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Mark Scheme (Results)

January 2015

International GCSE Physics (4PH0 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)	B (no earth connection);		1
(b)	C (the circuit cannot overheat if there is a fault);		1
(c)	A (in parallel);		1

Total 3 marks

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>2 (a)</td><td>3 or 4 ticks correct;;
OR
2 ticks correct;

<table><tr><td rowspan="2">Property</td><td colspan="3">Type of radiation</td></tr><tr><td>Alpha particles</td><td>Beta particles</td><td>Gamma rays</td></tr><tr><td>most ionising</td><td>(✓)</td><td></td><td></td></tr><tr><td>largest mass</td><td>✓</td><td></td><td></td></tr><tr><td>most penetrating</td><td></td><td></td><td>✓</td></tr><tr><td>highest speed</td><td></td><td></td><td>✓</td></tr><tr><td>negatively charged</td><td></td><td>✓</td><td></td></tr></table></td><td>ignore top line as this is given</td><td>2</td></tr>
<tr><td>(b) (i)</td><td>Number of neutrons = 2;
Number of protons 2;</td><td>Allow same ideas expressed in words</td><td>2</td></tr>
<tr><td>(ii)</td><td>Any one of-
MP1. Charge is larger (than other radiations);
MP2. Mass is larger (than other radiations);</td><td>comparative statement needed
ignore
• incorrect terminology e.g. more powerful
• references to protons and neutrons
no RA unless particles/radiation specified
condone
‘alpha particles have more momentum’</td><td>1</td></tr>
<tr><td>(c) (i)</td><td>Idea of background radiation;</td><td>Allow
Idea that some alpha particles (from source) will get through smoke
air is all around = insufficient</td><td>1</td></tr>
<tr><td>(ii)</td><td>Idea that radioactivity is random;</td><td>allow
• fluctuates
• source emits different numbers of alphas
• background radiation varies
ignore
• random movement of particles</td><td>1</td></tr>
<tr><td>(iii)</td><td>Idea that α particles are absorbed / deflected /stopped / scattered;

Idea that α particles are affected by <u>smoke</u>;</td><td>allow for both marks
smoke blocks the (alpha) particles</td><td>2</td></tr>
</table>

Total 9 marks

Question number	Answer	Notes	Marks
3 (a)	C (sound waves are longitudinal waves);		1
(b) (i)	C (the same as the amplitude of sound P);		1
(ii)	0.004 (s);	Allow answer by calculation or by reading from graph Allow equivalent value with matching unit, e.g. 4 ms	1
(iii)	500 (Hz)	Treat ii and iii as independent, but allow an ecf from ii to iii if seen Accept “double” P	1

Total 4 marks

Question number	Answer	Notes	Marks
4 (a) (i)	6.1 (m);		1
(ii)	any two from:- MP1. (on distance-time graph,) flat line means zero speed / eq MP2. (so) count when slope is zero; MP3. 7 (times);	allow flat or horizontal for zero slope	2
(b) (i)	(average) speed = (total) distance moved / (total) time taken	allow defined symbols ignore 'triangles'	1
(ii)	Substitution; Calculation; Matching unit; e.g. Average speed = 6.1 / (7x 60) = 0.0145 = 0.015 m/s	allow both substitution and calculation marks for a correct value without working allow 6.1, or ecf for distance 7 for time allow alternatives with compatible unit, e.g. 1.45 cm/s OR 1.5 cm/s 14.5 mm/s OR 15 mm/s 0.87 m/minutes 87 cm/minute 870 mm/minute Allow for 1 mark 6 / 7 or 0.9	3

Total 7 marks

Question number	Answer	Notes	Marks
5	Any five of: MP1. the air (molecules are/is) warmed / heated (by the coal fire); MP2. air expands / molecules move apart; MP3. air becomes less dense; MP4. **hot** air or **less dense** air rises; MP5. cooler air (from outside the furnace) displaces warm air; MP6. (above the chimney) air cools / contracts / becomes more dense; MP7. **cooled** air falls; MP8. Process (of convection) is repeated / continuous;	NB 'convection' is in the stem allow another gas for air -1 for explanations which include the idea that the air particles become less dense/air particles expand/eq	5

Total 5 marks

Question number	Answer	Notes	Marks
6 (a) (i)	only 2.65 (mm) circled;		1
(ii)	discards anomaly; performs averaging; quotes answer to 3sf / 2 d.p.; e.g. 3.60 + 3.62 + 3.63 + 3.61 ~~+ 2.65~~ + 3.62 + 3.60 + 3.61 (= 25.29) 25.29 ÷ 7 = 3.612857... = 3.61 (to 3 sf	÷ 7 or ÷ 8 sufficient even if sum is incorrect e.g. 3.61→3 marks 3.6128 →2 marks (wrong sf) 3.49→ 2 marks (includes anomaly) 3.4925→ 1 mark (includes anomaly and wrong sf)	3
(b) (i)	Bar chart/graph;	condone histogram	1
(ii)	Idea that (size) data is discontinuous; and either of - Idea that there are no values between sizes; Idea that a line graph would indicate continuity;	discrete, categoric, non continuous allow “no half sizes”	2
(iii)	Idea of inverse relationship; Idea of non-linearity;	allow a pattern sentence, condone negative correlation allow “almost” linear Ignore idea of proportionality	2

Question number	Answer	Notes	Marks
6 (c)	Any four of - MP1. idea of a displacement method; MP2. instrument to measure volume (of liquid displaced); MP3. a relevant experimental detail; MP4. second relevant experimental detail; MP5. use of **known liquid density** to find volume from mass (if appropriate);	Allow overspill or rise in level Allow balance if mass method used (see MP5) Including • idea of repetition or averaging at any stage • **full** immersion of object • check liquid level in displacement can, • subtracting before and after volume measurements , • care with meniscus (e.g. in the measuring cylinder), • check zero or tare of balance • avoid parallax when reading scale as above	4

Total 13 marks

Question number	Answer	Notes	Marks
7 (a) (i)	pressure = $\frac{\text{force}}{\text{area}}$	Allow symbols and rearrangements e.g. p=F/A	1
(ii)	substitute; rearrange; evaluate; **matching** unit; e.g. 270 000 = F ÷ 0.016 1 mark F = 270 000 x 0.016 2 marks 4320 3 marks N 4th mark	Substitution and rearrangement in either order allow in words Allow alternatives with matching unit, e.g. 4.32 3 marks kN 4th mark	4
(b)	Any three of MP1. idea of (continuous) random movement; MP2. collisions / impact/eq; MP3. with (inside) **walls** (of tyre); MP4. idea that force is produced (by bombarding molecules); MP5. idea of pressure as force on an area;	Allow momentum or NIII argument	3
(c)	any three of- MP1. (now) more particles/molecules in the tyre; MP2. molecules have more speed /more energy (because gas is warmer); MP3. more impacts/more frequent impacts / harder impacts (with walls of tyre); MP4. (hence) more force on the inside;	Allow change of momentum argument Allow collisions with walls do not award MP3 if the impacts are only with other molecules	3

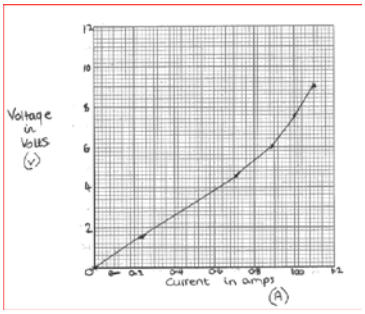
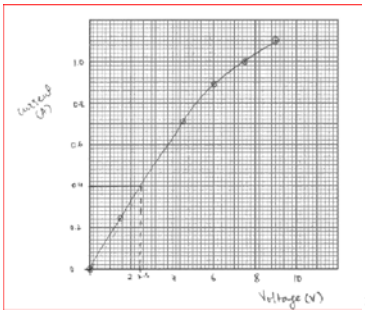
Total 11 marks

Question number	Answer	Notes	Marks
8 (a) (i)	gravitational potential energy = mass x g x height	Allow symbols and rearrangements, e.g. GPE = m x g x h	1
(ii)	Substitution into correct equation; Calculation; e.g. GPE = 2.75 x 10 x 0.61 = 17 (J)	16.8, 16.775, 16.78 (J) allow calculation with g = 9.81 =16.46 (J)	2
(iii)	Any two of- MP1. idea that system is inefficient OR not 100% efficient; MP2. idea that energy is lost / wasted / dissipated ; MP3. explanation /detail of fate of energy; e.g. used when working against {friction / drag / air resistance} as thermal energy to parts of the apparatus or surroundings transferred to surroundings by sound converted into KE as mass fell	condone used / transferred elsewhere Need mention of 'object' Ignore light allow to overcome friction allow heat for thermal energy	2
(iv)	Substitution into correct equation; Calculation; e.g. Energy transferred = 0.46 x 12.7 x 1.3 7.6 (J)	allow answer without working or equation seen (7.5946)	2
(b)	three of the following ideas- MP1. water has (initial) GPE; MP2. KE of (moving) water; MP3. Work done on turbine / generator; MP4. Work done against magnetic force; MP5. Electrical energy/power/current/voltage (produced);	allow KE in turbine / generator	3

Total 10 marks

Question number	Answer	Notes	Marks
9 (a) (i)	density = $\frac{\text{mass}}{\text{volume}}$	Allow symbols and rearrangements, e.g. $\rho = m / V$	1
(ii)	substitution into correct equation; calculation; matching unit; e.g. Density = 138 ÷ 16.3 = 8.47 g/cm^3	8.466, 8.5	3
(b)	B (incorrect and slightly too small)		1

Total 5 marks

Question number	Answer	Notes	Marks
10(a)	any 3 mistakes identified from MP1. cells are connected with wrong polarity; MP2. ammeter is connected in parallel (with wire); MP3. voltmeter is connected in series (with wire); MP4. circuit has not got a switch;	allow RA for any MP allow idea that meters should be swapped for two marks (MP2 and MP3)	3
(b) (i)	suitable scale chosen (> 50% of grid used); axes labelled with quantities and unit; plotting correct to nearest half square (minus one for each plotting error) ;; line of best fit through zero;  = 4 not curve mark  = 5	only scales in 1,2,5,10 or 8 acceptable orientation unimportant points must be shown clearly i.e. two plotting errors = no marks for plotting i.e. smooth curve I V 0.0 0. 0.2 1. 0.7 4. 0.8 6. 1.0 7. 1.1 9.	5
(ii)	0.40 A	range 0.39 A to 0.41 A	1
(iii)	One of - MP1. Temperature (of wire) was not constant; MP2. Resistance (of wire) was not constant;		1

Question number	Answer	Notes	Marks
10 (b) (iv)	Any four of -	ignore all details about the circuit already given	4
	MP1. instrument to measure temperature;		
	MP2. means to maintain constant temperature (of wire);	e.g. water bath, switch off and allow wire to cool	
	MP3. use of V = IR;	V ∝ I	
	MP4. idea of repeating / averaging (at same temperature);	obtain a range of values (of V, I)	
	MP5. idea of additional (interpolated) points;		
	MP6. use linear part of the graph;	Allow reference to candidate's graph, e.g. current below 0.6 A	
	MP7. use of gradient;	Orientation unimportant	

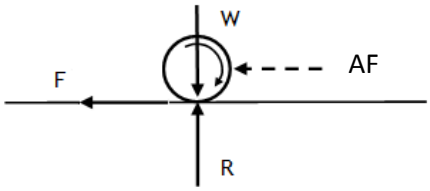
Total 14 marks

Question number	Answer	Notes	Marks
11 (a)	D;		1
(b)	Any four of - MP1. mention of ray box/pins; MP2. Use of protractor; MP3. (vary *i* to) obtain a range of values; MP4. statement of equation; $n = \frac{\sin i}{\sin r}$ MP5. plot a graph of sin *i* against sin *r*; OR calculate/work out/ find *n*; MP6. find gradient of graph; OR calculate average of n; MP7. sensible experimental precaution; OR improvement to a basic method;	ignore reference to critical angle allow Snell's Law equation in words allow correct use of A and D from diagram including – • draw lines with a ruler, • use a thinner beam/slit, • use a monochromatic beam, e.g. red, • fix block firmly in position, • set any anomalous readings aside, • use a sharp pencil, • use a more precise protractor e.g. to ½°	4

Total 5 marks

Question number	Answer	Notes	Marks
12 (a)	Terminal (velocity / speed);	allow bald 'terminal'	1
(b)	Any four of - MP1. weight acts downwards; MP2. drag/friction acts upwards; MP3. Idea that forces are balanced; MP4. reference to $f_{(R)} = ma$; MP5. Idea that when forces are balanced then acceleration is zero; MP6. constant velocity = no acceleration;	ignore • motion before terminal velocity • gravity allow • force of gravity • air resistance • acts to oppose motion • drag = weight • force up = force down • no resultant force Allow answers in terms of N I forces may be shown on diagram	4

Total 5 marks

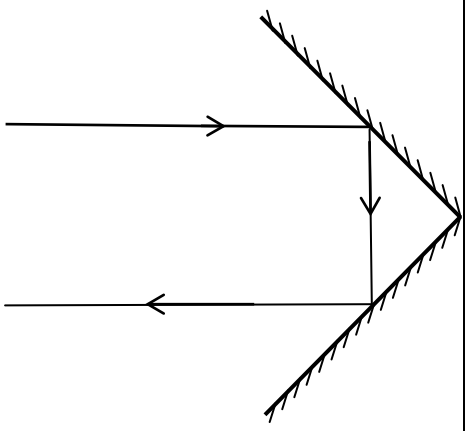
Question number	Answer	Notes	Marks
13 (a) (i)	Any two of -	In MP1, 2 & 3, position of arrows unimportant, but direction must match label Allow initial letters as shown in example	2
	MP1. arrow downwards, labelled weight;	ignore • gravity allow • mg • force of gravity	
	MP2. arrow upwards, labelled reaction/contact force; MP3. arrow to the left, labelled air friction / air resistance / drag;	• arrow drawn on left or right	
	MP4. arrow along the surface, labelled friction;	Accept arrow in either direction for MP4	
	e.g. 	N = normal contact force	
(ii)	Any three of -	ignore stem allow	3
	MP1. friction/resistance /drag (acts); MP2. (there is an) unbalanced force;	• resistive forces > {forward/driving} force • there is a resultant force	
	MP3. (hence) ball decelerates;	• its momentum changes • accelerates	
	MP4. reference to $f_{(R)} = ma$; MP5. (kinetic) energy dissipates / fate of energy discussed;		
(b) (i)	idea that friction is (much) less in the air;	allow • RA • no contact / ground friction • less energy lost	1

Question number	Answer	Notes	Marks
13 (c) (i)	KE = ½ mv^2;	Words or symbols	1
(ii)	Conversion to kg; Substitution into correct equation; Rearrangement; Evaluation; e.g. 45 g = 0.045 kg (or 1 kg = 1000 g etc) 36 = ½ x 0.045 x v^2 v^2 = $\frac{2 \times 36}{0.045}$ (= 1600) 40 (m/s)	allow • 1000 seen • steps in any order • correct answer with no working for full marks • up to 3 marks for use of 45 kg →1.26 (m/s)- working must be seen	4
(iii)	Any one of- • (Hit the ball transferring) more energy; • (Hit the ball with) more velocity; • (Hit the ball with) more speed; • (Hit the ball with) more force;	Ignore • harder • power Allow • momentum • keep contact for a larger part of the swing • go to a place where g is less (e.g. on the moon) • hit ball at a steeper angle / vertically (e.g. use a more lofted club)	1

Total 12 marks

Question number	Answer	Notes	Marks
14 (a) (i)	any two ideas from:- MP1. voltage / current is <u>induced</u>; MP2. (because) field in coil is changing / field (lines) cut; MP3. current/voltage changes direction when magnet does; MP4. magnet slows down causing decrease in amplitude;	allow voltage for amplitude	2
(ii)	Either of - (voltage/current) changes direction; Positive <u>and</u> negative (voltage/current);	Ignore “wave”	1
(iii)	any two of - MP1. direction of magnet changes; MP2. amount of field (lines) cut changes / rate of flux cutting; MP3. direction of flux cutting changes; MP4. speed of magnet changes / slows down; MP5. as movement diminishes, so does voltage;		2
(b)	Any three of - MP1. Alternating trace that diminishes; MP2. Amplitude is larger; MP3. Frequency is lower;		3

Total 8 marks

Question number	Answer	Notes	Marks
15 (a)	Reflection at first surface correct; Ray emerges parallel; 	Judge diagram by eye	2
(b)	rearrangement and correct substitution; factor of 2 taken into account; value given to at least 2 significant figures; e.g. Time to reach moon = ½ x 2.6 = 1.3 (s) Distance = time x speed = 1.3 x 300 000 = 390 000 (km) OR Total distance = 2.6 x 300 000 = 780 000 So distance to moon = ½ x 780 000 = 390 000 (km)	working must be shown Reverse argument (starting with 400000 km) allow 2 max	3

Question number	Answer	Notes	Marks
15 (c) (i)	Any three of - MP1. idea that distance from Earth to Moon varies; MP2. idea that orbit of Moon is not (quite) circular; MP3. idea that change is cyclic / is regular / takes (about) a month; MP4. idea that Earth is not (quite) at centre of (moon) orbit; MP5. appropriate <u>use</u> of time data; MP6. appropriate calculation of a distance;	allow • further/nearer • orbit elliptical • orbit radius varies • sinusoidal • 26.5 / 27 days E.g. largest time difference = 2.70 – 2.47 = 0.23 s e.g. $\Delta s = ½ \times ct$ $= ½ \times 3 \times 10^8 \times 0.23$ = 34 500 km	3
(ii)	Any one of - MP1. (average) moon orbit radius becomes larger; MP2. moon moving away (from Earth); MP3. gravitational force (or gravity) becoming weaker;	Allow reverse argument	1

Total 9 marks

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