark	2
(b) (i)	conversion of time to seconds; substitution into correct equation ($E = I \times V \times t$); evaluation; e.g. time = $7 \times 5 \times 60 \times 60$ (= 126 000) $E = 3.3 \times 9 \times 7 \times 5 \times 60 \times 60$ 3 742 000 (J)	Allow solution in stages i.e. from $P=IV$ and $P =E/t$ Allow for full marks 3 402 000 (J) (from use of 3 A given above) 3 780 000 (J) (from $1.5 \times 20 \times 7 \times 5 \times 60 \times 60$)	3

Question number	Answer	Notes	Marks
9 (b) (ii)	A description to include electrical; to light (and heat);	Reject "electricity" for the first mark Allow chemical to electrical to light for 1 mark only	2
		Total	9

Question number	Answer	Notes	Marks
10 (a) (i)	MP1 Any circuit including correct circuit symbols for a <ul style="list-style-type: none"> • battery /cell / d.c. power supply • ammeter • voltmeter ; MP2 ammeter clearly measures current through the wire; MP3 voltmeter clearly across wire;	ignore other components for MP1 allow even if voltmeter in series with ammeter allow circuit line drawn through meter allow voltmeter across a section of the test wire	3
(ii)	Idea of measuring current through the wire; Idea of measuring voltage across the wire; Idea of a range of values (of I and V); e.g. alter variable resistor OR repeat for different voltages		3
(b) (i)	any one of resistance changes (with temperature) ; wire gets hot and melts/burns/catches fire/dangerous; V proportional to I only at constant temperature; Ohms Law is only true if temperature constant;	Reject incorrect relationship between R and θ Ignore damage to wire	1
(ii)	any one of putting the wire in a water bath ; taking the reading quickly; switching off between readings; using only small currents;	Reject insulating the wire Allow to return to room temperature	1

Question number	Answer	Notes	Marks
(c) (i)	voltage = current \times resistance ;	Allow $V = I \times R$ and rearrangements	1
(ii)	horizontal line above axis;		1
		Total	10

Question number	Answer	Notes	Marks
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11 (a) (i)	GPE = mass \times g \times height ;	Allow GPE = $m \times g \times h$ and rearrangements	1
(ii)	Substitution into correct equation; Evaluation; e.g. $0.25 \times 10 \times 1.75$ 4.375 (J)	Reject "gravity" for g in 11(a)(i) 4.4, 4.38 Allow use of 9.81 (or 9.8) \rightarrow 4.29 for full marks	2
(b)	Value given in 11(a)(ii);		1
(c) (i)	KE = $\frac{1}{2} \times$ mass \times speed ² ;	Allow KE = $\frac{1}{2} \times m \times v^2$ and rearrangements	1
(ii)	Substitution into correct equation; Transformation; Evaluation; e.g. $3.1 = \frac{1}{2} \times 0.25 \times v^2$ $v^2 = 3.1 \div \frac{1}{2} \times 0.25$ $v = 4.98$ (m/s)	Substitution and transposition either order Accept 5.0, 5 and allow truncation e.g. 4.97 m/s	3
		Total	8

Question number	Answer	Notes	Marks
12 (a)	<p>A description to include any 5 of</p> <p>MP1 nucleus absorbs neutron OR nucleus hit by neutron;</p> <p>MP2 splits into (two) fragments/parts OR daughter atoms OR daughter nuclei;</p> <p>MP3 extra neutrons released;</p> <p>-</p> <p>MP4 (kinetic) energy released;</p> <p>MP5 released neutrons hit further nuclei OR uranium nuclei;</p> <p>MP6 moderator slows down the neutrons/ makes it more likely for a neutron to be absorbed;</p> <p>MP7 control rods absorb extra neutrons;</p> <p>MP8 idea that control rods help prevent a "runaway" chain reaction;</p>	<p>Correct process using consistently incorrect particle instead of neutron (e.g. electron) = max 4</p> <p>NB uranium, U-235 or nucleus must be mentioned</p> <p>Reject cells, molecules, more uranium</p> <p>Ignore heat</p> <p>allow atoms OR uranium atoms</p>	5
(b)	kinetic/movement energy;		1
(c)	Idea that the shielding absorbs radiation / particles / energy;	<p>Allow "stops radiation /particles from escaping"</p> <p>Ignore "radioactivity" escaping</p>	1
		Total	7

Question number	Answer	Notes	Marks
13 (a) i	there is a voltage; And one of (because there is a) change of flux OR field (lines) are cut; (which is) an induced voltage / emf;	Allow induced current	2
ii	greater deflection/voltage; Idea that rate of change of flux (linkage) is greater; eg more magnetic field lines cutting coil (per second)	ignore speed of magnet	2
(b) i	Idea that deflection is smaller;		1
ii	Idea that deflection is greater;		1
iii	Idea that deflection is in opposite direction;		1
		Total	7

Question	Answer	Notes	Marks
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number			
14 (a)	I (Nuclei / atoms) with same number of protons OR same atomic number; different number of neutrons OR different mass number; ii (stable isotopes) do not emit (ionising) radiation OR (stable isotopes) do not emit alpha, beta and gamma radiation ;	Ignore electrons Allow "(nuclei) of the same element" Allow different number of nucleons Ignore "radioactive", "decay" ignore idea of remaining the same element for ever	2 1
(b)	i 210 – 84 OR 126 ii ideas that proton number increases by 1; neutron number decreases by 1; iii beta decay	allow a calculation / nuclear equation Ignore discussion of "number of nucleons" allow β or β^- or β^+	1 2 1
(c)	Any two of idea that gamma is not a particle; e.g. gamma rays have no (rest) mass gamma rays do not have a proton number gamma rays do not contain any protons or neutrons gamma rays are electromagnetic radiation OR energy; no particles are lost (from the nucleus) when a gamma ray is emitted;	Allow photons	2
		Total	9
		Total for paper	120

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