



# Mark Scheme (Results)

## Summer 2013

International GCSE  
Physics (4PH0) Paper 1PR

Science Double Award (4SC0)  
Paper 1PR

## Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications come from Pearson, the world's leading learning company. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at [www.edexcel.com](http://www.edexcel.com) or [www.btec.co.uk](http://www.btec.co.uk) for our BTEC qualifications.

Alternatively, you can get in touch with us using the details on our contact us page at [www.edexcel.com/contactus](http://www.edexcel.com/contactus).

If you have any subject specific questions about this specification that require the help of a subject specialist, you can speak directly to the subject team at Pearson.

Their contact details can be found on this link: [www.edexcel.com/teachingservices](http://www.edexcel.com/teachingservices).

You can also use our online Ask the Expert service at [www.edexcel.com/ask](http://www.edexcel.com/ask). You will need an Edexcel username and password to access this service

### **Pearson: helping people progress, everywhere**

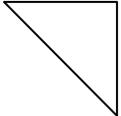
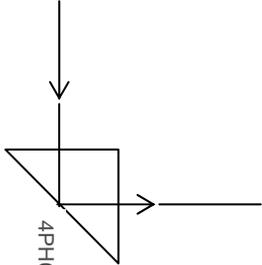
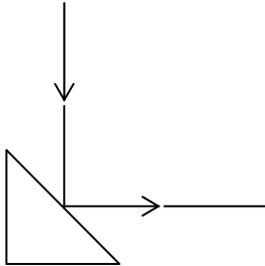
Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: [www.pearson.com/uk](http://www.pearson.com/uk)

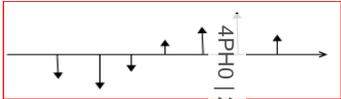
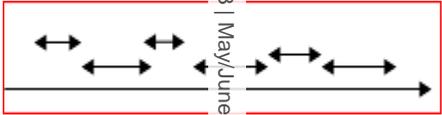
Summer 2013

Publications Code UG036657

All the material in this publication is copyright  
© Pearson Education Ltd

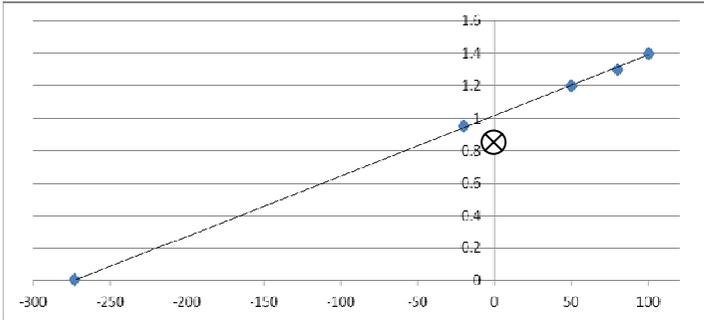


Question number		Answer	Notes	Marks
1 (a)		total internal reflection	Accept TIR	1
1 (b) (i)		prism drawn in correct orientation (by eye)  	Accept a freehand sketch of the triangular prism  Size of prism unimportant, e.g. can fill the entire square, but horizontal and vertical edges must be drawn	1
1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

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)</p> <p>Idea that longitudinal wave the direction of vibration is parallel to the direction of the wave; (May be shown with labels on the diagram)</p> <p>A named freehand sketch of either wave indicating the two directions; e.g.</p> <div style="display: flex; align-items: center;">  <div style="margin-left: 10px; writing-mode: vertical-rl; transform: rotate(180deg); font-size: small;">4PH0   2013   May/June   Paper 1   GradeMax</div> </div> <p>transverse</p> <div style="display: flex; align-items: center;">  </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 <math>\perp</math> to (for parallel) the same as, //</p> <p>the minimum labelling 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
(c)	any two of		2

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

Question number		Answer	Notes	Marks									
3 (a)		<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>temperature</td> <td>boiling point of nitrogen</td> <td>boiling point of water</td> </tr> <tr> <td>in °C</td> <td>-196</td> <td></td> </tr> <tr> <td>in Kelvin</td> <td></td> <td>373</td> </tr> </table> <p>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											

<p>3 (b) (i)</p>	<p>Plotting to nearest half-square (minus one for each plotting error, up to max 2 marks) ;;</p> <p>line of best fit that intersects x-axis between -250 and -300;</p> <p>(ii) point (0, 0.85) circled or otherwise indicated;</p> 	<table border="1" data-bbox="1288 210 1688 580"> <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	<p>3</p> <p>1</p>
Temperature in °C	Volume in litres														
-20	0.95														
0	0.85														
50	1.20														
80	1.30														
100	1.40														
<p>b(iii)</p>	<p>Reading from graph to nearest small square (<math>\pm 5</math> degrees);</p>		<p>1</p>												

Question number		Answer	Notes	Marks
4 (a)		any three of  MP1 idea that there is <b>current</b> (in the wire/coil);  MP2 idea that (the coil has) a <b>magnetic field</b> ;  MP3 idea that coil's magnetic field <b>interacts</b> with field of permanent magnet;  MP4 idea that there is a <b>force</b> on the coil/wire;  MP5 Idea that current or force <b>reverses</b> 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

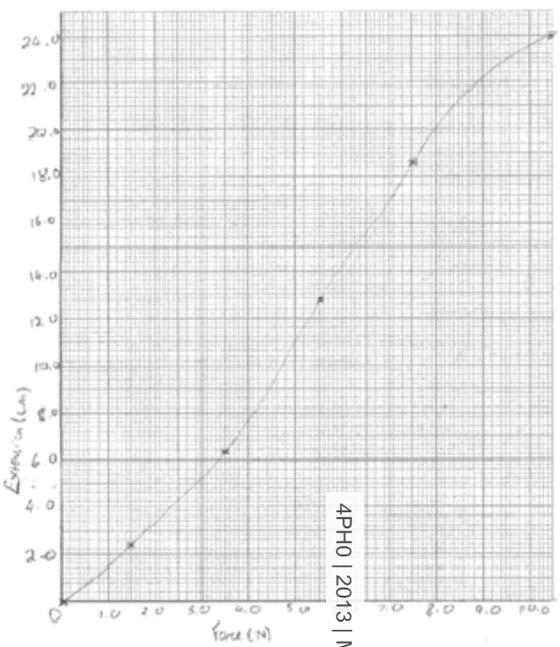
<p>(b) (i)</p>		<p>any two of</p> <p>MP1 increase magnetic field( e.g. stronger magnets or magnets closer or magnets curved round coil);</p> <p>MP2 increase current OR voltage Or more cells;</p> <p>MP3 increase number of turns (on coil);</p> <p>MP4 a sensible alternative suggestion e.g. use two or more 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>	<p>2</p>
<p>(ii)</p>		<p>Suggestion that clearly results in reversal of the current OR the cell connections OR the magnet’s field;</p>		<p>1</p>
<p>(c)</p>		<p>any two of</p> <p>MP1 Idea that force is increased (by stronger field);</p> <p>MP2 Idea of radial magnetic field (rather than a uniform one);</p> <p>MP3 Coil remains in the field for a longer time;</p>	<p>Allow idea that iron is magnetised</p> <p>Allow idea that magnetic field acts “all the way around”</p> <p>Allow idea that force acts over a larger part of a cycle</p>	<p>2</p>

Question number		Answer	Notes	Marks
5	(a) B D	constant velocity of <u>5 m/s</u>  Idea that velocity/speed = 0	Allow speed is <u>5 m/s</u>  Allow "stops", "stationary", "at rest"	2
	(b)	Idea of greater slope (for stage E); e.g. the gradient is steeper	Allow reverse argument, provided stage A is identified e.g. "stage A has a shallower slope"  Allow attempts to demonstrate through - calculation of both gradients - qualitative comparison of data	1
	(c)	distance = speed × time OR distance = area under graph; attempt to find any area; attempt to total correct areas (or use trapezium method); evaluation; e.g. distance = area under graph $7 \times 7$ or $\frac{1}{2} \times 7 \times 3$ $(7 \times 7) + (\frac{1}{2} \times 7 \times 3) = 49 + 10.5$ 59.5 (m)	The correct relationship can be <b>implicit</b> in the working  59.5 (m) with no working = full marks  Allow the trapezium method - e.g. $7 \times (7+10) \div 2 = 7 \times 8.5$ = 59.5 (m)	4
	(d)	Correct equation shown ; e.g. (average speed) = distance (moved) / time (taken)  Substitution of correct distance and suitable time; Correct evaluation ; e.g. $106.5/27$ 3.94 (m/s)	Allow d/t    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)	3

Question number		Answer	Notes	Marks
6 (a) (i)		any three of Idea of collisions / impact (with walls); Continuous bombardment; force produced; Pressure = force ÷ area;	Ignore collisions between particles Allow idea of momentum changing	3
(ii)		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

Question number		Answer	Notes	Marks
7	(a)	(i) pressure difference = height (or depth) x density x $g$ ;  (ii) substitution into correct equation; evaluation; e.g. $1028 \times 10 \times 700$ $7\,196\,000$ (Pa)  (iii) (total pressure =) $72 \times 10^5 + 1 \times 10^5$ (Pa);	Allow $h \times \rho \times g$ (and rearrangements) Reject "gravity" for $g$ in 7(a)(i) Allow standard form  Allow use of $g = 9.8(1) \rightarrow 7\,059\,276$ or $7\,052\,080$  Allow $7\,296\,000$ (Pa) OR answer to 7(a)(ii) + $100\,000$	1  2  1
	(b)	(i) pressure = force/area  (ii) Substitution into correct equation; Transformation; Evaluation; e.g. $41 \times 10^5 = F/3.1$ $F = 41 \times 10^5 \times 3.1$ $1.271 \times 10^7$ (N)	Allow $p = F/A$  Substitution and transposition either order  $12\,710\,000$ , $127.1 \times 10^5$ , $1.3 \times 10^7$	1  3
	(c)	because fresh water has a lower density than sea water OR reverse argument;		1
	(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 $\div$ volume; MP5 suitable units used, e.g. g for mass and $\text{cm}^3$ 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" style="margin-left: 40px;"> <thead> <tr> <th>item</th> <th>Tick if needed</th> </tr> </thead> <tbody> <tr> <td>ammeter</td> <td></td> </tr> <tr> <td>steel spring</td> <td></td> </tr> <tr> <td>retort stand and clamp</td> <td style="text-align: center;">✓</td> </tr> <tr> <td>rubber band</td> <td>given ✓</td> </tr> <tr> <td>ruler</td> <td style="text-align: center;">✓</td> </tr> <tr> <td>thermometer</td> <td></td> </tr> <tr> <td>mass hanger</td> <td style="text-align: center;">✓</td> </tr> <tr> <td>mass</td> <td>given ✓</td> </tr> </tbody> </table>	item	Tick if needed	ammeter		steel spring		retort stand and clamp	✓	rubber band	given ✓	ruler	✓	thermometer		mass hanger	✓	mass	given ✓	each incorrect tick = -1	2
item	Tick if needed																				
ammeter																					
steel spring																					
retort stand and clamp	✓																				
rubber band	given ✓																				
ruler	✓																				
thermometer																					
mass hanger	✓																				
mass	given ✓																				

(b) i	5.5 (in the table)		1																					
ii	<p>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;</p> 	<p>-1 for each incorrect plot                  Allow (ecf) a balanced straight line of best fit that takes account of any plotting errors and indicated anomalies</p> <table border="1" data-bbox="1187 502 1803 853"> <thead> <tr> <th>Mass in g</th> <th>Force in N</th> <th>Extension in cm</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0.0</td> </tr> <tr> <td>150</td> <td>1.5</td> <td>2.4</td> </tr> <tr> <td>350</td> <td>3.5</td> <td>6.3</td> </tr> <tr> <td>550</td> <td></td> <td>12.8</td> </tr> <tr> <td>750</td> <td>7.5</td> <td>18.6</td> </tr> <tr> <td>1050</td> <td>10.5</td> <td>24.0</td> </tr> </tbody> </table>	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	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																						
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																					

4PH01 2013 | May/June | Paper 1 | GradeMax

Question number	Answer	Notes	Marks
9 (a) i	0.45;	no unit penalty	1
ii	Power = current × 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 1 mark	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 $1.5 \times 20 \times 7 \times 5 \times 60 \times 60$ )  Allow max of 1 if time not in seconds, e.g. 1040 (J) (from $3.3 \times 9 \times 7 \times 5$ , time in hours) 62400 (J) (from $3.3 \times 9 \times 7 \times 5 \times 60$ , time in minutes)	3
ii	A description to include  electrical;  to <b>light</b> (and heat);	Reject “electricity” for the first mark  Allow chemical to electrical to light for 1 mark only	2
		Total	9



		Total	10
--	--	-------	----

Question number	Answer	Notes	Marks
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 <sup>2</sup> ;	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	11

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

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
		<b>Total</b>	<b>7</b>

Question number	Answer	Notes	Marks
14 (a) i	(Nuclei / atoms ) with same number of protons OR same atomic number; different number of neutrons OR different mass number;	Ignore electrons Allow "(nuclei) of the same element" Allow different number of nucleons	2
ii	(stable isotopes) do not emit (ionising) radiation OR (stable isotopes) do not emit alpha, beta and gamma radiation ;	Ignore "radioactive", "decay" ignore idea of remaining the same element for ever	1
(b) i	210 – 84 OR 126		1
ii	ideas that proton number increases by 1; neutron number decreases by 1;	allow a calculation / nuclear equation Ignore discussion of "number of nucleons"	2
iii	beta decay	allow $\beta$ or $\beta^-$ or $\beta^+$	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
		<b>Total</b>	<b>9</b>

Further copies of this publication are available from  
Edexcel Publications, Adamsway, Mansfield, Notts, NG18 4FN

Telephone 01623 467467

Fax 01623 450481

Email [publication.orders@edexcel.com](mailto:publication.orders@edexcel.com)

Order Code UG036657 Summer 2013

For more information on Edexcel qualifications, please visit our website  
[www.edexcel.com](http://www.edexcel.com)

Pearson Education Limited. Registered company number 872828  
with its registered office at Edinburgh Gate, Harlow, Essex CM20 2JE

Ofqual  
.....



Llywodraeth Cynulliad Cymru  
Welsh Assembly Government

