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# Mark Scheme (Results)

## Summer 2015

## Pearson Edexcel GCSE in Physics (5PH2F) Paper 01 Unit P2: Physics for your future

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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.

**Quality of Written Communication**

Questions which involve the writing of continuous prose will expect candidates to:

- Write legibly, with accurate spelling, grammar and punctuation in order to make the meaning clear
- Select and use a form and style of writing appropriate to purpose and to complex subject matter
- Organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities.

Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

| Question Number | Answer | Acceptable answers | Mark |
|---|---|---|---|
| **1(a)** | stopwatch /stopclock (1)<br><br>{trundle/measuring} wheel/measuring tape or tape measure (1)<br><br>ignore speedometer/speed camera/radar | (electronic) timer<br>timing app (on 'phone)<br><br>clock and watch on their own are insufficient<br><br>any suitable length measuring device<br>e.g. accept metre {rule(r)/stick}<br><br>but ruler on its own is insufficient<br><br>**Answers may be in either order** | **(2)** |

| Question Number | Answer | Acceptable answers | Mark |
|---|---|---|---|
| **1(b)(i)** | white (car) (1) | Allow the use of other columns that identify correct car<br>e.g. 5.6(s) | **(1)** |

| Question Number | Answer | Acceptable answers | Mark |
|---|---|---|---|
| **1(b)(ii)** | substitution (1)<br>80 ÷ 4.3<br><br>evaluation (1)<br>19 (m/s)<br><br>Throughout the paper do not penalise<br>answers to many places of decimal<br>e.g. here 18.604651 gets both marks | Allow full marks for correct answer with no working seen.<br><br>accept 18.6 (m/s)<br><br>ignore 18 and 18.0 as incorrect rounding<br><br>accept any power of 10 error for 1 mark | **(2)** |

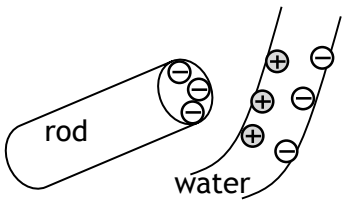
| Question Number | Answer | Acceptable answers | Mark |
|---|---|---|---|
| **1(b)(iii)** | 40 (miles per hour) (1) | accept answers in range<br>39 – 43 (miles per hour)<br><br>ecf from b(ii)<br>multiply bii by 2.222 range +/- 2.0 | **(1)** |

| Question Number | Answer | Acceptable answers | Mark |
|---|---|---|---|
| **1(c)** | {steady/constant} speed (at first) (1)<br><br>(then) slows down (1) | accept velocity for speed<br>ignore as time increases distance travelled increases<br><br>(then) slower/less speed/decelerates/negative acceleration | **(2)** |

Total for Question 1 = 8 marks

| Question Number | Answer | Acceptable answers | Mark |
|---|---|---|---|
| **2(a)(i)** | **A** positive : equal (1) | | **(1)** |

| Question Number | Answer | Acceptable answers | Mark |
|---|---|---|---|
| **2(a)(ii)** | An explanation linking<br><br>negative charge(s)/electrons (1)<br><br>(move/ transfer) {to (plastic) rod / to it / from cloth} (1) | Any reference to positive charges, positive electrons or protons moving scores zero marks for question<br><br>ignore contradictions to Q i.e. cloth is negatively charged<br><br>attract is insufficient for transfer<br><br>e.g. {rod /it} gains/gets electrons (from cloth) for 2 marks<br><br>the cloth loses electrons (to the rod) for 2 marks | **(2)** |

| Question Number | Answer | Acceptable answers | Mark |
|---|---|---|---|
| **2(a)(iii)** | B<br><br> | | **(1)** |

| **Question Number** | Answer | Acceptable answers | **Mark** |
|---|---|---|---|
| **2(a)(iv)** | a suggestion including:<br><br>plastic rod has {become neutral/ discharged/no longer charged/not negatively charged (anymore)}<br><br>OR<br><br>{charge/electrons} {transferred/ taken} from rod (to/by the water) (1) | Any reference to positive charges, positive electrons or protons moving scores zero marks for question<br><br>accept the rod loses its charge/ electrons OR rod is 'earthed'/ 'grounded'<br><br>ignore has same charge as water<br><br>the water removes/washes away the electrons/charge | **(1)** |

| Question Number | Answer | Acceptable answers | Mark |
|---|---|---|---|
| **2(b)** | Conversion to correct units:<br>120 seen anywhere (1)<br><br>Substitution:<br>0.08 x 120 (1)<br><br>Evaluation:<br>9.6 (C) (1) accept 10 C | Allow full marks for correct answer with no working seen.<br><br>0.08 x 2 gains 1 mark for sub of their time into correct eq'n<br>0.16 (C) gains 2 marks<br>(only mistake is not converting time to seconds)<br><br>accept any power of 10 error for 2 marks e.g. 960 (C) | **(3)** |

Total for Question 2 = 8 marks

| Question Number | Answer | Acceptable answers | Mark |
|---|---|---|---|
| **3(a)(i)** | **A** nuclear reactor | | **(1)** |

| Question Number | Answer | Acceptable answers | Mark |
|---|---|---|---|
| **3(a)(ii)** | **D** generator | | **(1)** |

| Question Number | Answer | Acceptable answers | Mark |
|---|---|---|---|
| **3(b)** | A description including any four from:<br><br>(there are) 89 particles in the nucleus (1)<br><br>protons (1)<br><br>(there are) 36 (protons) (1)<br><br>neutrons (1)<br><br>(there are) 53 (neutrons) (1)<br><br>i.e. 36 protons and 53 neutrons gains four marks | ignore all references to electrons<br><br>(its) {mass/nucleon} number / RAM / $A_r$ / A <u>is 89</u><br><br>{atomic/proton} number / positive charge / Z <u>= 36</u><br><br>Numbers must be correctly linked to gain credit<br>e.g. 36 neutrons gets 1 mark (for neutrons)<br><br>53 protons and 36 neutrons gains two marks (for protons and neutrons)<br><br>89 protons and neutrons gets 3 marks<br><br>(altogether there are) 89 protons and neutrons. 36 are protons gains 4 marks | **(4)** |

| Question Number | Answer | Acceptable answers | Mark |
|---|---|---|---|
| **3(c)** | nucleus (1)<br><br>neutron (1) | **Answers in this order only** | **(2)** |

| Question Number | Answer | Acceptable answers | Mark |
|---|---|---|---|
| **3(d)** | An explanation linking two of the following:<br><br>control rods absorb neutrons<br>(1)<br><br>control rods moved into / inserted (into reactor core)<br>(1)<br><br>to capture <u>more</u> neutrons / increase (surface) area (of control rods) (1)<br><br>(and so) fewer neutrons left ( to cause fission )<br>(1) | Ignore 'to control/reduce the reaction(s)' as paraphrase of stem<br><br>accept control rods take in/soak up neutrons<br>ignore slow down neutrons<br><br>accept lowered/pushed down (into reactor)<br>NOT move(d) up AND down<br><br>accept {stops / reduces number (of)} neutrons colliding (with uranium nuclei) | **(2)** |

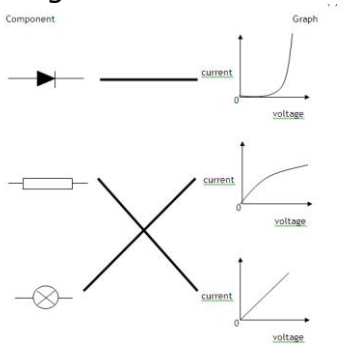
Total for Question 3 = 10 marks

| Question Number | Answer | Acceptable answers | Mark |
|---|---|---|---|
| **4(a)(i)** | (correct) voltmeter symbol seen anywhere (1)<br><br>voltmeter symbol connected in parallel / across heater (1) | accept symbols that are attempts at circles. accept line through symbol<br><br>accept for second mark:<br>any symbol or diagram of meter or box provided it is just from one side of the heater to the other | **(2)** |

| Question Number | Answer | Acceptable answers | Mark |
|---|---|---|---|
| **4(a)(ii)** | Substitution (into V = I x R)<br><br>V = 0.56 x 15 (1)<br><br>Evaluation<br>= 8.4 (V)<br>(1) | Allow full marks for correct answer with no working shown<br><br>accept any power of 10 error for 1 mark e.g. 84 (V) or 0.84 (V) scores 1 mark<br><br>accept rounding to 8 (V) for both marks | **(2)** |

| Question Number | Answer | Acceptable answers | Mark |
|---|---|---|---|
| **4(a)(iii)** | Substitution<br>Energy = 6.0 x 0.40 x 30<br>(1)<br>Evaluation<br>72(J)<br>(1) | accept any power of 10 error for 1 mark e.g. 720 or 7200 (J) scores 1 mark<br><br>Allow full marks for correct answer with no working shown | **(2)** |

| Question Number | Answer | Acceptable answers | Mark |
|---|---|---|---|
| **4(a)(iv)** | An explanation linking any two from:<br><br>(there is the same) current in the (variable) resistor/ wires<br>(1)<br><br>(so) <u>energy</u> is {transferred/used/goes to/ lost/ wasted} in the <u>{(variable) resistor/wires}</u> (1)<br><br>(so) <u>{(variable) resistor / wires}</u> gains/loses thermal energy<br>(1) | <br><br>accept there is a p.d. across the (variable) resistor or {p.d./voltage} across heater is different to battery {p.d./voltage}<br><br>ignore references to voltmeter and heater<br><br>ignore 'energy wasted as heat' without qualification<br><br>accept {resistor/wires} {heats/warms} (up) gains 1 mark<br><br>energy lost in (variable) {resistor/ wires} as heat<br>gains both marks | **(2)** |

| Question Number | Answer | Acceptable answers | Mark |
|---|---|---|---|
| **4(b)** | Connecting lines as shown<br><br><br>(2) | all 3 for 2 marks<br><br>allow one mark if one or two lines correct<br><br>more than one line from any component or to any graph is incorrect, so a maximum of 1 mark is possible | **(2)** |

Total for Question 4 = 10 marks

| Question Number | Answer | Acceptable answers | Mark |
|---|---|---|---|
| **5(a)** | **D** driving for a long time without taking a break | | **(1)** |

| Question Number | Answer | Acceptable answers | Mark |
|---|---|---|---|
| **5(b)(i)** | substitution<br>1200 x 8(.0 ) (1)<br><br>evaluation<br>9600 (J) OR 9.6 x $10^3$ (J)<br>(1) | Give full marks for correct answer with no working.<br><br>9.6 x any other power of 10 = 1 mark | **(2)** |

| Question Number | Answer | Acceptable answers | Mark |
|---|---|---|---|
| **5(b)(ii)** | substitution<br>0.5 x 1400 x $25^2$<br>(1)<br><br>evaluation of v squared<br>0.5 x 1400 x 625<br>(1)<br><br>evaluation<br>4.4 x $10^5$ (J) (1)<br>OR<br>440 000 | Give full marks for correct answer with no working.<br><br>accept 625 seen anywhere for this mark e.g. 875 000 gets 1 mark (forgot ½)<br><br>437 500 (J)<br>4.4 x any other power of 10 = 2 marks | **(3)** |

| Question Number | | Indicative Content | Mark |
|---|---|---|---|
| **QWC** | ***5(c)** | An explanation including some of the following points:<br><br>• Statement of what is meant by stopping distance<br><br>Factors affecting driver<br>• factors affecting driver's thinking distance/reaction time<br><br>Factors dependent on the car<br>• factors affecting braking distance e.g. tyre tread, condition of brakes<br>• cars may be carrying different loads<br>• cars may have different masses<br>External factors<br>• road surface<br>• weather<br>• uphill / downhill<br>Use of data<br>• calculation of thinking, braking and or stopping distances for average driver<br>• calculation of thinking, braking and or stopping distances for driver A<br>• calculation of thinking, braking and or stopping distances for driver B | **(6)** |

| Level | 0 | No rewardable content |
|---|---|---|
| 1 | 1 - 2 | • a limited explanation of the differences using one fact OR one piece of data from the chart OR factor(s) affecting thinking/braking distance.<br>e.g. A has a longer thinking distance OR B is a longer braking distance<br>OR thinking distance can be affected by a driver using their phone<br>• the answer communicates ideas using simple language and uses limited scientific terminology<br>• spelling, punctuation and grammar are used with limited accuracy |
| 2 | 3 - 4 | • a simple explanation, giving more than one fact using data from the chart about either car OR at least one piece of data about each OR using one piece of data from the chart about one car AND at least one factor affecting thinking/braking distance<br>OR a statement linking data from the chart to the cause for one car but nothing correct about the other car<br>e.g. A has a braking distance of (about) 33 m, its thinking distance is longer than an average car.<br>OR B has a longer stopping distance. B's reaction time is faster than the Highway code.<br>OR B has a very short thinking time. Car B's brakes may be worn out<br>OR Driver A may have drunk alcohol making his reaction time slower. Car B has better brakes (NB 2nd sentence is incorrect)<br>• the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately<br>• spelling, punctuation and grammar are used with some accuracy |
| 3 | 5 - 6 | • a detailed explanation linking data from the chart to the cause for one car AND at least one statement about the other<br>OR two statements linking data from the chart to the cause for one car<br>e.g. B has a braking distance of (about) 60 m. This means B might be on a wet road. A has a longer thinking distance.<br>OR B has a shorter thinking distance than A. A has a longer thinking distance compared to the average (in highway code). He may be a drink driver.<br>• the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately<br>• spelling, punctuation and grammar are used with few errors |

Total for Question 5 = 12 marks

| Question Number | Answer | Acceptable answers | Mark |
|---|---|---|---|
| **6(a)** | Any one of<br><br>Treatment of cancer / radiotherapy<br><br>Imaging e.g.: looking at broken bones, tracers<br><br>sterilizing (equipment/dressings)<br><br>(1) | NOT ultrasound applications/ chemotherapy<br><br>accept(to) cure/kill/detect cancer (cells)<br><br>accept X-ray(s)/X-ray machine<br>accept PET/CT scans<br>ignore MRI scans<br><br>accept (to) kill bacteria<br><br>ignore medical treatment and similar vague statements | **(1)** |

| Question Number | Answer | Acceptable answers | Mark |
|---|---|---|---|
| **6(b)** | 12 hours = 2 half lives (1)<br><br>10 (mg) (1) | idea of halving seen e.g. 40 ÷ 2 or 20 (mg) ignore 80 (mg) and 99 ÷ 2<br><br>OR<br><br>idea of 2 half lives seen or 40/4<br>OR<br>(6 is 1 half-life and )12 is 2 (half-lives)<br>OR 1/4<br><br>Give full marks for correct answer with no working. | **(2)** |

| Question Number | Answer | Acceptable answers | Mark |
|---|---|---|---|
| **6(c)(i)** | An explanation to include two from:<br><br>Radiation is ionising (1)<br><br>Radiation can cause specified damage e.g. cancer or damage/mutate DNA (1)<br><br>if dose/exposure is too high (1) | <br><br>(causes) ionisation/ (can) ionise/ mutate cells/tissue<br><br>ignore radiation poisoning/death/make you ill<br>ignore {damage/kill} cells/tissue<br><br>if absorb(ing) too much (radiation) or<br>so you don't absorb too much (radiation)<br><br>Accept for both marks:<br>Too much radiation can cause cancer (after a while) | **(2)** |

| Question Number | Answer | Acceptable answers | Mark |
|---|---|---|---|
| **6(c)(ii)** | ☒ **C** we have a better understanding of the risks from radiation (1) | | **(1)** |

| Question Number | | Indicative Content | Mark |
|---|---|---|---|
| **QWC** | ***6(c)(iii)** | An explanation including some of the following points<br><br>• identification of alpha, beta, gamma as possible types of radiation<br>• identification of X-rays as possible type of radiation<br>• film is dark(er)/changes colour where radiation is absorbed<br>• different areas of the film are exposed to different types of radiation<br>• gamma (or X-rays) affect all areas of film<br>• beta absorbed/stopped by aluminium/passes through paper<br>• beta only reaches (top) part of film<br>• alpha unlikely to be detected at all<br>• the lead will stop (some of) gamma or (some) gamma will pass through lead/aluminium/paper<br>• the paper will stop/absorb alpha<br><br>throughout the question accept symbols for types of radiation | **(6)** |

| Level | 0 | No rewardable content |
|---|---|---|
| 1 | 1 - 2 | • a limited explanation which gives one relevant fact about types of radiation or the film badge<br>e.g. types of radiation are alpha, beta and gamma<br>OR beta absorbed by aluminium<br>OR the radiation affects the film<br>OR gamma can pass through lead<br>• the answer communicates ideas using simple language and uses limited scientific terminology<br>• spelling, punctuation and grammar are used with limited accuracy |
| 2 | 3 - 4 | • A simple explanation, giving more than one relevant fact about types of radiation OR the film badge OR at least one fact about both.<br>e.g. The 3 types of radiation are alpha, beta and gamma. Gamma can pass through lead.<br>OR The 3 types of radiation are alpha, beta and gamma. Radiation makes the film change colour.<br>OR beta will get through the paper but alpha will be stopped (by paper).<br>OR Radiation makes the film change colour. The lab. will compare how much got through the paper, aluminium and lead<br>• the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately<br>• spelling, punctuation and grammar are used with some accuracy |
| 3 | 5 - 6 | • a detailed explanation giving more than two relevant points about the film badge<br>OR at least one fact about the types of radiation AND more than one about the film badge<br>e.g. Beta will get through the paper but alpha will be stopped (by paper).Gamma can penetrate the aluminium.<br>OR The film detects radiation. The aluminium will stop beta but, not gamma.<br>OR The 3 types of radiation are alpha, beta and gamma. Beta will get through the paper but alpha will be stopped (by paper).<br>• the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately<br>• spelling, punctuation and grammar are used with few errors |

Total for Question 6 = 12 marks

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