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Mark Scheme (Results)

January 2020

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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<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>1 (a)</td><td>1 mark for each correct tick;;;

<table>
<tr><th>Methods of generating electricity</th><th>Uses a renewable energy resource</th></tr>
<tr><td>coal power station</td><td></td></tr>
<tr><td>diesel generator</td><td></td></tr>
<tr><td>geothermal power station</td><td>✓</td></tr>
<tr><td>hydroelectric power station</td><td>✓</td></tr>
<tr><td>natural gas turbine</td><td></td></tr>
<tr><td>nuclear power station</td><td></td></tr>
<tr><td>solar cell</td><td>(✓)</td></tr>
<tr><td>wind turbine</td><td>✓</td></tr>
</table></td><td>4 candidate ticks = 2 marks max.
5-6 candidate ticks = 1 mark max.
7 candidate ticks = 0 marks</td><td>3</td></tr>
<tr><td>(b) (i)</td><td>B (by radiation);

A is incorrect because transfers by heating cannot take place through space
C is incorrect because there are no electrical conductors between the Sun and the panel
D is incorrect because it requires particles that are not present in the vacuum of space</td><td></td><td>1</td></tr>
<tr><td>(ii)</td><td>any 1 of:
MP1. only generates electricity when it is sunny / eq;

MP2. idea of visual pollution;

MP3. idea that solar panels take up a lot of space;</td><td>allow not generating electricity at night
ignore ‘depends on the weather’

Condone ‘ugly’</td><td>1</td></tr>
</table>

Total for Question 1 = 5 marks

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Question number	Answer	Notes	Marks
2 (a)	density = mass / volume;	allow standard symbols and rearrangements e.g. ρ = m / V condone use of d for density	1
(b)	substitution OR rearrangement; evaluation; unit; e.g. 8.46 = 454 / V OR V = m / ρ (V =) 53.7 cm^3	equation must be correct -1 for POT error allow m^3 only if consistent with data used 53.664… 5.37×10^{-5} m^3 gains 3 marks	3

Total for Question 2 = 4 marks

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Question number	Answer	Notes	Marks
3 (a) (i)	momentum = mass × velocity;	allow standard symbols and rearrangements e.g. p = m × v reject use of m for momentum	1
(ii)	substitution; evaluation to 2 or 3 s.f.; e.g. (p =) 17 × 2.9 (p =) 49 (kg m/s)	 allow 49.3 (kg m/s)	2
(b) (i)	use of conservation of momentum; momentum of stone A after collision calculated; momentum of stone B after collision calculated; evaluation of velocity of stone B; e.g. momentum before = momentum after p_A = (17 × 0.4 =) 6.8 p_B = (50 – 6.8 =) 43.2 (v_B = 43.2 / 19 =) 2.3 (m/s)	seen written explicitly or implied by working allow, for 1 mark only, "(total) momentum before = (total) momentum after" if no other marks scored. allow 42.5, 42.2 from non-rounded values for (a) allow 2.27… (m/s) allow 2.22…, 2.23…	4
(ii)	conversion of ms to s; substitution into F = Δp / t; evaluation of force; e.g. t = 0.025 s F = 43.2 / 0.025 (F =) 1700 (N)	allow ÷1000 / 0.025 seen anywhere in working no mark for formula alone as given in paper 2 marks max. for POT error e.g. 1.7 (N) allow ecf from (b)(i) allow answers in the range 1688-1728 accept, in full, responses including use of 'F = ma' provided correct values for u, v and Δt to calculate a.	3

Total for Question 3 = 10 marks

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Question number	Answer	Notes	Marks
4 (a)	any four of: MP1. idea of friction/rubbing (between powder and funnel/plastic tubing); MP2. powder becomes charged; MP3. metals are conductors; MP4. charge is transferred to/from metal rod and thin piece of metal; MP5. metal rod and thin piece of metal have the same charge; MP6. therefore they repel / eq;	 ignore whether positive or negative charge allow electrons transferred	4
(b) (i)	A (gains negatively charged electrons); B is incorrect because it would leave the metal can positively charged C is incorrect because electrons are not positively charged D is incorrect because electrons are not positively charged		1
(ii)	charge = current $\times$ time;	allow standard symbols and rearrangements e.g. $Q = I \times t$ reject use of C/c for charge or current	1
(iii)	substitution; rearrangement; evaluation; e.g. (-) 9.4×10^{-9} = current $\times$ 12 (current =) (-) 9.4×10^{-9} / 12 (current =) (-) 7.8×10^{-10} (A)	 -1 for POT error $7.83\ldots \times 10^{-10}$ (A)	3
(c)	any three of: MP1. any relevant danger; MP2. idea that metal can/aircraft should be earthed; MP3. charge will flow to/from ground; MP4. idea that no charge will build up on metal can/aircraft;	 e.g. spark, explosion, fire allow description of earthing e.g. 'connect metal can to ground with a wire' allow addition of earth path to diagram allow idea that 'charge is neutralised'	3

Total for Question 4 = 12 marks

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Question number	Answer	Notes	Marks
5 (a)	any 4 of: MP1. connect oscilloscope to microphone; MP2. adjust the oscilloscope to get a steady trace / eq; MP3. adjust time base / oscilloscope to give a minimum of 1 complete cycle (on the screen); MP4. measure number of squares for a number of complete cycles / waves; MP5. multiply number of squares by the time base / eq. (to find T); MP6. use f = 1/T;	ignore references to wavelength, amplitude, finding number of waves passing a point allow 'use oscilloscope to measure/find the time period / time for one wave' if neither MP4 or MP5 scored	4
(b) (i)	any 1 of: MP1. force / tension (on the string); MP2. material string is made from; MP3. diameter / thickness of the string; MP4. temperature;		1
(ii)	correctly calculated mean; given to nearest whole number; e.g. 34.3… gains first mark 34 gains both marks	 mark independently	2
(iii)	suitable linear scale chosen (>50% of grid used); axes labelled with quantities and unit; <u>all</u> plotting correct to nearest half square;	ignore orientation ignore point at 60cm	3
(iv)	acceptable curve of best fit drawn;	i.e. smooth curve within 1 small square of each point ignore parts of curve outside plotted points if extrapolated	1
(v)	string length in range 26-31cm;	allow ecf from candidate's line	1
(vi)	both 120cm and 140cm strings / eq; (because) humans cannot hear frequencies lower than 20Hz;	allow correctly read string length from graph for 20Hz frequency	2

Total for Question 5 = 14 marks

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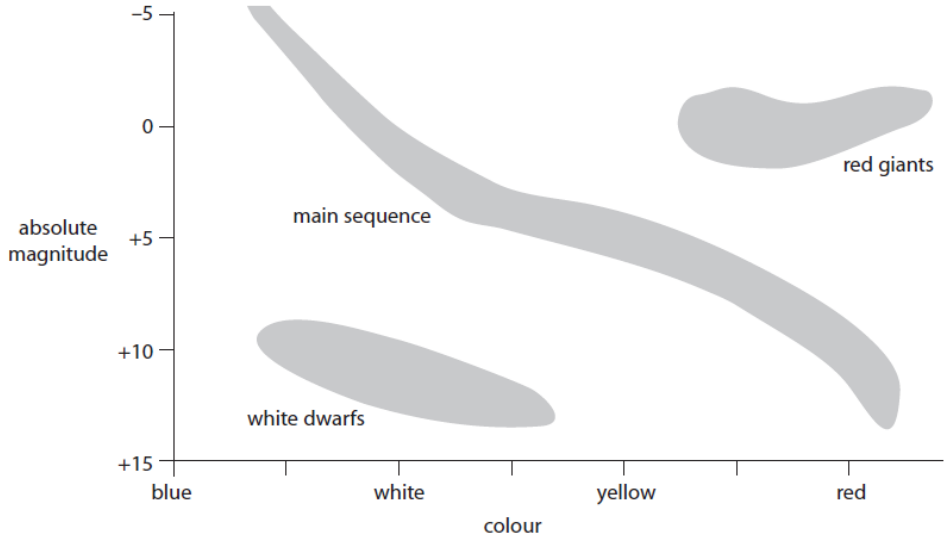
Question number	Answer	Notes	Marks
6 (a)	(a measurement of) the brightness (of a star); at a standard distance;	allow measurement of luminosity/power of a star apparent magnitude allow at 10 pc/32.6 ly. condone incorrect distance.	2
(b)	correct absolute magnitude scale; x-axis labelled 'colour'; main sequence top-left to bottom-right with clear flatter region in the middle; white dwarf region in bottom-left corner with part of it in line with 'white' label on x-axis; red giant region in top-right corner with part of it in line with 'red' label on x-axis;  	i.e. going from +15 to -5 in regular intervals condone 'temperature'	5

Total for Question 6 = 7 marks

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Question number	Answer	Notes	Marks
7 (a) (i)	(92 =) number of protons (238 =) number of nucleons / number of protons <u>and</u> neutrons	ignore atomic number allow mass ignore mass number	2
(ii)	(nucleus) loses two protons; (nucleus) loses two neutrons;		2
(b) (i)	evaluation of mass of U-238 in plate; evaluation of number of atoms; e.g. mass = $(1.1 \times 0.045) = 0.0495$ kg (n = $0.0495 / 4.0 \times 10^{-27}$ =) 1.2×10^{25}	accept 49.5 g or 0.0495 kg or correct standard form 1.2375×10^{25}	2
(ii)	any three from idea that food is irradiated / not contaminated; alpha cannot penetrate skin or body / range of alpha insufficient to reach body; contains low percentage of uranium(-238); (long half-life means that) activity will be very low / decays very slowly;	ignore references to paper Accept 'mass' for 'percentage'	3

Total for Question 7 = 9 marks

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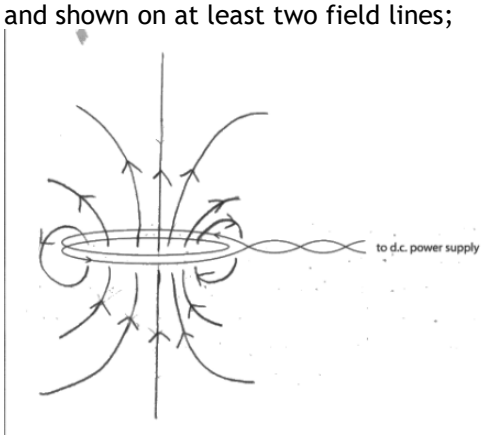
Question number	Answer	Notes	Marks
8 (a)	A (into the page); B is incorrect because this field would produce a force into the page C is incorrect because this field would produce a force to the left D is incorrect because this field would not produce a force at all		1
(b)	at least one straight, vertical central field line; at least one field line drawn circling the wire / at least one peripheral field loop; field direction correct and consistent throughout and shown on at least two field lines;  	ignore breaking of field lines as they pass through the centre of the coil judge by eye condone spiral drawn around wire DOP	3
(c) (i)	any three of: MP1. (current produces) alternating magnetic field (in charging base coil); MP2. idea that field is cut by coil in phone; MP3. voltage induced (across coil in phone); MP4. therefore current in battery (from coil in phone);	 allow equivalent words for alternating e.g. variable, changing etc. allow higher level responses in terms of flux linkage	3
(ii)	any **one** advantage; e.g. battery will charge faster / stronger magnetic field any **one** disadvantage; e.g. causes a great(er) heating effect	 condone 'greater risk of electric shock'	2

Total for Question 8 = 9 marks

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