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Mark Scheme (Results)

January 2021

Pearson Edexcel International GCSE In Physics (4PH1) Paper 2P

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January 2021
Publications Code 4PH1_2P_2101_MS
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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.

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Question number	Answer	Notes	Marks
1 (a)	any two from: MP1. light waves are transverse and sound waves are longitudinal; MP2. light travels faster than sound; MP3. light can travel through vacuum but sound waves can't;	ignore references to frequency and wavelength condone 'different speeds'	2
(b) (i)	B (microwaves); A is incorrect because gamma rays have a shorter wavelength than infrared C is incorrect because ultraviolet rays have a shorter wavelength than infrared D is incorrect because visible light waves have a shorter wavelength than infrared		1
(ii)	B (heating lamps); A is incorrect because ultraviolet rays are used in fluorescent lamps C is incorrect because there is too much interference from the Earth for infrared to be used for satellite transmissions D is incorrect because gamma rays are used to sterilise medical equipment		1
(iii)	D (skin burns); A is incorrect because infrared is not absorbed by the retina B is incorrect because infrared is non-ionising C is incorrect because infrared cannot penetrate into the body to cause internal heating		1

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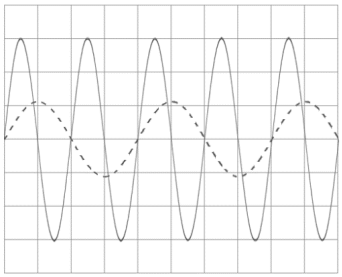
(c)	trace drawn with higher amplitude throughout; trace drawn with higher frequency throughout; e.g. 	allow variable amplitude allow variable amplitude	2

Total for Question 1 = 7 marks

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<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>2 (a)</td><td>2;</td><td></td><td>1</td></tr>
<tr><td>(b)</td><td>all rows correct;;
any 2 rows correct;
e.g.
<table><tr><th>Constituent</th><th>Parent nucleus</th><th>Daughter nucleus</th></tr><tr><td>strontium-94</td><td></td><td>✓</td></tr><tr><td>uranium-236</td><td>✓</td><td></td></tr><tr><td>xenon-140</td><td></td><td>✓</td></tr></table></td><td></td><td>2</td></tr>
<tr><td>(c)</td><td>any two from:

MP1. neutrons absorbed by another <u>nucleus</u>;
MP2. uranium-235 named;
MP3. <u>nucleus</u> splits, releasing more neutrons (and process repeats);</td><td>do not penalize use of atom for nucleus for more than one mark</td><td>2</td></tr>
</table>

Total for question 2 = 5 marks

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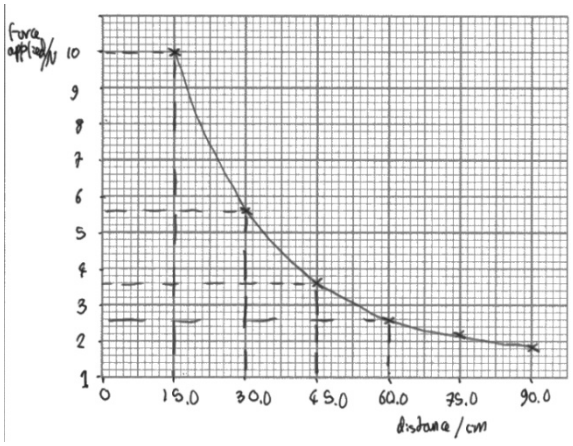
Question number	Answer	Notes	Marks
3 (a)	(metre) rule(r)/(metal) tape measure;	allow (Vernier) caliper(s)	1
(b) (i)	3.6;	allow 3.7	1
(ii)	idea that the reading would be larger than the range of the instrument;		1
(c) (i)	suitable linear scale chosen (>50% of grid used); axes labelled with quantities and units; plotting correct to nearest half square;  	ignore plotting of 45cm point	3
(ii)	line (curve) of best fit acceptable;	allow ECF from plotting i.e. smooth curve with points evenly distributed about it	1
(d)	any four from: MP1. as distance increases, **force** decreases; MP2. (because) moment = force x distance; MP3. any one calculated moment value from results table or graph; MP4. a second calculated moment value from results table or graph; MP5. evidence shows moments are not all the same; MP6. (but) no pattern in the data (so could be attributed to experimental errors);	no mark for simply 'student is right/wrong' allow evidence shows moments are similar allow consistent conclusion i.e. variation isn't large enough	4

Total for Question 3 = 11 marks

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Question number	Answer	Notes	Marks
4 (a) (i)	idea that it will run out / cannot be replaced;	ignore renewed/re-used	1
(ii)	any two correct readings taken from graph; evaluation of total; e.g. (proportion =) 27.5 + 35 + 19.5 (proportion =) 82 (%)	 allow 81-83 (%)	2
(b)	a named effect e.g. global warming, acid rain; a named pollutant e.g. carbon dioxide, sulphur dioxide, nitrogen (di)oxide;	 -1 for incorrectly linked effect and pollutant	2
(c) (i)	correct reading of solar from graph; evaluation; e.g. solar = 1.5% (solar output = $0.015 \times 4.76 \times 10^{11}$ =) $7.1(4) \times 10^{9}$ (W)	seen anywhere in working	2
(ii)	correct use of ratio; evaluation; e.g. land area = 4.76×10^{11} / 250 (land area =) 1.90×10^{9} (m^2)	 allow $1.904\ldots \times 10^{9}$ (m^2)	2
(iii)	any three from: MP1. land area needed is much less than total land area of USA / there is enough space; MP2. land area needed is (much) less than 1% of total land area; MP3. idea that Sun doesn't shine all the time; MP4. idea that some areas of land may not be suitable for solar power;	no mark for simple yes/no for suitability allow ecf from (ii) also scores MP1 allow idea of competing land uses e.g. housing/agriculture	3

Total for question 4 = 12 marks

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Question number	Answer	Notes	Marks
5 (a) (i)	(soft) iron;	accept other suitable ferromagnetic materials	1
(ii)	input power = output power; OR primary voltage × primary current = secondary voltage × secondary current;	allow • formula in words or symbols • standard abbreviations: i.e. s, p, in, out, 1, 2	1
(iii)	substitution; rearrangement; evaluation; e.g. 275 000 × I_p = 230 × 95 (I_p =) 230 × 95 / 275 000 (I_p =) 0.079 (A)	 -1 for POT error 79.45…(A) scores 2 marks allow 0.07945…	3
(b)	any five from: MP1. step-up transformer used before transmission; MP2. voltage is increased before transmission; MP3. current is reduced before transmission; MP4. less heating in transmission cables; MP5. less energy wasted in transmission cables; MP6. step-down transformer used after transmission; MP7. voltage is decreased after transmission **for safety**;	allow any mark if clear from diagram	5

Total for question 5 = 10 marks

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Question number	Answer	Notes	Marks
6 (a)	W marked between +10 and +15 absolute magnitude and between blue and white/yellow colour marks;		1
(b)	X marked between 0 and -5 absolute magnitude and between yellow/red and end of colour scale;		1
(c)	Y marked above and to the left of the Sun;	judge by eye	1
(d)	Z marked vertically in line with and below the Sun;	judge by eye	1
(e)	Any one from: MP1. idea that the Moon does not emit its own light; MP2. Idea that the Moon is not a star MP3. idea that the (surface) temperature of the Moon is too low / does not fit on the scale;		1

Total for Question 6 = 5 marks

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Question number	Answer	Notes	Marks
7 (a)	substitution into momentum = mass × velocity; evaluation; e.g. p = 0.0041 × 0.15 (p =) 0.00062 (kgm/s)	allow use of standard symbols e.g. p = m × v -1 for POT error allow decimal or standard form allow 0.000615	2
(b)	velocity of ball increases; momentum increases;	allow ball speeds up	2
(c)	substitution into F = (mv – mu) / t; rearrangement; evaluation; e.g. 1.3 = 0.0041 × v (– 0) / 0.0025 (v =) 1.3 × 0.0025 / 0.0041 (v =) 0.79 (m/s)	 -1 for POT error allow 0.79268…	3

Total for Question 7 = 7 marks

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Question number	Answer	Notes	Marks
8 (a)	(force to the) right; (because) opposite charges attract / like charges repel;	allow 'towards the positive plate" or "away from the negative plate"	2
(b)	line drawn showing the ink drop deflecting to the right of the centre and hitting paper below; line drawn starts vertical and becomes increasingly more curved as the ink drop moves towards paper;	allow ECF from (a) if direction of force to the left DOP	2
(c) (i)	substitution into force = mass × acceleration; rearrangement; evaluation; e.g. $8.5 \times 10^{-7} = 1.1 \times 10^{-10} \times a$ (a =) $8.5 \times 10^{-7} / 1.1 \times 10^{-10}$ (a =) 7700 (m/s^2)	-1 for POT error allow 7727.27…	3
(ii)	use of $v^2 = u^2 + (2 \times a \times s)$; substitution OR rearrangement; evaluation in metres; conversion to mm; e.g. $v^2 = u^2 + (2 \times a \times s)$ $3.9^2 = 0 + (2 \times 7700 \times s)$ OR $s = (v^2 - u^2) / 2a$ (s =) 9.9×10^{-4} (m) (s =) 0.99 (mm)	can be implied from substitution allow ECF from (i) independent mark award if correct conversion attempted on incorrect answer allow 9.8×10^{-4} - 9.9×10^{-4} allow 0.98 - 0.99	4
(d)	idea of swapping polarities of plates; idea of increasing the amount of charge on plates;	allow positively charging ink drop allow increasing amount of charge on ink drop allow decreasing {mass or volume} of the ink drop	2

Total for Question 8 = 13 marks

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