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Mark Scheme (Results)

January 2014

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

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

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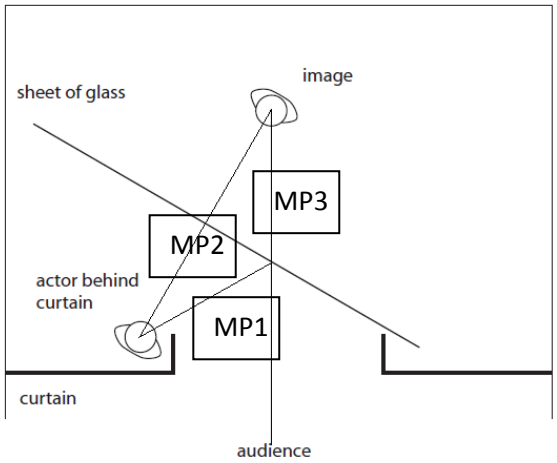
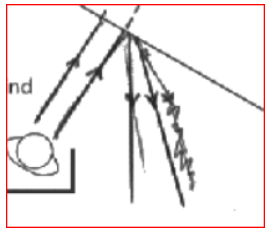
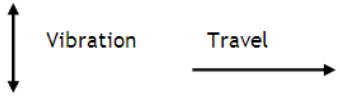
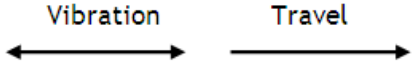
General Marking Guidance

- 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)		C (the walls)		1
	(b)		D (40%)		1
	(c)	(i)	Any two of – • Fibres are good insulators / bad conductors; • Air is a bad conductor / good insulator; • Because air particles are widely spaced; • conduction requires solids/does not occur in gases;	no marks for • 'air is trapped' as is given in stem • conduction/convection mechanism described e.g. air can't convect up through layers	2
		(ii)	stopping /reducing (formation of) convection <u>currents</u>; air in the insulation can't move/eq;	allow air is trapped fibres prevent movement of air	2

Total 6 marks

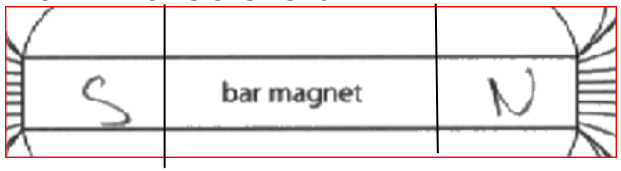
Question number			Answer	Notes	Marks
2	(a)		MP1. Ray <u>reflects</u> correctly (by eye, any ray straight down the page (allow +/- 10°), ignore horizontal displacement); MP2. Normal shown / construction line between actor and image; MP3. Reflected ray projecting back to image;	  not spread out from 1 point for MP1	3
2	(b)		any one from: cannot be formed on a screen/eq ; rays do not actually come from there ; rays {diverge/don't actually cross} after reflection; image formed by extension (backwards) of light rays	ignore what is seen in a mirror not real properties of image in mirror, e.g. inverted, same distance	1

	(c)	(i)	Any suitable example; e.g. sound, ultrasound, deep water waves	Allow seismic (P-) waves, waves in a (slinky) spring	1
		(ii)	vibrations/oscillations are parallel or perpendicular; To direction of energy transfer/ direction of travel; Correct identification of both types;	allow vibrations up and down for perpendicular vibrations back and forward for parallel Accept suitably labelled diagrams a correct description of either wave = 2 marks e.g. Transverse:  Longitudinal:  ignore: examples of either type of waves if no other mark, accept descriptions of pressure changes or clear diagram(s) showing compression and rarefaction for 1 mark only	3

Total 8 marks

Question number			Answer	Notes	Marks
3	(a)	(i)	power = voltage x current;	Accept rearrangements and symbols e.g. current = power ÷ voltage, P=IV, I=P/V ignore a triangle mnemonic an eqn in units	1
		(ii)	2.9 (A);	Accept 2.92 (A), 2.916 (A)	1
	(b)	(i)	Any three of : MP1. if current gets too high/exceeds 13A or a set value; MP2. fuse (wire) melts / breaks; MP3. breaking circuit / switching off; MP4. prevents cable over heating;	allow: fuse blows stops current /flow of electrons	3
		(ii)	any one of: MP1. cable can't be fully extended; MP2. limits the use of the extension cable; MP3. can't exceed 1200 W; MP4. can't reach 10.0 (A) / max working value/eq; AND (because otherwise) 5 A fuse will blow/ will cut the power;	allow RA ignore vague comments re energy or power being too much or too high	2
		(iii)	(to prevent) the cable overheating/OWTTE;		1

Total 8 marks

Question number	Answer	Notes	Marks
4 (a)	Position of poles indicated correctly near end of magnet; S on L AND N on R ;	Allow at the end of the magnet within ¼ or either end  	2
(b)	Any suitable method, e.g. • Place plotting compass at side/end of magnet; • Mark position of end of compass; • Move end of compass needle to new mark (and repeat); OR ○ Place magnet under paper / plastic; ○ Sprinkle iron filings over; ○ Tap paper gently (to reveal pattern);	allow suitably clear diagram(s) reject for one mark 'charges' ignore comments about finding the direction of the field allow: steel dust for iron filings place for sprinkle	3

Total 5 marks

Question number			Answer	Notes	Marks
5	(a)	(i)	starting height (of the toy car);		1
		(ii)	a positive correlation between the 2 key variables, eg The higher the (starting) height, the faster the (final) speed / speed at bottom;	NB response needs to mention both key variables	1
	(b)		use a ruler or a set square ; further detail; e.g. held vertically check for zero error thickness of board taken into account avoid parallax errors	Allow suitably labelled diagram drawn in the space below perpendicular to bench	2

Question number			Answer	Notes	Marks
5	(c)	(i)	any one of the following ideas; ○ speed might have increased / changed on slope ○ car might have accelerated ○ other forces could be acting hence (she has) calculated the average speed;	accept slowed down ignore timing errors	2
		(ii)	any three from: MP1. Suitable equipment / method chosen; MP2. Detail of measuring the distance; MP3. Detail of measuring the time; MP4. Detail of experimental set-up; MP5. Speed at bottom = 2 x total distance ÷ total time (assuming constant acceleration from rest) / idea of doubling; allow MP5 independent of other marks	*Acceptable approaches, e.g.* - Light gate and data logger computer; Placed at end of ramp; With interrupter of some description on toy car; OR Attach ticker tape to car; Find the part of the tape that matches end of the ramp; Work out distance over time for a small section; OR Film with video camera; With scale marked in background; Measure from frame by frame playback; OR motion sensor(near bottom of ramp); facing up the ramp; readings taken at the bottom;	Max 3

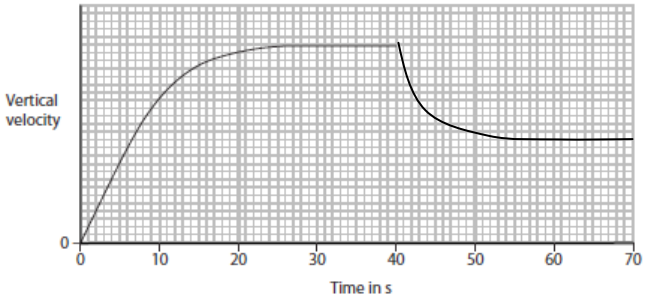
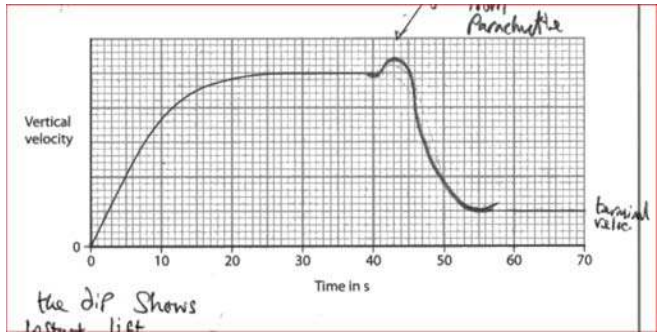
Question number			Answer	Notes	Marks
5	(d)		Any three of timing variation; distance variation /accuracy of starting position; friction effect; poor 'launch';	Acceptable ideas include- error from starting / stopping stopclock / effect of reaction time (IGNORE 'human error') car not running straight/ramp not even effect of (rolling) friction effect of air resistance/drag friction not constant car pushed at start car hits side of ramp ignore different car/changing slope height	Max 3

Total 12 marks

Question number			Answer	Notes	Marks
6	(a)		MP1. Substitution into correct equation; MP2. Rearrangement; MP3. Divide by 2; MP4. Conversion between km and m; e.g. 1.5 x 1000 = 1500 Speed = $\frac{\text{distance}}{0.26}$ Distance = 1500 x 0.26 = 390 (m) So distance to fish = 195 m	Accept x 1000 at any point in calculation 0.39 gets 2 marks 390 gets 3 marks	4
	(b)		Any two of MP1. Reflected from different depths within shoal; MP2. So (reflected pulse(s)) travels different distances; MP3. Fish move; MP4. Reflection from sea bed;		2

Total 6 marks

Question number			Answer	Notes	Marks
7	(a)	(i)	Weight = mass x g;	allow in accepted symbols ignore units, triangle eqns	1
		(ii)	700; N / newton(s);	 ignore kg m/s^2	1 1
	(b)		*EXPANATIONS (not descriptions)* Any four from: MP1. Weight / resultant force downwards; MP2. so at first (skydiver) accelerates; MP3. but drag increases with speed; MP4. hence resultant force decreases; MP5. so acceleration then decreases; MP6. so forces eventually balanced; MP7. causing terminal velocity;	 allow suitable labels on graph drag = weight allow constant speed for terminal velocity but not maximum speed	4

Question number			Answer	Notes	Marks
	(c)		Arrow up labelled drag / air resistance/air friction; Arrow down labelled weight; arrows approximately equal length;	independent marks Judged by eye throughout No requirement for arrows to be attached to centre of mass	3
	(d)		smooth reduction in velocity; to a new lower terminal/constant positive velocity; e.g. –	any line or curve except along the t = 40 s line Ignore attempts to show effects of opening the parachute or reaching the ground	2
					

Total 12 marks

Question number			Answer	Notes	Marks
8	(a)		Substitution into correct equation; Calculation; e.g. - 1.3 x 10.3 x 4.7; 63 (J);	No credit for merely quoting the equation as $E = IVt$ is given on p2. 62.9 (J)	2
	(b)	(i)	Work done = force x distance moved (in the direction of the force);	Accept rearrangements and symbols e.g. force = $\frac{\text{work}}{\text{distance}}$ W = F x d F=W/d	1
		(ii)	Substitution into correct equation; Calculation; e.g. - Work done = 20 x 0.85; 17 (J);		2
		(iii)	Value given in 8(b)(ii);	Allow GP(E)	1
	(c)	(i)	Efficiency = useful energy output divided by total energy input;	Accept efficiency in terms of work or power and percentage e.g. Efficiency = (work out / work in) x 100 %	1
		(ii)	17 divided by 63; 0.27;	Allow ecf answer from b(ii) [or (b)(iii)] divided by answer from (a) Allow 27%	2

Total 9 marks

Question number			Answer	Notes	Marks
9	(a)	Clip diagram	Any five from: Basic plan – MP1. Add (known value) masses one at a time; MP2. Measure length of the spring; MP3. Find extension; Results – MP4. Draw graph with suitable named axes; Accuracy – MP5. Detail of spring measurement, e.g. measure from same part each time/ fiducial marker; MP6. Make sure spring stationary before reading; MP7. repeat readings by taking off masses; MP8. Check value of masses on a balance; MP9. Check ruler vertical or parallel to spring/ hold ruler in clamp / avoid parallax errors;	allow suitable labelled additions to diagram Force or load or mass against extension or length	5
9	(b)		MP1. straight line only; MP2. axes labelled force/weight and extension; MP3. DOP line through origin;	units not needed, any orientation allow for 2 marks max: graph of force and length, st line with intercept	3
	(c)		returns to original length / shape; when (stretching) force is removed;		2

Total 10 marks

Question number			Answer	Notes	Marks
10	(a)	(i)	B radio waves		1
		(ii)	C Microwaves and radio waves travel at the same speed in a vacuum.		1
		(iii)	any one sensible property; e.g. travels (very) fast travel at speed of light can be coded can travel in vacuum	Allow can penetrate the ionosphere, can carry more information (than radio) higher frequency /shorter wavelength (than radio) minimal diffraction	1
	(b)		Quantities substituted in the correct equation; Rearrangement; Calculation; Conversion from hours/days to s at any point (implicit if correct ans in km); e.g. $3.1 = \frac{2 \times \pi \times r}{(24 \times 3600)}$ $r = \frac{3.1 \times 24 \times 3600}{2\pi}$ r = 42 600 km	No credit for quoting the equation as $v = 2\pi r/T$ is given on page 2. sub and rearrange in either order allow 3600 or 86 400 seen Allow 42630, 42628 Allow 42622 (from $\pi = 3.142$)	4

10	(c)		any suitable point; e.g. Satellite always appears in same part of sky satellite always about the same point on the Earth no need (for satellite dish) to track because it orbits in the same time the earth rotates	Allow idea of geostationary orbit	1

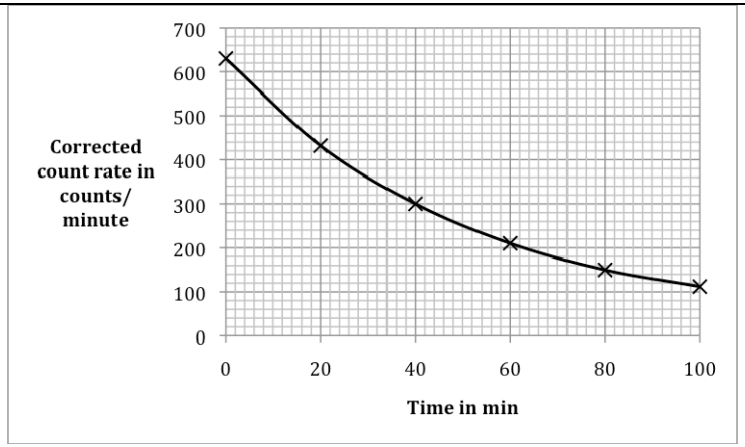
Total 8 marks

Question number			Answer	Notes	Marks
11	(a)		Electrical; Chemical / potential;		2
	(b)	(i)	Charge = current x time;	Accept rearrangements and standard symbols e.g. current = $\frac{\text{charge}}{\text{time}}$ Q = I x t I=Q/t ignore units	1
		(ii)	Substitution; Calculation; Matching correct unit i.e. coulomb/C; e.g. Q = $\frac{400 \times 3.5 \times 3600}{1000}$ 5000 C	 Allow mC Allow 5040 MAX 2 if time not converted into s (1.4, 1400, 60, 60 000,seen) POT error seen	3
	(c)		Longer (charging) time needed; Any one of P=IV; Lower current OR charge (supplied at a) lower rate; rate of charging lower/ less energy available;		2

Total 8 marks

Question number			Answer	Notes	Marks
12	(a)	(i)	Any two sources: MP1. radiation from rocks/buildings/radon gas; MP2. cosmic radiation / radiation from the Sun / stars; MP3. radiation from medical sources; MP4. nuclear waste / accidents; MP5. some foods e.g. coffee, bananas;	 Ignore : cosmic <u>microwave</u> (background) radiation /<u>cmbr</u> allow named radioactive isotopes accept fire / smoke detector	2
		(ii)	Any three of MP1. Remove the radioactive source; MP2. Measure the (background) count rate; MP3. Repeat the measurement / measure for a long time; MP4. Background radiation is 30 (counts per minute); MP5. Subtract this value from (each) reading(s);	Accept standard abbreviations e.g. cpm Allow for 2 marks: measure the count rate without the source	3

<table>
<tr><th colspan="3">Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>12</td><td>(a)</td><td>(iii)</td><td>scale; at least half the paper
axes labelled including units;
Plotting to nearest sm sq;;
Best fit line to include at least 5 points;</td><td rowspan="2">-1 each plotting error, minimum 0 for plotting

<table><tr><th>Time in min</th><th>Corrected count rate in counts/minute</th></tr><tr><td>0</td><td>630</td></tr><tr><td>20</td><td>432</td></tr><tr><td>40</td><td>300</td></tr><tr><td>60</td><td>210</td></tr><tr><td>80</td><td>150</td></tr><tr><td>100</td><td>112</td></tr></table></td><td>5</td></tr>
<tr><td></td><td></td><td></td><td> 
</td><td></td></tr>
<tr><td></td><td></td><td>(iv)</td><td>Evidence of correct graph use;
Correct value;</td><td>Allowed range is 35-42</td><td>2</td></tr>
</table>

Question number			Answer	Notes	Marks
12	(b)		correct statement about a neutron; e.g. neutron changes neutron number decreases by 1 correct statement about a proton/ atomic/ number of positive charges in nucleus; e.g. (neutron changes) into a proton proton number increases by 1 number of positive charges increases by 1	ignore : 'it becomes unstable' Accept answers in terms of quarks (down to up) or anti-neutrinos allow for 1 mark if no other mark gained: nucleus becomes another/new element it loses energy nucleus recoils reject: all implication that nucleus becomes ionised	2
	(c)	(i)	MP1. (they emit) ionising radiation; plus any one of - MP2. Cannot be seen; MP3. Can damage/harm cells; MP4. Can cause tumours / cancer;		2
		(ii)	Any three suitable, e.g. MP1. Reduce exposure time; MP2. Handle with tongs/use robotic handling/keep at distance /eq; MP3. Use shielding / work in fume cupboard /eq MP4. Wear film badge / monitor;	NB reduction of risks when WORKING with sources, not how to keep sources safe etc refs to gloves, mask etc are considered as shielding allow keep source in lead container when not in use	3

Total 19 marks

Question number			Answer	Notes	Marks
13	(a)	(i)	substitution / rearrangement; final value for volume; final value for time; e.g. 8 x 200 = V x 1 V = 1600 (litres) time = 100 (minutes)	($p_1V_1 = p_2V_2$) – no mark as given on page 2. No credit for merely quoting the equation. Allow 99 minutes (i.e. assumption that the final 16 litres not available)	3
		(ii)	Any two suitable points, e.g. MP1. pressure decreases as depth decreases; MP2. reference to p = h g; MP3. reference to pV equation (if temperature constant); MP4. additional bubbles join together as they rise; MP5. temperature increases nearer surface;		2
13	(b)	(i)	displacement method described; measure water displaced (with measuring cylinder); OR measure radius / diameter / circumference; calculate volume (with equation);		2
		(ii)	not a fair test; change of temperature / volume;	ignore 'each pump will have different pressure'	2

Total 9 marks

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