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Mark Scheme (Results)

Summer 2019

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

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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)	B – gravitational; A is incorrect because there are no charges C is incorrect because there are no magnetic fields D is incorrect because nuclear forces are short range		1
(b)	D – universe; A is incorrect because the universe contains billions of galaxies B is incorrect because each solar system contains several planets C is incorrect because galaxies contain billions of stars		1
(c)	A – absolute magnitude; B is incorrect because colour determines the surface temperature of a star C is incorrect because diameter determines the power of a star D is incorrect because temperature determines the power of a star		1

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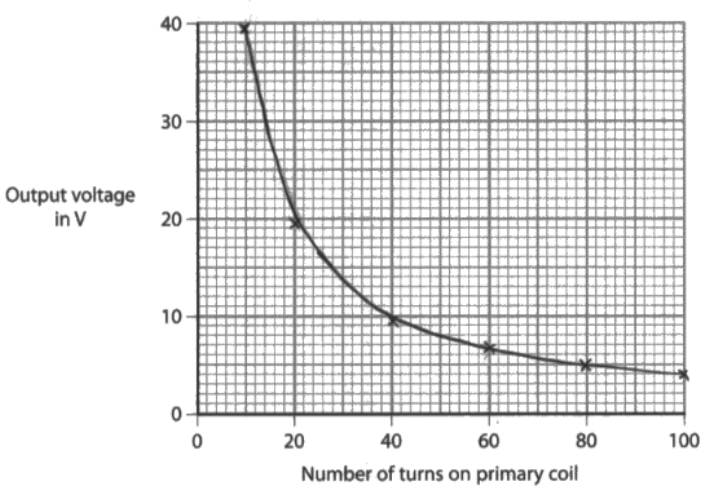
<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>2 (a) (i)</td><td>Points plotted to within half a small square;
<table><tr><th>Number of turns on primary coil</th><th>Output voltage in V</th></tr><tr><td>10</td><td>39.6</td></tr><tr><td>20</td><td>19.7</td></tr><tr><td>40</td><td>9.9</td></tr><tr><td>60</td><td>6.6</td></tr><tr><td>80</td><td>5.0</td></tr><tr><td>100</td><td>4.0</td></tr></table>
</td><td>Points should lie on a very good curved line.</td><td>1</td></tr>
<tr><td>(ii)</td><td>Best fit line is smooth curve;</td><td>ECF their data points.</td><td>1</td></tr>
<tr><td>(iii)</td><td>As number of (primary) turns increases, (secondary) voltage decreases;

At a decreasing rate/is non-linear;</td><td>Allow RA

Allow unqualified ‘inversely proportional’ for 2 marks.

Ignore:
‘negative exponential’</td><td>2</td></tr>
</table>

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b)	(i)	$(N_p/N_s) = (V_p/V_s)$;	Allow any correct rearrangment. Allow ”i(nput) and o(utput)” or “1 and 2”for “p(rimary) and s(econdary)”. Allow correct word equation. Ignore ‘P’ for ‘N’ Condone ‘T’, ‘t’ or ‘n’ for ‘N’ Condone ‘coils’ for ‘turns’	1
	(ii)	Substitution of values for N_p, V_P and V_s ; Evaluation of N_s ; e.g. 40 / N_s = (6.8/9.9) = 0.686….; N_s = 40 /0.601.. = 58(.2….) ;	Allow any row of data from table or co-ordinates for a point on the line on the graph Accept answer in range 57-60. Accept non-integer number of turns.	2

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Question number	Answer	Notes	Marks
3 (a)	Any FIVE from:	A fully labelled diagram can score all the marks.	5
	MP1. measure time for a set distance;	allow measuring wavelength for a known frequency	
	MP2. realistic values suggested for experiment to work;	e.g. • at least 1m for microphones and oscilloscope method • at least 100m for seeing and hearing a clap method • at least 50m for wall and echo method • wavelength measured at least 10cm	
	MP3. suitable measuring instrument named;	e.g. stop clock, stopwatch, ruler, tape measure, oscilloscope, trundle wheel, timer	
	MP4. further detail of setup;	e.g. • two microphones on bench connected to oscilloscope • start timing when see a clap and stop when hear it • clap by wall and time how long for clap to come back • moving a microphone until waveforms line up on oscilloscope • For echo method, idea time and distance is “there and back”	
	MP5. idea of repeats **AND** average;		
	MP6. speed = distance / time;	allow speed = frequency × wavelength for appropriate method	

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(b)	(i)	Measurement of one period on oscilloscope; Use of x-scale; Evaluation of period in s; e.g. Period = 4 squares Period = 4 x 0.25 (ms) Period = 1.0×10^{-3} (s)	 -1 POT error Allow 1 SF answer Condone period = 0.0005 (s) or 0.002 (s) or in standard form for 2 marks MAX.	3
	(ii)	Substitution into given equation f = 1/ T; Evaluation; i.e $f = 1/(1.0 \times 10^{-3})$ f = 1000 (Hz)	Allow ECF from b) (i)	2

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Question number	Answer	Notes	Marks
4 (a)	A helium **nucleus** / 2 protons and 2 neutrons/ 4 nucleons, 2 protons;	Ignore chemical symbol	1
(b) (i)	Arrow labelled Y, through X away from nucleus; Line of action of force would pass through centre of nucleus by eye;		2
(ii)	Arrow labelled Z, opposite direction to their answer from b) (i) by eye; Same size as their answer from b) (i) by eye;	If no arrow Y, condone correct direction for arrow Z, i.e. force arrow pointing away from point X.	2
(iii)	MP1 Force on alpha is repulsive; MP2 Alpha and nucleus must be same (type of) charge; MP3 Alpha is positive **therefore** nucleus is positive;	Allow 'like charges repel' for MP1 and MP2	3
4 (c)	Selection of F = ma; Substitution or re-arrangement; Evaluation; e.g. $a = 3.6 / 6.6 \times 10^{-27} = 5.5 \times 10^{26}$ m/s^2	Can be implied from working -1 for PoT error Allow 5.45×10^{26}, 5.454×10^{26}, $5.4545... \times 10^{26}$ etc Condone 5.4×10^{26}	3

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Question number	Answer	Notes	Marks
5 (a)	An arrow drawn from left to right by eye;		1
(b)	Comparative statements for side containing A: Wavefronts closer together/EQ; (therefore) wavelength smaller; Same speed; (v = f x λ so) frequency larger;	Allow RA for B Allow e.g."waves more compressed together" Condone mention of the Doppler effect for 1 mark if no other mark scored.	4

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Question number	Answer	Notes	Marks
6 (a) (i)	Substitution (including conversion of time to seconds); Re-arrangement of given equation P = W/t; Evaluation; e.g. Energy = 75 x (22 x 60) = 99 000 (J)	 Allow W or E for energy or work. Can be implied from their working. Accept 1650 or 5.9 million for 2 marks.	3
(ii)	Any ONE assumption from • dog does not change temperature • dog does not change power output • rate of transfer is constant (despite increase in temp of water) • no heating of outside world/surroundings/material of bag • no heating from the surroundings	 Ignore unqualified '100% efficient' or 'no energy lost'	1
(iii)	Use of Q = m x c x $\Delta\theta$; Substitution of their energy, mass, c; Evaluation of temp change; Calculation of final temp = temp change + 16; e.g. 99 000 = 8.7 x 4200 x $\Delta\theta$ temp rise = 99 000/(8.7 x 4200) = 2.7 final temp = 19 (^{o}C);	 Allow ECF from (a)(i) Allow ECF from evaluation of temp change. Accept 16.04... for all marks (ecf E without min->s conversion) Accept answer to 3 or more sf i.e 18.7	4

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(b)	Any THREE from MP1 Dog and water are at different temperatures; MP2 Dog and water in physical contact so likely to be conduction; MP3 No movement of particles from dog to water, so not convection / EQ; MP4 Dog and bag are both solids, so convection impossible; MP5 Not much radiation as dog and water similar temperatures;	Allow "no gap between dog and bag so no convection"	3

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Question number	Answer	Notes	Marks
7 (a)	Cosmic Microwave Background Radiation (CMBR) (Cosmological) Red shift of <u>galaxies</u>	Allow one missing word Accept reference to Hubble's Law. Allow higher level idea of ratio of hydrogen to helium as alternative to either marking point.	2
(b)	<u>CMBR</u> MAX TWO from MP1 CMBR appears to be the same in all directions/is everywhere; MP2 Which implies all parts of the Universe were in contact a long time ago; MP3 Wavelength has increased as the universe has expanded; MP4 universe was (significantly) hotter long ago; <u>Red Shift of Galaxies</u> MAX TWO from MP5 The further the galaxy is from Earth, the greater the red-shift; MP6 The greater the red-shift, the faster the galaxy is moving away; MP7 Speed of galaxies increases (is directly proportional to) with increased distance; MP8 Relationship between speed and distance implies expansion from a single point or since the Big Bang;	Allow implication of idea of coming from single point Allow frequency has decreased Allow RA Condone "star" for "galaxy" for MP5 Allow 'red shift' for 'speed of galaxies' Allow 'galaxies moving apart from each other' for 'relationship between speed and distance'	4

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Question number	Answer	Notes	Marks
8 (a)	Centre of gravity;	Accept 'Centre of Mass'	1
(b) (i)	Moment = force x (perpendicular) distance;	Condone M = f x d	1
(ii)	Any correct moment; i.e. 2.1 x 0.28 or W x 0.032 Evidence of use of principle of moments; i.e. 2.1 x 28 = W x 3.2 Re-arrangement ; i.e. W = 2.1 x 28 /3.2 Evaluation; W = 18 (N)	Allow calculation performed in cm Accept unrounded 18.375, 18.4 N. Condone for 1 mark statement of principle of moments.	4

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Question number	Answer	Notes	Marks
9 (a) (i)	Selection of P=F/A; Conversion of g to kg; Evaluation of weight; Evaluation of pressure; Correct answer: 140 (Pa) i.e. $W = 3.7 \times 10^{-3} \times 10 = 3.7 \times 10^{-2}$ N; $P = 3.7 \times 10^{-2} / (2.6 \times 10^{-4})$; P = 140 (Pa);	 0.0037 seen anywhere Accept any value that rounds to 140. i.e 142, 142.3, Accept use of 9.8(1) for 'g', giving 139(.46)	4
(ii)	Same weight (and larger cross-sectional area); P=F/A so smaller pressure;	Allow 'force' for weight	2
(b)	Increases continuously from -10 °C to 0 °C; Remains constant at 0 °C; Increases continuously from 0 °C to 20 °C;	Responses with no period of time at 0 °C score max 1 mark. Accept • Any gradient • Straight lines or curves for the increasing temperature parts • Any non-zero amount of time at 0 °C by eye Ignore any numbers on the time axis.	3
(c)	Any TWO from: Bonds between particles are weakened or broken; Particles go from regular to irregularly packed/EQ; Particles go from vibrating (about a fixed position) to sliding past each other/EQ;	 Allow particles get (slightly) further apart/EQ; ignore references to KE	2

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