

# Mark Scheme (Results)

June 2014

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

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

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Question number	Answer	Notes	Marks
1 (a) (i)	B;		1
(ii)	A;		1
(iii)	Similarity:- any wave property e.g. transfer energy, reflection, refraction, vibration;  Difference:- any one of <ul style="list-style-type: none"> <li>• longitudinal particles oscillate in { same direction/ parallel to} the direction of travel;</li> <li>• transverse { particles oscillates/vibration} at right angles to the direction of travel;</li> </ul>	Allow diffraction carry energy  Allow <ul style="list-style-type: none"> <li>• direction of energy transfer for direction of travel</li> <li>• only transverse waves can be polarised</li> <li>• transverse waves cannot travel through a liquid</li> </ul> Ignore mention of vacuum/ medium	1

(b)

5

circle the mistake in this sentence	the correct word(s) is
They all travel at $3 \times 10^2$ m/s in a vacuum.	$10^8$ GIVEN
Sound waves are electromagnetic.	any of radio, micro(wave), infrared (IR), visible, ultraviolet (UV), X-ray or gamma
Infrared waves are the most harmful to people.	gamma
Gamma waves are used for heating up food.	micro(waves)/ Infrared (IR)
Radio waves have the highest frequency.	Gamma ( $\gamma$ )
Gamma waves have a very long wavelength.	radio (waves)

each line for 1 mark;;;;;

(Total for Question 1 = 9 marks)

Question number	Answer	Notes	Marks
2 a i	96 000 000; matching unit e.g. Hz;	allow $96 \times 10^6$ Allow for 2 marks 96 MHz 96 000 kHz	1 1
ii	Idea that plaque vibrates also;	Allow shakes plaque free breaks plaque up  Ignore ideas of physical contact, e.g.: hits plaque knocks plaque off	1
iii	One of to clean out the <b>debris</b> / eq; to cool the tip / eq ; to reduce damage to the tooth/eq;	allow wash away ignore unqualified 'to clean'	1

b	i	B reflected ;		1
	ii	wave speed = frequency x wavelength;	Allow rearrangements and standard abbreviations and symbols e.g. frequency = speed / wavelength $v = f \times \lambda$ etc	1
	iii	rearranged equation ; substitution; evaluation; e.g. $f = v/\lambda$ $(f =) \frac{1540}{0.00044}$ 3.5 (MHz)	rearrange and sub in either order  allow a power of ten (POT) error for 2 marks  allow matching unit e.g. 3500 kHz	3

(c)	Any TWO from MP1 US is longitudinal wave OR MP1 UV is transverse wave;  MP2 US needs a medium; MP3 UV an electromagnetic wave;  MP4 UV has (much) higher frequency than US/ RA;  MP5 US has a lower speed than UV; MP6 UV has same speed as light;	Care- avoid giving two marks for MP1      allow equivalent statement about $\lambda$ speed of $\sim 300$ m/s (in air) speed of $3 \times 10^8$ m/s  Ignore statements about harmful effects	2
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(Total for Question 2 = 11 marks)

Question number	Answer	Notes	Marks
3 (a)	(i) sub into $E = I \times V \times t$ ; evaluation; rounding to 2SF; e.g. (E=) $2.1 \times 1.5 \times 12$ 37.8 (J) 38 (J)	Correct answer without working gains 3 marks	3
	(ii) $GPE = m \times g \times h$ ;	accept: <ul style="list-style-type: none"> <li>• word equations and rearrangements</li> </ul> do not accept: <ul style="list-style-type: none"> <li>• gravity for g</li> <li>• 10 for g</li> <li>• a 'units' only eqn</li> </ul>	1
	(iii) sub into eqn; evaluation;  e.g. (GPE=) $0.13 \times 10 \times 0.63$ 0.82 (J)	no POT error as eqn has 'g'  0.819 (J) allow 0.802 (J) ( g as 9.81)	2
	(iv) any TWO from: MP1 energy 'lost' as heat and/or sound; MP2 mass has gained KE; MP3 mass of string has been ignored / eq; MP4 motor not 100% efficient;	allow eqn	2

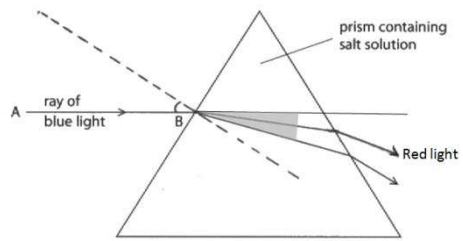


Question number	Answer	Notes	Marks
3 (b)	<p>Any FOUR from:</p> <p>MP1. Current in <u>coil</u> ;</p> <p>MP2. (Creates) magnetic field (around the wires of the coil);</p> <p>MP3. Interaction of (this) field with that of (permanent) magnets;</p> <p>MP4. There is a force on the wire(of coil);</p> <p>MP5. Reference to left hand rule;</p> <p>MP6. force up on one side and down on other side;</p> <p>MP7. Idea that commutator reverses current (every half turn);</p>	<p>allow credit for points shown labelled diagram</p> <p>current in circuit is not enough coil becomes an electromagnet</p> <p>can be shown on diagram idea of catapult field</p> <p>reference to moment/turning effect on the coil</p>	4

(Total for Question 3 = 12 marks)

Question number	Answer	Notes	Marks
4. (a) (i)	change of direction of a wave (as it changes from 1 medium to another);	allow definition in terms of change of speed condone 'bending of light'	1
(ii)	MP1. right angle by eye;  MP2. incident angle marked; MP3. incident angle value in range $31^\circ$ to $34^\circ$ ;	allow normal labelled with right angle ( $90^\circ$ or symbol)  Give 2 marks (MP2 and MP3) for answer in range without a marked incident angle	3

iii



MP1.  $r_r > r_b$  ;

MP2.  $r_r < i$  ;

MP3. less refraction than for blue light on emergence;

red line above blue line  
inside prism  
refraction at first surface  
(inside grey area)

exit rays diverge  
downwards

3

iv	<p>what happens inside the prism ONE mark from:- MP1. (blue light will) refract more (at the first surface); MP2. it will be nearer the normal; MP3. 'r' will be smaller;</p> <p>what happens on emergence:- ONE mark from:- MP4. it will bend even more; MP5. so larger deviation than previously;</p>	allow for MP1  it will go slower;	2
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Question number	Answer	Notes	Marks														
4 b i	<div data-bbox="470 351 929 718" data-label="Figure"> </div> <div data-bbox="421 734 810 1066" data-label="Table"> <table border="1"> <thead> <tr> <th>Sugar concentration (%)</th> <th>Refractometer reading</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>48</td> </tr> <tr> <td>10</td> <td>60</td> </tr> <tr> <td>30</td> <td>57</td> </tr> <tr> <td>50</td> <td>69</td> </tr> <tr> <td>70</td> <td>86</td> </tr> <tr> <td>90</td> <td>108</td> </tr> </tbody> </table> </div> <p data-bbox="414 1077 1512 1252">           axes labelled with units;            scales correct and linear to cover at least half the grid on one of the axes;            points;;            (-1 for each incorrect point to a maximum of 2)            curve of best fit drawn;         </p>	Sugar concentration (%)	Refractometer reading	0	48	10	60	30	57	50	69	70	86	90	108		5
Sugar concentration (%)	Refractometer reading																
0	48																
10	60																
30	57																
50	69																
70	86																
90	108																

(ii)	point 10, 60 circled; (10,)50;	allow 49-52	1 1 1
(iii)	63 / ans from candidates graph;	ans in range 62-66	
(iv)	Any two from <ul style="list-style-type: none"> <li>• pattern sentence / positive correlation / positive slope;</li> <li>• gradient changes/nonlinearity discussed;</li> <li>• not through the origin;</li> </ul>	as one increases the other increases allow <ul style="list-style-type: none"> <li>• refractometer readings increase faster than % sugar concentration</li> <li>• attempted mathematical description e.g. exponential or similar</li> </ul>	2

(Total for Question 4 = 19 marks)

Question number	Answer	Notes	Marks
5 (a)	any two from : a balance/scales; metre rule or measuring tape; stopwatch or stop-clock;	allow newtonmeter	2
(b)	dependent = time (taken for fall);  independent = mass (of cupcake cases);	accept speed (of cupcake cases)  accept number/weight (of cupcake cases)	2
(c)	Any ONE of • (constant) height;  • still air/no (cross) wind; • from rest/zero force at launch; • identical (cupcake) cases;		1
(d)	time in s; mass in g;	accept in either order  accept mass in kg weight in N number of cupcake cases in numbers/no units	2

(e)	Any one of <ul style="list-style-type: none"><li>• detail of any sensible and valid procedure; e.g. repeat readings for time and then average readings</li><li>• detail of more suitable conditions e.g. measure over a larger fall work indoors/reduce draughts ;</li></ul>	allow more accurate timing methods;	1
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Question number	Answer	Notes	Marks
5(f)	down arrow labelled weight;	allow gravitational force/pull ignore 'gravity'	2
(i)	up arrow labelled drag;	allow air resistance accept friction, upthrust ignore lift	
(ii)	any three from  MP1. idea of <b>unbalanced</b> force; e.g. at the start, the only force is weight part way down, the weight is greater than the drag MP2. (this unbalanced) force causes acceleration; MP3. idea of balanced forces near the bottom; e.g. near the bottom the forces are equal MP4. therefore no acceleration; e.g. it reaches terminal velocity	do not credit repeat of the diagram above  there is no upward force at the start  weight equals drag	3

(Total for Question 5 = 13 marks)

Question number	Answer	Notes	Marks
6 (a)	D americium-238;		1
(b) (i)	either order: uranium -234, uranium-235;	accept symbols but not just the numbers	1
(ii)	either order: plutonium-238, americium-238	accept symbols	1
(iii)	either order: uranium-235, americium-238	accept symbols	1
(c) (i)	will decay/ emit radioactive particles (or gamma);	allow named particles 'they are radioactive' 'they emit radioactivity'	3

(ii)	time taken;  and either • For <b>half</b> of (radioactive) nuclei / atoms / isotope to decay; OR • For (radio)activity to halve;	allow how long it takes  Ignore particles / molecules 'break down' 'reactivity'  <b>Reject</b> for ONE mark ideas of • half of a time • half a nucleus/ an atom • complete decay	
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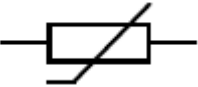





Question number	Answer	Notes	Marks
(d) (i)	$  \begin{array}{ccccccc}  & & \boxed{4} & & \boxed{234} & & \boxed{0} \\  238 & & & & & & \\  \text{Pu} & \longrightarrow & \alpha & + & \text{X} & + & \gamma \\  94 & & \boxed{2} & & \boxed{92} & & \boxed{0}  \end{array}  $ <p>one mark for alpha correct;  one mark for gamma correct;  one line for <b>balancing</b> the top line; NB ECF from alpha and or gamma  one mark for <b>balancing</b> the bottom line; NB ECF from alpha and or gamma</p>		4
(ii)	Uranium;		1
(e) (i)	proton number / atomic number decreases by 1;  nucleon number / mass number remains unchanged (as p and n have same mass);		2
(ii)	plutonium -238;	condone plutonium without nucleon number	1

(Total for Question 6 = 15 marks)

Question number	Answer	Notes	Marks
7 (a) (i)	can all be switched separately ; others stay alight when 1 bulb blows/eq;		2
	(ii) One of - to prevent overheating in the circuit / appliance/ wiring/ lamps; to switch off the circuit; to prevent current exceeding a certain value;	IGNORE live wire/plug	1
	(iii) (if or when) current exceeds stated value/current too high; the fuse (over heats and) melts;  this breaks the circuit/stops the current/ turns the circuit off;	allow "fuse blows" ignore burns ignore 'stops the electricity'	3

Question number	Answer	Notes	Marks
7 (b) (i)	$P = I \times V$ ;	Allow <ul style="list-style-type: none"> <li>• rearrangements</li> <li>• standard abbreviations</li> <li>• equation in words</li> </ul>	1
(ii)	rearrangement; sub into equation; evaluation; e.g. $I = P/V$ $= 250 / 230$ $= 1.1$ (A)	rearrange and sub in either order allow a power of ten (POT) error for -1	3
(iii)	value 3 (A); fuse (value should only be) a little bigger than the current;	1.09 (A) Allow ecf from bii	2
(iv)	In ANY order Any two from:- MP1. circuit breakers are resettable/eq; MP2. circuit breakers work instantly/ fuses do not work instantly; MP3. doesn't require earth wire; MP4. Circuit breakers are more sensitive;		2
(c)	D		1

(Total for Question 7 = 15 marks)

Question number	Answer	Notes	Marks
8 (a) (i)	<p>symbols for circuit components;</p> <ul style="list-style-type: none"> <li>• cell, battery, 'box' labelled power supply, a.c. symbol, component ends for battery</li> <li>• ammeter or milliammeter</li> <li>• thermistor</li> </ul>  <p>a series circuit;</p>	<p>Acceptable power supply symbols</p>   <p>   (DC)  or   (AC) </p> <p>ignore all other symbols</p>	2
(ii)	<p>voltmeter in parallel with thermistor;</p>	<p>ecf from 'thermistor' in ai</p>	1

(iii)	<p>any FIVE from:</p> <p>MP1. measure current at any known/fixed temperature;</p> <p>MP2. measure voltage at any known/fixed temperature;</p> <p>MP3. measure temperature;</p> <p>MP4. vary temp and take new readings ;</p> <p>MP5. idea of allowing temp to equalise between readings;</p> <p>MP6. either change temp by heating water OR start at 100°C and allow to cool;</p> <p>MP7. either start from ice OR use ice cubes to take temp down below room temp;</p> <p>MP8. calculate V/I;</p> <p>MP9. repetition/averaging (at any stage);</p> <p>MP10. use of stirrer/digital thermometer;</p>		5
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Question number	Answer	Notes	Marks
8 (b) (i)	<p>no mark for the choice any valid explanation (dependant on choice of line or curve); e.g. A/curve it fits more points/all the points are closer to the line / eq;</p> <p>OR B /straight line it has 4 points above the line, 4 points below the line/eq;</p>	<p>accept theory says it should be a curve the resistance will not be zero at 100 °C</p>	1
(ii)	<p>One of the following ideas:-</p> <ul style="list-style-type: none"> <li>• the new point could be nearer to one line than the other;</li> <li>• the lines are furthest apart at 10°C;</li> </ul>	<p>accept this measurement would give more data</p>	1
(c)	<p>Any one correct ; All three correct;; L metal wire at constant temperature K diode J filament lamp</p>		1

Question number	Answer	Notes	Marks										
9 (a) (i)	<table border="0" style="width: 100%;"> <tr> <td style="text-align: center; width: 50%;">surface colour</td> <td style="text-align: center; width: 50%;">sensor reading</td> </tr> <tr> <td style="text-align: center;">shiny black</td> <td style="text-align: center;">87</td> </tr> <tr> <td style="text-align: center;">dull black</td> <td style="text-align: center;">61</td> </tr> <tr> <td style="text-align: center;">dull silver</td> <td style="text-align: center;">70</td> </tr> <tr> <td style="text-align: center;">shiny silver</td> <td style="text-align: center;">47</td> </tr> </table> <p>any one correct; all 3 correct;;</p>	surface colour	sensor reading	shiny black	87	dull black	61	dull silver	70	shiny silver	47		2
surface colour	sensor reading												
shiny black	87												
dull black	61												
dull silver	70												
shiny silver	47												
(ii)	(different surfaces) emit heat at different rates/eq;	allow emit different amounts of heat / radiation	1										

Question number	Answer	Notes	Marks
9 (b) (i)	$P = \rho \times g \times h$ ;	do not accept: <ul style="list-style-type: none"> <li>• gravity for g</li> <li>• 10 for g</li> <li>• d for density</li> </ul> accept: <ul style="list-style-type: none"> <li>• word equations and rearrangements</li> <li>• for h allow height depth height difference</li> </ul>	1
	(ii) sub into eqn for P;  evaluation; unit; e.g. (P=) 1260x10x0.25 3150 Pa	no POT error as 'g' used allow 9.8(1) for g  1260x9.8x0.25 3090 allow <ul style="list-style-type: none"> <li>• <math>\text{N/m}^2</math></li> <li>• matching unit e.g. 3.15 kPa</li> </ul>	3

<p>(iii)</p>	<p>any THREE from:  MP1. black absorbs IR/heat;  MP2. black heats up more than shiny;  MP3. gas particles on black side move faster/get hotter/have more KE/move apart;  MP4. pressure on left/black side increases;</p>	<p>Allow RA where appropriate</p> <p>allow gas expands</p> <p>allow force(/area) for pressure</p> <p>ignore: ideas of collisions</p>	<p>3</p>
<p>(iv)</p>	<p>difference in liquid height is less;  more difficult/harder to move ;</p>	<p>height goes down less /decrease in h is less  allow: argument in terms force /pressure</p>	<p>2</p>

(v)	<p>MP1 it will give a bigger temperature (range)/eq;  AND  DOP a suitable comment  e.g.  MP2 a larger difference in water level;</p> <p>MP3 a larger difference in air volume;</p> <p>MP4 a larger difference in (kinetic) energy of  air/gas molecules/particles;</p> <p>MP5 idea of upper limit to range;</p>	<p>Allow  the girl is right</p> <p>amount of water for  water level  amount of air for air  volume  speed of molecules  /particles</p> <p>water would reach the  bulb</p> <p>if the second statement  is chosen, no marks</p>	2
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(Total for Question 9 = 14 marks)

