Mark Scheme (Results)

Summer 2017

Pearson Edexcel International GCSE
Physics (4PH0) Paper 1P
Science (Double Award) (4SC0) Paper 1P

Pearson Edexcel Level 1/Level 2 Certificate
Physics (KPH0) Paper 1P
Science (Double Award) (KSC0) Paper 1P

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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)	D; (beta particle) **The only correct answer is D** A is not correct because it is an em wave B is not correct because it is an em wave C is not correct because it is a particle with 2p and 2n		1
(b) i	A; (a nucleus) **The only correct answer is A** B is not correct because electrons are negative and thus attract the positive nucleus C is not correct because gamma rays are uncharged D is not correct because neutrons are uncharged		1
ii	C; **The only correct answer is C** A is not correct because it shows no deflection and alpha particles should be repelled B is not correct because it shows attraction D is not correct because it shows attraction		1
iii	D; **The only correct answer is D** A is not correct because it penetrates bone whereas alpha particles would be stopped by skin B is not correct because it penetrates muscle C is not correct because it penetrates skin		1

iv	A;(high ionising ability) **The only correct answer is A** B is not correct because mass of radioactive source or particle is irrelevant to smoke detectors C is not correct because the half-life does not affect how a smoke detector works, but how long it works for D is not correct because alpha particles have a short range		1

Total for question 1 = 5 marks

Question number	Answer	Notes	Marks
2 (a)	Metals conduct heat; Suitable qualifier DOP; e.g. quickly/good/better than non-metals	condone 'metals conduct' for 1 mark	2
(b)	Black; (because) they are good emitters;	ignore references to absorption, radiation	2
c i	Any four from:- MP1. air next to radiator; MP2. air (particles) gains thermal energy /particles move faster; MP3. spaces between particles increase; MP4. this heated **air** is less dense; MP5. (therefore) hot **air** rises;	 allow air becomes hot allow air particles are more spread out, air expands but not air particles expand ignore hot air particles are less dense ignore heat rises	4
c ii	any sensible suggestion; e.g. maximise surface area	allow lots of smaller pipes increase temperature of hot water radiator lower down	1

Total for question 2 = 9 marks

Question number			Answer	Notes	Marks
3	a		ultraviolet;	UV	1
	b		gamma;	accept γ	1
	c		frequency decreases; because c= f.λ OR speed is constant;	accept eqn in words all travel at same speed	2
	d		infrared;	IR	1
	e	i	any three from:- MP1. time taken (is noted); MP2. for the beam /microwaves to get to plane and return; MP3. distance calculated from speed = distance/time; MP4. distance is halved;	 for signal to get to plane and back accept 'bounce back' any form of the eqn allow time halved	3
		ii	any suitable and sensible suggestion; e.g. • planes move very fast • planes travel a long distance in a short time • planes can arrive from any direction • updates distance/position of plane frequently		1

Total for question 3 = 9 marks

Question number	Answer	Notes	Marks
4 a (i)	covered with a non-conductor/eq;	accept named insulator e.g. plastic, rubber do not accept thermal ideas	1
(ii)	Any two from MP1. a (thin) **wire** which melts /eq; MP2. when current in excess of 5A/which limits the current to 5A; MP3. to break the circuit;	 low melting point, 'blows' allow at 5A allow 'stops the current' 'cuts off the current'	2
(iii)	outside case is made of metal/eq; direct connection to ground;	allow conducting for metal e.g. 'connected to earth' 'connected to the earth (pin) in the plug'	2
(iv)	outside case (of appliance) is made of an insulator / there is no metal or conductor on the outside; (therefore) can't get a shock from it/it doesn't need to be earthed/it is safe to touch;	ignore wires, leads accept named insulator no need for earth lead	2
(b)	re-settable; cuts off the circuit faster;	allow reusable detects leakage current in the earth lead ignore cost	2

Total for question 4 = 9 marks

Question number	Answer	Notes	Marks
5 a	any four from:- MP1. nuclear to KE (of fission products); MP2. KE (of fission products) to thermal energy (of coolant); MP3. thermal energy (of coolant) to thermal energy (of water); MP4. thermal energy (of water) transferred to KE of the steam; MP5. KE of steam transferred to KE of turbines; MP6. KE of turbines transferred to electrical energy in generator;	allow nuclear to thermal for 1 mark instead of MP1 AND MP2 allow thermal energy to KE for 1 mark instead of MP3 AND MP4 allow KE to electrical energy for 1 mark instead of MP5 AND MP6	4
b	C; (hydroelectric power station) **The only correct answer is C** A is not correct because wind farms use KE B is not correct because geothermal power stations use thermal energy D is not correct because coal-fired power stations use thermal energy		1
c	A; (coal-fired power station) **The only correct answer is A** B is not correct because solar farms use em radiation		1

		C is not correct because hydroelectric power stations use GPE D is not correct because wind farms use KE		
d	i	B; (thermal) **The only correct answer is B** A is not correct because lamps do not emit sound in normal use C is not correct because electrical energy is the input energy D is not correct because light is the useful energy output		1
	ii	efficiency = $\frac{\text{useful (energy) output}}{\text{total (energy) input}}$;	with or without 'x100'	1
	iii	substitution; evaluation; e.g. Efficiency = $\frac{1.5}{188}$ (X100) = 0.0080 (0.80 as a %)	0.007979 or 0.7979 % 0.008% loses 1 mark	2

Total for question 5 = 10 marks

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>6 a i</td><td>any one of:-
background light affects readings (of LDR);
to control the level of light;</td><td>light affects results / LDR
idea of fair test</td><td>1</td></tr>
<tr><td>ii</td><td><table>
<tr><th>type of variable</th><th>example</th><th>accept</th></tr>
<tr><td>control</td><td>light level in the room/eq;</td><td>voltage / power of source</td></tr>
<tr><td>dependent</td><td>current;</td><td></td></tr>
<tr><td>independent</td><td>light intensity;</td><td>distance from LDR;</td></tr>
</table></td><td></td><td>3</td></tr>
<tr><td>b i</td><td><table>
<tr><td>50</td><td>3.9</td><td>16.0</td><td>3.8</td><td>7.9</td></tr>
</table>;</td><td></td><td>1</td></tr>
<tr><td>ii</td><td>3.9 (mA);</td><td>allow ans which round to 3.9 e.g. 3.85
allow truncation e.g. 3.8</td><td>1</td></tr>
<tr><td>c i</td><td>labels (quantity and unit) on both axes;
scales on both axes;

points (to ½ sq);;
<table>
<tr><th rowspan="2">Distance from lamp in cm</th><th colspan="4">Current in mA</th></tr>
<tr><th>1st reading</th><th>2nd reading</th><th>3rd reading</th><th>Average (mean)</th></tr>
<tr><td>10</td><td>100.1</td><td>102.8</td><td>109.6</td><td>104.2</td></tr>
<tr><td>20</td><td>26.9</td><td>25.1</td><td>25.8</td><td>25.9</td></tr>
<tr><td>30</td><td>10.6</td><td>10.7</td><td>11.7</td><td>11.0</td></tr>
<tr><td>40</td><td>6.1</td><td>6.2</td><td>5.8</td><td>6.0</td></tr>
<tr><td>50</td><td>3.9</td><td>16.0</td><td>3.8</td><td>7.9</td></tr>
<tr><td>60</td><td>2.9</td><td>2.7</td><td>2.9</td><td>2.8</td></tr>
<tr><td>80</td><td>1.6</td><td>1.5</td><td>1.5</td><td>1.5</td></tr>
</table></td><td>check that scale is linear and occupies at least half the grid

-1 for each error
accept point (50, 3.9) or (50, 7.9)</td><td>4</td></tr>
<tr><td>ii</td><td>curve of best fit;</td><td>if point (50,7.9) plotted line must avoid this point</td><td>1</td></tr>
</table>

d i	pattern sentence; e.g. as distance increases, current decreases it's a non-linear relationship;	 allow • decreasing rate • curved line (of best fit) • slope changes • inverse square reject • negative correlation • inversely proportional • exponential	2
d ii	resistance reduces;	however expressed	1
e	shifted downwards; (because) less light gets through;	accept shifted to LEFT (assumes inverse graph plotted)	2

Total for question 6 = 16 marks

Question number	Answer	Notes	Marks
7 a i	drag/friction labelled on up arrow; weight labelled on down arrow; both arrows same size;	ignore upthrust, resultant, unqualified resistance, air resistance reject unqualified gravity judge by eye	3
ii	force up = force down; (therefore) no acceleration; (hence TV =) constant velocity/speed;	accept • weight = drag (or resistance or friction) • balanced forces • resultant force is zero ignore maximum velocity	3
b i	any two from:- long thin container e.g. measuring cylinder; metre rule; (electric) balance; micrometer; light gates; stop clock/ EQ; magnet (to remove the balls);	ignore oil, steel balls, condone beaker allow ruler, (metal) tape measure scales callipers	2
ii	any 5 from:- MP1. labelled diagram; MP2. fixed and measured distance; MP3. time over the distance; MP4. measures diameter or mass; MP5. repeat and average (for same ball); MP6. use of speed = distance/ time; MP7. prelim experiment to determine range / criterion for choice of range; MP8. start some distance from the top/allow for forces to equalise; MP9. determine velocity at different points and plot graph;	the medium can be air, water or oil must be more than repeat of previous diagram mark start and end position allow repeat for reliability criterion for diameter of ball	5

c	discussion of **either** idea of discrete data (however expressed); bar chart DOP; **or** data is continuous (however expressed); scatter gram DOP;	Allow line graph	2

Total for 7 = 15 marks

Question number			Answer	Notes	Marks
8	a		to reduce drag/eq;	aerodynamic, streamlined	1
	b	i	work done = force X distance (moved in direction of force);	in words or accepted symbols	1
		ii	conversion of units; substitution; evaluation; e.g. 180 000 x 17 3 100 000 (J)	 3 060 000 3.1×10^6 (J)	3
		iii	substitution; evaluation; unit; e.g. $\frac{3\ 060\ 000}{8}$ 380 000 W	 ecf from ii (e.g. 26 100 000) 382 500 (e.g. from ecf 3 262 500) watts, J/s	3
	c	i	acceleration = $\frac{\text{change of velocity}}{\text{time taken}}$	in words or accepted symbols e.g. Δv/t	1
		ii	substitution; evaluation; e.g. $= \frac{14.8 - 6}{6} = \frac{8.8}{6}$ $= 1.5$ (m/s^2)	 1.467 ans in range 1.4 to 1.5	2
		iii	distance = area under graph; one area correct; correct answer; e.g. ½ x 6 x 8.8 or 6 x 6 or 14.8 x 2 92 (m)	seen or implied 6 x 8 or 2 x 8.8 ans which round to 92	3

d	i	P= F/A;	in words or accepted symbols or rearranged	1
	ii	factor of 6 (wheels) accounted for; substitution; rearrangement; evaluation; e.g. 240 000 = 180 000/A A = $\frac{180\ 000}{240\ 000}$ = 0.75 m^2 for 6 0.13 (m^2)	0.125 (m^2) if 0.75 seen, then 3 marks POT errors = -1 CHECK carefully as 240000/180000 = 1.33	4

Total for question 8 = 19 marks

Question number	Answer	Notes	Marks
9 a i	idea that ray does not change direction at A;	allow so it can calculate angle at B condone no refraction	1
ii	idea that refraction is wavelength/colour dependent;	allow • dispersion for refraction, • would get different angles/spectrum for different colours	1
iii	the normal;		1
b i	61 ° ± 2°		1
ii	$\frac{\sin i}{\sin r} = n$	allow sine	1
iii	substitution; evaluation (to 2 SF); e.g. $\frac{\sin 61}{\sin 30} = n_{\text{air to glass}}$ $n_{\text{air to glass}} = 1.7(49)$	allow ecf from (b) (i) allow evaluation to 3 or 4 SF $\frac{\sin 30}{\sin 61} = n_{\text{glass to air}}$ $n_{\text{glass to air}} = 0.57$ (0.572) accept ans in range 1.7 to 1.8 (0.56 to 0.58)	2
c i	sin c = 1/n; OR either of these for both marks c is the angle (of incidence) inside the glass above which TIR occurs;; c is the angle (of incidence) inside the glass for which refracted angle is 90°;;	allow a labelled diagram	2
ii	reflection shown; at the correct angle;	judge by eye reflection plus refraction = 0	2

Total for question 9 = 11 marks

Question number	Answer	Notes	Marks
10 a i	a **nucleus splits**;	not atom	1
ii	using a conservation of nucleons method; 2;		2
iii	MP1. one of the released neutrons is absorbed by another **uranium nucleus**; MP2. (hence) releasing more or other neutrons;	allow hits, collides allow matching plurals ignore creates neutron	2
iv	MP1. barium or krypton named; MP2. (one of the two nuclei) formed from (uranium) fission / splitting;	allow symbols ignore emission/come off etc care that repeat of stem is not credited	2
b	MP1. a neutron changes into proton; MP2. mass/nucleon number remains constant;	1n $\rightarrow$1p +1e allow 'it' ignore 'electrons have no mass'	2

Total for question 10 = 9 marks

Question number	Answer	Notes	Marks
11 a	any two of:- MP1. pull (existing) magnet out of coil; MP2. push S pole first into coil; MP3. push N pole into other side of coil; MP4. reverse the connections to the coil;	 magnet moves to L etc reverse the magnet	2
b i	coil moves through /cuts; the magnetic field (of the magnet);	conductor or wire moving through allow rotates through magnetic field lines	2
ii	any two from:- MP1. faster rotation; MP2. stronger magnet or field; MP3. more turns on the coil; MP4. larger area of coil;	 (soft) iron core more coils on the loop	2
iii	any two from:- MP1. energy is transferred to/by lamp; MP2. more input energy required; MP3. so more work done (moving coil);	 energy is lost as thermal energy or light in the lamp coil works harder	2

Total for question 11 = 8 marks

Total = 120

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