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# Mark Scheme (Results)

## January 2021

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

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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) (i) | B – QR;<br><br>A is not correct as the substance is a solid<br>C is not correct as the substance is a liquid<br>D is not correct as the substance is boiling | | 1 |
| (ii) | A – PQ;<br><br>B is not correct as the substance is part solid, part liquid<br>C is not correct as the substance is a liquid<br>D is not correct as the substance is boiling | | 1 |
| (iii) | any **irregular**, spaced out collection of particles; | | 1 |
| (iv) | D – they move quickly and randomly;<br><br>A is not correct as this is how particles in a solid move<br>B is not correct as only particles at 0 K can theoretically be stationary<br>C is not correct as this is how particles in a liquid move | | 1 |
| (b) (i) | thermometer; | allow temperature sensor, temperature probe | 1 |
| (ii) | 80 (°C); | | 1 |
| (c) | temperature difference = 27 (°C);<br>substitution;<br><br>evaluation;<br><br>e.g.<br>ΔT = 37 - 10 = 27 (°C)<br>energy = 1.2 × 840 × 27<br>(energy =) 27 000 (J) | <br>allow ECF from incorrect temperature difference<br><br>37296, 10080 = 2 marks<br><br><br><br>allow 27216, 27220, 27200 | 3 |

**(Total for Question 1 = 8 marks)**

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| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 2 (a) (i) | centre of gravity / centre of mass; | allow centre of weight | 1 |
| (ii) | balance / newtonmeter; | allow newton scales<br>ignore scales | 1 |
| (b) (i) | moment = force × (perpendicular) distance; | allow standard symbols and rearrangements e.g. moment = F × d<br>ignore m for moment | 1 |
| (ii) | substitution;<br><br>e.g.<br>0.68 × 4.3 (= 2.924 N cm) | | 1 |
| (iii) | idea that anti-clockwise moment = clockwise moment;<br>rearrangement;<br>evaluation;<br><br>e.g.<br>2.9 = F × 11<br>F = 2.9 / 11<br>(F =) 0.26 (N) | stated or implied by working<br><br>allow ECF from (ii)<br><br>allow 0.2636...-0.2658...<br>allow 0.27<br>condone 0.263 | 3 |

**(Total for Question 2 = 6 marks)**

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| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 3 (a) | (to the) left;<br><br>(because) repulsion (due to like magnetic poles); | allow towards A, away from B<br>ignore backwards<br>reject if mention of charge | 2 |
| (b) (i) | 0.045 (kg m/s); | allow 'the same' | 1 |
| (ii) | momentum of B after collision = 0.045 – (-0.021);<br>evaluation;<br><br>e.g.<br>0.045 - −0.021<br>(momentum =) 0.066 (kg m/s) | <br><br>allow 0.024 for 1 mark<br><br>allow 0.045 + 0.021 | 2 |
| (iii) | substitution into<br>F = change in momentum / time taken;<br>evaluation;<br><br>e.g.<br>F = 0.066 / 0.19<br>(F =) 0.35 (N) | allow ECF from (ii)<br><br>use of 0.024 from (ii) gives 0.126... (N)<br><br><br><br>allow 0.347... (N) | 2 |
| (iv) | (to the) right; | allow towards B, away from A | 1 |

**(Total for Question 3 = 8 marks)**

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| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 4 (a) (i) | speed = frequency × wavelength; | allow standard symbols and rearrangements e.g. v = f × λ | 1 |
| (ii) | determination of period;<br>conversion from ms to s;<br>evaluation of frequency;<br>substitution into v = f × λ;<br><br>evaluation of speed;<br><br><br>e.g.<br>period = 4 squares<br>period = (4 × 1 =) 4 ms<br>frequency (= 1/4 × $10^{-3}$) = 250 (Hz)<br>speed = 1.4 × 250<br>speed = 350 (m/s) | <br><br><br><br>allow ECF from incorrect frequency<br>-1 for POT error<br>175, 700 (m/s) = 3 marks<br><br><br>allow 0.004 (s) | 5 |
| (b) | any five from:<br><br>MP1. reference to reaction time;<br><br>MP2. suggestion that light flash and sound may not be at the same time;<br><br>MP3. idea that distance is too short (to give accurate value);<br><br>MP4. idea that ruler is not appropriate to measure this distance;<br><br>MP5. idea of mis-counting the number of ruler lengths;<br><br>MP6. idea of zero error on ruler;<br><br>MP7. idea of ruler not going in a straight line;<br><br>MP8. idea of lack of repeats;<br><br>MP9. idea that time of travel is too short to be measured by a human; | ignore descriptions of different experimental methods<br>allow description of reaction time issues<br><br><br><br><br><br>allow suggestion that trundle wheel/tape measure should be used<br><br><br><br><br>allow ground not being level | 5 |

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|---|---|---|---|
| | | | |

**(Total for Question 4 = 11 marks)**

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| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 5 (a) | substitution into $v^2 = u^2 + 2as$;<br>rearrangement;<br>evaluation;<br><br>e.g.<br>$75^2 = (0^2 +) 2 \times 4.1 \times s$<br>s = 5 625 / 8.2<br>(s =) 690 (m) | allow alternative method of finding the time taken and then using **average** speed = distance/time<br><br>1371-1372 = 2 marks<br><br>allow 686, 685.9756… | 3 |
| (b) (i) | any two from:<br>MP1. idea of radiation that is always present / present everywhere;<br>MP2. idea of no 'obvious' source;<br>MP3. any valid source of background radiation given e.g. radon/rocks/cosmic rays/medical or military activity/the Sun etc.; | | 2 |
| (ii) | any three from:<br>MP1. idea that excessive exposure time can be harmful/increases risk;<br>MP2. idea that dosage is higher (at maximum height);<br>MP3. idea that increased risk of cancer;<br><br>MP4. idea that there is less atmosphere to absorb cosmic radiation;<br>MP5. cosmic rays/radiation is increased; | allow cell mutation for cancer | 3 |

**(Total for Question 5 = 8 marks)**

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| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 6 (a) | any two from:<br>MP1. CMBR appears to be the same in all directions / is everywhere;<br>MP2. (which) implies all parts of the Universe were in contact a long time ago;<br>MP3. wavelength has increased (as the universe has expanded);<br>MP4. Universe was (significantly) hotter long ago; | <br><br><br>allow implication of idea of coming from single point<br>allow red-shift of radiation<br>allow frequency has decreased<br>allow RA | 2 |
| (b) | change in wavelength = 78 (nm);<br>substitution;<br>rearrangement;<br>evaluation;<br><br><br><br>e.g.<br>(683 – 605 =) 78 (nm)<br>78 / 605 = v / c<br>$v = 3.0 \times 10^8 \times (78/605)$<br>(v =) $3.9 \times 10^7$ (m/s) | ignore units<br><br><br>-1 for POT error<br>use of incorrect source wavelength gives $3.4 \times 10^7$ (m/s) = 3 marks<br><br><br><br><br>allow $3.86... \times 10^7$ (m/s) | 4 |

**(Total for Question 6 = 6 marks)**

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| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 7 (a) | movement of electrons;<br>bucket gains electrons; | <br>scores both marks | 2 |
| (b) | (droplets in each stream are) like/same charge;<br>(like charges) repel; | <br>ignore attraction to bucket | 2 |
| (c) (i) | use of KE = ½mv$^2$;<br><br>substitution;<br>evaluation;<br><br><br>e.g.<br>KE = ½mv$^2$<br>KE = ½ × 6.2 × 10$^{-9}$ × 3.8$^2$<br>(KE =) 4.5 × 10$^{-8}$ (J) | stated or implied by working<br><br><br>-1 for POT error<br>allow 4.4×10$^{-8}$,<br>4.47 × 10$^{-8}$ = 2 marks<br><br><br><br>allow 4.4764 × 10$^{-8}$ (J) | 3 |
| (ii) | substitution into Q = It;<br><br>rearrangement;<br>evaluation;<br><br>e.g.<br>1.1 × 10$^{-10}$ = current × 9.2 × 10$^{-3}$<br>current = 1.1 × 10$^{-10}$ / 9.2 × 10$^{-3}$<br>current = 1.2 × 10$^{-8}$ (A) | stated or implied by working<br><br><br>-1 for POT error<br><br><br><br><br>allow 1.195… × 10$^{-8}$ (A) | 3 |
| (iii) | substitution into E = QV;<br><br><br>conversion of kV to V;<br><br><br>evaluation;<br><br>e.g.<br>E = 1.1 × 10$^{-10}$ × 1.7<br>1.7 kV = 1700 V<br>(E =) 1.9 × 10$^{-7}$ (J) | allow **valid** substitution into E=VIt<br>ignore units<br>allow 1700 or ×1000 seen anywhere in working<br>-1 for POT error<br><br><br><br><br>allow 1.87 × 10$^{-7}$ (J),<br>1.88 × 10$^{-7}$ (J),<br>1.8768 × 10$^{-7}$ (J) | 3 |

**(Total for Question 7 = 13 marks)**

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| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 8 (a) | any four from:<br>MP1. idea that step-down means secondary voltage is less than primary voltage;<br>MP2. current in (primary) coil produces magnetic field;<br>MP3. the current is changing / has frequency of 50 Hz;<br>MP4. causing a (changing) magnetic field in the core;<br>MP5. the core strengthens the magnetic field;<br>MP6. the secondary coil experiences a changing magnetic field;<br>MP7. which induces a voltage in the secondary coil; | allow RA<br><br><br>allow recognition that alternating current is used<br><br><br><br>allow 'secondary is cut by (changing) field lines'<br>allow current for voltage | 4 |
| (b) (i) | $(N_p/N_s) = (V_p/V_s)$; | allow any correct rearrangement<br>allow "i(nput) and o(utput)" or "1 and 2"for "p(rimary) and s(econdary)"<br>allow correct word equation<br>ignore 'P' for 'N'<br>condone 'T', 't' or 'n' for 'N'<br>condone 'coils' for 'turns' | 1 |
| (ii) | substitution;<br>rearrangement;<br>evaluation;<br><br>e.g.<br>$(160/45) = 12/V_s$<br>$V_s = 12 / (160/45)$<br>$(V_s =) 3.4$ (V) | <br><br><br><br><br><br>allow 3.375 (V) | 3 |

**Total for Question 8 = 8 marks)**

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