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Mark Scheme (Results)

Summer 2016

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

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

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Summer 2016
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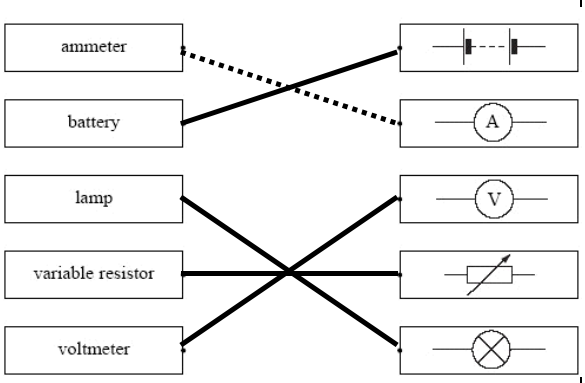
General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question number	Answer	Notes	Marks
1 (a)	 all 4 lines;;; any 2 lines;; any one line;	(dotted line is given)	3
(b) (i)	light dependent resistor / LDR;	allow • photo sensitive resistor • light sensitive resistor allow recognisable spellings	1
(ii)	thermistor;	allow recognisable spellings total marks = 5	1

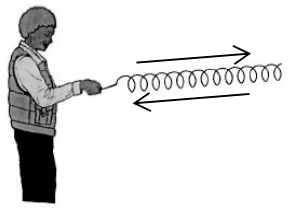
Question number	Answer	Notes	Marks
2 (a)	any suitable from: e.g. • asteroid; • meteor(ite); • (artificial) satellite; • a moon; • comet; • named planet; • dwarf planet e.g. Pluto; • neutron star; • white dwarf; any two suitable from: • (the) Universe; • galaxy; • solar system; • star / Sun; • named planet (1); • named planet (2); galaxy;	accept appropriate correct answers planets: • Mercury • Venus • Mars 'Sun and star' is 1 mark only planets should be gas giants: • Jupiter • Saturn • Uranus • Neptune	4
(b) (i)	gravitational force / gravitational pull / (force of) gravity;		1
(ii)	B;		1
(iii)	single straight arrow directed towards the Sun;	judge by eye	1
(iv)	B;		1
		total marks = 8	

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>3 (a)</td><td>minimum of three straight arrows for different particles (with different lengths);

arrows in different directions;</td><td>judge by eye
arrows need not be attached to particles but it should be clear which particle they refer to</td><td>2</td></tr>
<tr><td>(b)</td><td>any three from:
MP1. particles collide/impact/eq;
MP2. with sides/walls of container;
MP3. idea that force is produced;

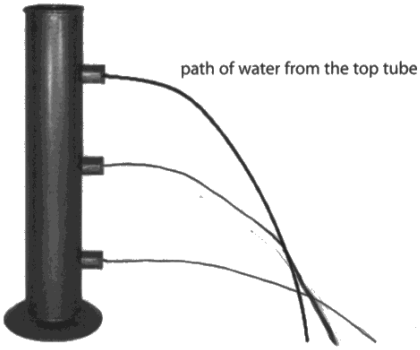
MP4. idea of pressure as force on an area;</td><td>allow
hit for collide

allow particle changes momentum
p = F/A</td><td>3</td></tr>
<tr><td>(c)</td><td>idea that pressure increases/eq;</td><td></td><td>1</td></tr>
<tr><td>(d)</td><td><table><tr><th>Statement</th><th>Tick (☐)</th></tr><tr><td>the gas particles get bigger</td><td></td></tr><tr><td>the mass of gas particles stays the same</td><td>✓</td></tr><tr><td>the gas particles move faster</td><td>✓</td></tr><tr><td>the average distance between gas particles increases</td><td>✓</td></tr><tr><td>the temperature of the gas decreases</td><td></td></tr></table>
one mark for each correct;;;
if 4 ticks then max mark is 2
if 5 ticks then zero marks</td><td></td><td>3</td></tr>
<tr><td></td><td></td><td>total marks = 9</td><td></td></tr>
</table>

Question number	Answer	Notes	Marks
4 (a) (i)	arrows in opposite directions and (roughly) parallel with the length of the spring; 	allow • a line with a double head • arrows to R & L ignore arrow length arrows need not be adjacent to the spring judge by eye	1
(ii)	any suitable example; e.g. sound ultrasound 'p' wave	ignore waves in a slinky	1
(b) (i)	suitable horizontal line (labelled W); e.g. from peak to peak from trough to trough from midpoint to corresponding midpoint between any adjacent points in phase	judge by eye but should start and finish at suitable points	1
(ii)	2.5 (cm)	do not allow 5/2 allow 2 ½	1
(iii)	substitution into f=1/T; evaluation; unit; e.g. f=1/15 0.067 Hz	no mark for equation as it is given on page 2 -1 for POT error ignore answers given as fractions allow 0.07, 0.0667 s^{-1} condone incorrect truncation e.g. 0.06, 0.066, 0.0666	3

(iv)	(ring oscillates) perpendicular / at right angles}; to the direction the wave travels/eq;	allow direction of energy transfer reject 2nd mark if reference to longitudinal wave e.g. 'ring moves parallel to the direction of the wave'	2
(v)	any suitable example; e.g. a named EM wave EM wave 's' wave	allow wave on a rope total marks = 10	1

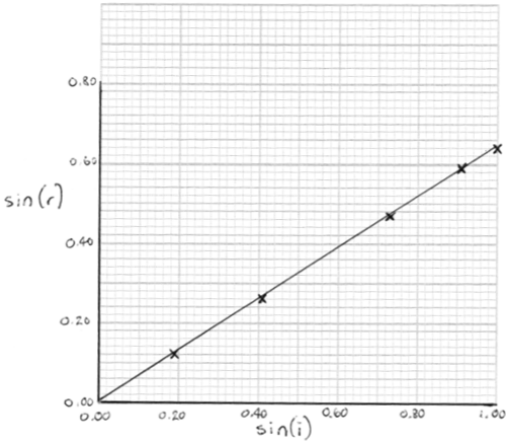
Question number	Answer	Notes	Marks
5 (a) (i)	geothermal / geothermic;	allow nuclear	1
(ii)	any suitable resource or method; e.g. • wind (turbine) • hydro-electric • waves • tidal • solar (panels) • biofuels/biomass	ignore nuclear ignore unqualified 'water' allow photovoltaic cells, (sun)light allow wood	1
(b)	any four from: MP1. thermal energy is transferred from hot rock to cold water OR water heats up; MP2. water molecules gain KE (as they are heated); MP3. steam gains KE as it is heated by the rock; MP4. GPE of steam increases as it gains height; MP5. turbine gains KE from hot water/steam; MP6. generator (coils) transfer KE (from turbine) into electrical energy; MP7. electrical energy is transferred from pump into GPE/KE of water; total marks = 6	allow 'mechanical energy' for KE throughout allow 'heat' for thermal energy allow water turned into steam allow turbine transfers KE to electrical energy	4

Question number	Answer	Notes	Marks
6 (a) (i)	pressure difference = $\rho \times g \times h$	accept in words or rearranged form allow 'd' for density do not accept 'gravity' must be 'g' or gravitational field strength	1
(ii)	both are curves; lowest curve travels further than top curve (if extrapolated);  		2
(iii)	MP1. water at bottom has greater pressure / pressure increases with depth; MP2. (therefore) force on water at the bottom is greatest;	allow idea that there is more weight above a point, the lower the point is allow water leaves lower holes with greater speed	2
(b) (i)	water level is constant in each vessel; 	ignore lines drawn in gaps between vessels	1
(ii)	any two from: MP1. vessels are connected; MP2. same density / type of liquid in all; MP3. air pressure is the same for all; MP4. pressure only depends on the depth;	allow water flows to other vessels allow pressure does not depend on (surface) area total marks = 8	2

Question number	Answer	Notes	Marks
7 (a)	any three from: paper / pen / pencil; protractor; ruler / straight edge; light source (& power supply); (optical) pins;	 allow cork board ignore unqualified 'light' allow needles	3
(b) (i)	line drawn at P at 90° to the flat surface;	judge by eye	1
(ii)	41(°); 21(°);	tolerance +/- 3° no ECF	2
(iii)	change of medium / eq; change in speed / wavelength;	allow change of refractive index / (optical) density ignore changes direction reject second mark if contradiction seen	2

<table>
<tr><td>(c) (i)</td><td>label on both axes;

scale on both axes;

plotting;;
 
</td><td>ignore orientation
ignore any units
linear scale using ≥50% of the grid
tolerance is +/- 0.5 square
-1 for each error

<table><tr><th>sin i</th><th>sin r</th></tr><tr><td>0.19</td><td>0.12</td></tr><tr><td>0.41</td><td>0.26</td></tr><tr><td>0.73</td><td>0.47</td></tr><tr><td>0.91</td><td>0.59</td></tr><tr><td>1.00</td><td>0.64</td></tr></table></td><td>4</td></tr>
<tr><td>(ii)</td><td>straight line of best fit (towards zero);</td><td>points should be evenly distributed about the line</td><td>1</td></tr>
<tr><td>(iii)</td><td>n = sin i ÷ sin r</td><td>accept sine for sin</td><td>1</td></tr>
<tr><td>(iv)</td><td>correct use of data from graph or table seen;
value in range 1.54-1.60;</td><td>total marks = 16</td><td>2</td></tr>
</table>

Question number	Answer	Notes	Marks
8 (a) (i)	P = I x V;	accept standard symbols or in words or rearranged	1
(ii)	substitution and rearrangement; evaluation; e.g. (I =) 110/230 (I =) 0.48 (A)	 allow 0.5, 0.47826 (A) condone 0.47, 0.4782	2
(b) (i)	any suitable suggestion; e.g. carries a high(er) <u>current</u> has low(er) <u>resistance</u>	ignore references to cable overheating/melting	1
(ii)	L or live;		1
(iii)	any suitable suggestion; e.g. double insulated does not have a metal case / has a plastic case	 case is not a conductor / is an insulator	1
(c)	substitution into a suitable equation; time in correct units; evaluation; e.g. (E = I x V x t) (E =) 0.17 x 230 x 55……1 mark (E =) 0.17 x 230 x 55 x 60…2 marks (E =) 130 000 (J)……3 marks OR (E = P x t) (E =) 40 x 55……1 mark (E =) 40 x 55 x 60……2 marks (E =) 130 000 (J)……3 marks	no mark for the equation as given in the paper allow if x60 / 3300 seen anywhere in working 129 030 (J) allow 131 835 for use of V = 235V 132 000(J) total marks = 9	3

Question number	Answer	Notes	Marks
9 (a) (i)	number of protons = 1; number of neutrons = 2;		2
(ii)	any three of the following **comparisons**: MP1. beta particle is negatively charged <u>and</u> alpha is positively charged; MP2. beta particle has lower/less mass ORA; MP3. beta particle has 1 charge but alpha has 2 charges; MP4. beta particle is an electron but alpha is 2p + 2n /eq; MP5. beta is less ionising; MP6. beta has higher speed; MP7. beta particles have larger range; MP8. beta has higher penetrating ability;	ignore descriptions of applications of types of radiation allow 'beta is lighter' ORA allow beta can pass through paper but alpha will be stopped	3
(iii)	any sensible suggestion; e.g. • alpha is 4 nucleons, tritium has (only) 3 / eq • tritium has only 1p, 2p are in alpha • tritium has not got enough mass / mass number too low • tritium has not got enough nucleons • tritium has not got enough p / atomic number too low • tritium has not got enough p+n	ignore tritium is too small	1
(b)	any two from: MP1. energy explanation; e.g. beta particles have given up all their KE on impact MP2. absorption explanation; e.g. beta particles have hit (and been absorbed by) phosphor MP3. penetration explanation; e.g. beta cannot penetrate (thick) glass / tube MP4. range explanation; e.g. signs are further away than the range of beta	ignore: • beta particles have low ionisation /OWTTE • no gas can escape	2

Question number	Answer	Notes	Marks
9 (c) (i)	time taken; and either of • for (radio)activity to **halve**; • for **half** of (radioactive) nuclei / atoms / isotope to decay;	allow how long it takes reject 'half the time' allow count rate for activity reject: • particles • molecules • substance • 'break down' • 'reactivity' • a nucleus / an atom • halve in mass • to completely/fully decay	2
(ii)	working seen/appropriate line(s) on graph seen; 13.5 years;	 tolerance ± 0.5 years	2
(d)	MP1. correct judgment re claim; MP2. (because) EITHER correct statement re time (at which the activity is 400); OR activity (at 20 years); e.g. the manufacturer is correct because the time would be 21.5 years (to reach an activity of 400) OR the manufacturer is correct because the activity is 420 (counts per minute) (at 20 years)	 allow range of 21-22 years allow range of 410 to 440 total marks = 14	2

Question number	Answer	Notes	Marks
10	any six from: **discussion of conduction** MP1. metal spike conducts the thermal energy; MP2. thermal energy is conducted into middle of/inside the potato; **discussion of convection** MP3. convection (current) occurs; MP4. due to density of air decreasing / air expanding; MP5. potato receives hotter air near the top; **discussion of radiation** MP6. thermal energy is radiated/emitted from the black surface; MP7. potato absorbs thermal energy from all sides; **general** MP8. electrical energy is transferred into thermal energy in the heating element;	allow 'heat' for thermal energy throughout metal is a good conductor (of thermal energy) allow potato is heated / cooked from the inside ignore references to absorption at walls allow potato is heated / cooked from the outside total marks = 6	6

Question number	Answer	Notes	Marks
11 (a)	9100 (N)		1
(b) (i)	F = m x a;	accept standard symbols or in words or rearranged	1
(ii)	substitution and rearrangement; evaluation; e.g. (a =) 400/910 (a =) 0.44	-1 for POT error allow 0.4, 0.43956044 0.43 gains 1 mark only	2
(c)	any three from: MP1. speed increases; MP2. so drag {starts to act / increases}; MP3. downward forces increase; MP4. (hence) acceleration decreases;	ignore references to the initial acceleration award 1 mark for mention of terminal velocity if no other mark awarded allow air resistance / friction increases allow unbalanced force decreases	3
(d)	acceleration increases; with any one from: • weight decreases / downward force reduces; • unbalanced force increases; • mass decreases;	total marks = 9	2

Question number	Answer	Notes	Marks
12 (a) (i)	94;		1
(ii)	any two sensible suggestions: e.g. • to make results (more) reliable; • to produce an average reading; • to identify anomalous results; • because there may have been a temperature change; • because there may have been friction in the syringe;	ignore references to keeping it a fair test	2
(b) (i)	any sensible suggestion: e.g. • reduced scale gives fuller use of the grid; • because the lowest value of p or V is 50/eq; • because p or V cannot be zero;	allow RA ignore there are no values below 40	1
(ii)	idea of straight line having an even distribution of points about the line; all points seem to be on the curve;	no mark for a bald 'it's the curve' or 'it's the line' allow points are very close to the curve	2
(iii)	any sensible suggestion; e.g. • keep the temperature constant • ensure no air gets into/out of the syringe/eq • keep apparatus exactly the same • wait for same time after adding/removing loads to take the volume reading		1
(iv)	any two from: MP1. increase sensitivity/resolution of instruments; MP2. take reading(s) to fill in the middle of the graph/eq; MP3. take reading(s) to extend the range of the graph;	ignore references to parallax error / accuracy allow take readings with greater precision/eq	2

<table>
<tr>
<td>(c)</td>
<td>MP1. one correct value of p x V calculated;

MP2. second correct value of p x V calculated;

MP3. statement of agreement with Boyle's Law (within bounds of experimental error);

<table>
<tr><th>Pressure in kPa</th><th>Average volume in cm³</th><th>Space for calculations</th></tr>
<tr><td>100</td><td>50</td><td>5000</td></tr>
<tr><td>90</td><td>55.5</td><td>4995</td></tr>
<tr><td>84</td><td>60</td><td>5040</td></tr>
<tr><td>55</td><td>92</td><td>5060</td></tr>
<tr><td>60</td><td>84</td><td>5040</td></tr>
<tr><td>50</td><td>101</td><td>5050</td></tr>
</table>
</td>
<td>allow calculation of a pressure ratio

allow calculation of a volume ratio

e.g.
• pV is a constant
• p α 1/V
• p is inversely proportional to V

total marks = 12</td>
<td>3</td>
</tr>
</table>

Question number	Answer	Notes	Marks
13 (a)	any four from: MP1. there is a current in the rod; MP2. (therefore) magnetic field around rod; MP3. magnetic fields interact / overlap; MP4. producing a force (on the rod); MP5. catapult effect / motor effect / LH rule; MP6. rod moves to the right / towards the power supply;	allow 'AB' for rod throughout allow current in the rail ignore references to cutting field lines accept the rod moves sideways / left	4
(b)	any four from: MP1. alternating current changes direction (continuously); MP2. current in coil produces alternating magnetic field/eq; MP3. (producing) force on the coil/cone; MP4. reversing direction of current reverses direction of the force; MP5. hence coil/cone vibrates; MP6. cone vibrates air particles; total marks = 8	allow any marking point if clear from diagram allow changing magnetic field allow coil / cone moves in and out / backwards and forwards	4

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