edexcel

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 or 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.

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.

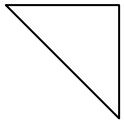
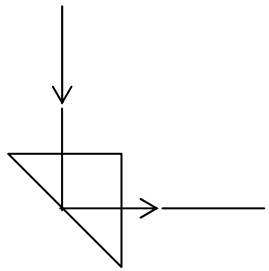
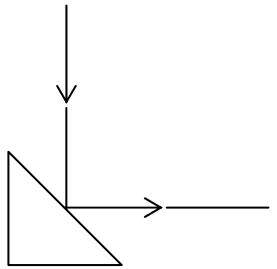
Their contact details can be found on this link: www.edexcel.com/teachingservices.

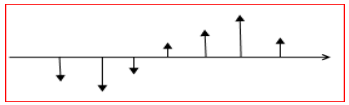
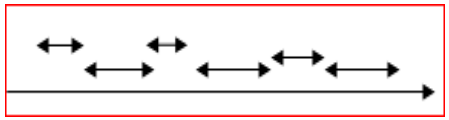
You can also use our online Ask the Expert service at www.edexcel.com/ask. You will need an Edexcel username and password to access this service

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

Summer 2013
Publications Code UG036657

Question number			Answer	Notes	Marks
1	(a)		total internal reflection	Accept TIR	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
	(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

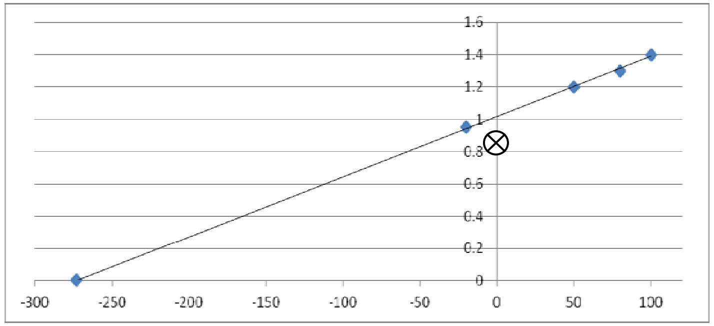
Question number		Answer	Notes	Marks
2 (a) (i)		B- 2 cm		1
(ii)		C- 8 cm		1
(b)		Idea that in a transverse wave the direction of vibration is perpendicular to the direction of the wave; (May be shown with labels on the diagram) Idea that longitudinal wave the direction of vibration is parallel to the 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.  transverse  Longitudinal	Allow (for vibration) oscillation / displacement / disturbance (for direction of wave) direction of travel / energy / transfer (for perpendicular) at right angles, is ⊥ to (for parallel) the same as, // the minimum labeliing is to name of the type of wave they have drawn. Allow sine waves with appropriate arrows Allow diagrams indicating compression and rarefaction e.g. in a spring 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 e.g. transverse vibrates up and down but longitudinal vibrates back and forward	3
(c)		any two of		2

			MP1 can travel through vacuum OR needs no medium; MP2 speed (in a vacuum) OR speed = 3 X10^8 (m/s); MP3 obeys laws of reflection / refraction; MP4 obeys wave equation OR speed = frequency × wavelength; MP5 carries energy/ information; MP6 they are transverse	"speed in a vacuum" where seen, scores 2 marks (MP1 and MP2) Accept reflect, refract, diffract	
(d)	i		D - X-rays		1
	ii		A – absorbed by the bone		1
	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	2

Question number		Answer	Notes	Marks
3 (a)		<table><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> one mark for each correct;;	ignore -273	2

<table>
<tr><td>3 (b) (i)</td><td></td><td>Plotting to nearest half-square (minus one for each plotting error, up to max 2 marks) ;;

line of best fit that intersects x-axis between -250 and -300;</td><td rowspan="2"><table><tr><th>Temperature in °C</th><th>Volume in litres</th></tr><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></table></td><td>3</td></tr>
<tr><td>(ii)</td><td></td><td>point (0, 0.85) circled or otherwise indicated;

 
</td><td>1</td></tr>
<tr><td>b(iii)</td><td></td><td>Reading from graph to nearest small square (±5 degrees);</td><td></td><td>1</td></tr>
</table>

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

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

Question number		Answer	Notes	Marks
5 (a) B		constant velocity of 5 m/s	Allow speed is 5 m/s	2
D		Idea that velocity/speed = 0	Allow "stops", "stationary","at rest"	
(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 × 7 or ½ × 7 × 3 (7 × 7) + (½ × 7 × 3) = 49 + 10.5 59.5 (m)	The correct relationship can be **implicit** in the working 59.5 (m) with no working = full marks Allow the trapezium method - e.g. 7 × ((7+10) ÷ 2) = 7 × 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 ÷ 4 = 26.6 (s)	3

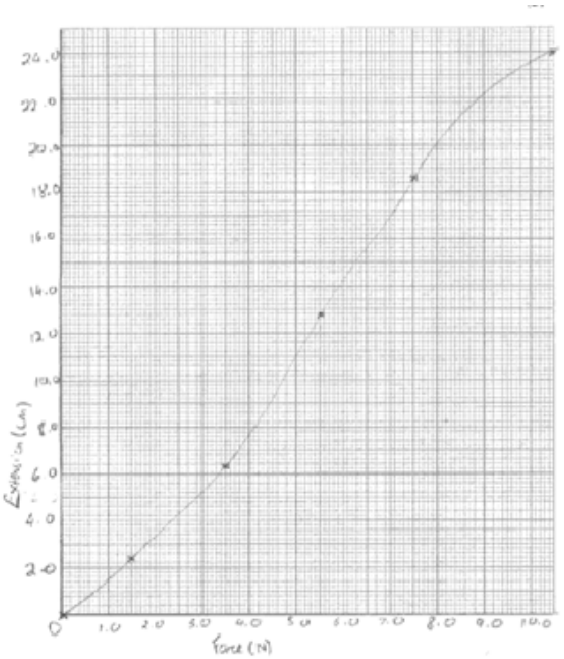
Question number		Answer	Notes	Marks
6 (a) (i)		any three of		3
		Idea of collisions / impact (with walls);	Ignore collisions between particles	
		Continuous bombardment;		
		force produced;	Allow idea of momentum changing	
		Pressure = force ÷ area;		
(ii)		Idea that the student is right OR the pressure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

Question number		Answer	Notes	Marks
7 (a) (i)		pressure difference = height (or depth) x density x *g* ;	Allow h × ρ × *g* (and rearrangements) Reject "gravity" for *g* in 7(a)(i)	1
(ii)		substitution into correct equation; evaluation; e.g. 1028 X 10 X 700 7 196 000 (Pa)	Allow standard form Allow use of g = 9.8(1) → 7 059 276 or 7 052 080	2
(iii)		(total pressure =) 72 x10^5 + 1 x 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 × 10^5 = F/3.1 F= 41 × 10^5 x 3.1 1.271 x 10^7 (N)	Substitution and transposition either order 12 710 000, 127.1 x 10^5 , 1.3 x 10^7	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 ÷ 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 ρ=m/V Allow ml, l Allow "discard anomalous results"	5

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>8 (a)</td><td>all 3 for both marks;;

any two for 1 mark ;

<table>
<tr><th>item</th><th>Tick if needed</th></tr>
<tr><td>ammeter</td><td></td></tr>
<tr><td>steel spring</td><td></td></tr>
<tr><td>retort stand and clamp</td><td>✓</td></tr>
<tr><td>rubber band</td><td>given ✓</td></tr>
<tr><td>ruler</td><td>✓</td></tr>
<tr><td>thermometer</td><td></td></tr>
<tr><td>mass hanger</td><td>✓</td></tr>
<tr><td>mass</td><td>given ✓</td></tr>
</table>
</td><td>each incorrect tick = -1</td><td>2</td></tr>
</table>

<table>
<tr><td>(b)</td><td>I</td><td>5.5 (in the table)</td><td></td><td>1</td></tr>
<tr><td></td><td>ii</td><td>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;
  </td><td>-1 for each incorrect plot
Allow (ecf) a balanced straight line of best fit that takes account of any plotting errors and indicated anomalies
<table><tr><th>Mass in g</th><th>Force in N</th><th>Extension in cm</th></tr><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></table></td><td>5</td></tr>
<tr><td></td><td>iii</td><td>No / yes (no mark)

Idea that Hooke’s law should show (direct) proportionality;

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’</td><td>

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’</td><td>2</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>10</td></tr>
</table>

Question number	Answer	Notes	Marks
9 (a) I	0.45;	no unit penalty	1
ii	Power = current × voltage;	Allow P = I × V and rearrangements	1
iii	Substitution; Evaluation; e.g. 1.5= I x 0.45 I = 3.3 (A) (answer to at least 2 s.f.)	Allow reverse argument yielding 1.35 (W) for 1mark	2
(b) i	conversion of time to seconds; substitution into correct equation (E = I × V × t); evaluation; e.g. time = 7 × 5 × 60 × 60 (= 126 000) E = 3.3 x 9 x 7 x 5 x 60 x 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 x 20 x 7 x 5 x 60 x 60) Allow max of 1 if time not in seconds, e.g. 1040 (J) (from 3.3 x 9 x 7 x 5, time in hours) 62400 (J) (from 3.3 x 9 x 7 x 5 x 60, time in minutes)	3
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
1 (a i 0)	MP1 Any circuit including **correct circuit symbols** for • battery /cell / d.c. power supply • ammeter • voltmeter ;	ignore other components for MP1	3
ii	MP2 ammeter clearly measures current through the wire; MP3 voltmeter clearly across wire; 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	allow even if voltmeter in series with ammeter allow circuit line drawn through meter allow voltmeter across a section of the test wire	3
(b) i	any one of resistance changes (with temperature) ;	Reject incorrect relationship between R and Θ	1 1
ii	wire gets hot **and** melts/burns/catches fire/dangerous; V proportional to I only at constant temperature;	Ignore damage to wire Reject insulating the wire	1
(c)	Ohms Law is only true if temperature constant;	Allow to return to room temperature	
i	any one of putting the wire in a water bath ; taking the reading quickly; switching off between readings; using only small currents; voltage = current × resistance ;	Allow V = I × R and rearrangements	
ii	horizontal line above axis;		1

		Total	10

Question number	Answer	Notes	Marks
11 (a) i	GPE = mass × *g* × height ;	Allow GPE = m × *g* × h and rearrangements	1
ii	Substitution into correct equation; Evaluation; e.g. 0.25 x 10 x 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) → 4.29 for full marks	2
(b)	Value given in 11(a)(ii);		1
(c) i	KE = ½ × mass × speed^2 ;	Allow KE = ½ × m × v^2 and rearrangements	1
ii	Substitution into correct equation; Transformation; Evaluation; e.g. 3.1 = ½ × 0.25 × v^2 v^2 = 3.1 ÷ ½ × 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 **absorbs** radiation / particles / energy;	Allow "stops radiation /particles from escaping" Ignore "radioactvity" escaping	1
			Total	**12**

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 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 **β or β^- or β^+**	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**

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

Order Code UG036657 Summer 2013

For more information on Edexcel qualifications, please visit our website
www.edexcel.com

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

Llywodraeth Cynulliad Cymru
Welsh Assembly Government