

# Mark Scheme (Results)

June 2011

International GCSE

Physics (4PH0) Paper 1P

Science Double Award (4SC0) Paper 1P

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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.

**INTERNATIONAL GCSE PHYSICS 4PH0/1P – SUMMER 2011**

ecf - error carried forward  
dop - dependent on previous  
ora - or reverse argument  
owtte - or words to that effect

| Question number | Answer   | Notes  | Marks |
|-----------------|--|--|-------|
| 1 (a) (i)       | gravitational  |  | 1     |
| (ii)            | elastic  |  | 1     |
| (iii)           | kinetic  |  | 1     |
| (b) (i)         | bounces lower / less / smaller / shorter / not as high (each bounce) | ACCEPT: refs to diagram e.g. "loops / dotted lines less tall"<br>ACCEPT: distance between bounces gets smaller   | 1     |
| (ii)            | (transferred away to) thermal energy                                 | ACCEPT: heat / sound<br>REJECT: other forms of energy e.g. light / chemical<br>ACCEPT: refs to where the energy goes e.g. "to the air", "to the ground", "to the surroundings"<br>IGNORE: friction | 1     |

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**Total 5 Marks**

| Question number | Answer                                       | Notes   | Marks      |
|-----------------|--|---|------------|
| 2 (a)           | A – <u>visible</u> (light)<br><br>B – X-rays | REJECT: rainbow<br>REJECT: 'light' alone<br><br>ACCEPT: X / X - radiation | 1<br><br>1 |
| (b)             | C  |   | 1          |
| (c)             | B  |   | 1          |
| (d)             | B  |   | 1          |

|              |  |  |          |
|--------------|--|--|----------|
| <p>2 (e)</p> | <p>For first chosen region of the spectrum<br/>corresponding hazard;<br/>corresponding risk reduction;</p> <p>For second chosen region of the spectrum<br/>corresponding hazard;<br/>corresponding risk reduction;</p> <p><b>NB No mark for naming the type of radiation</b></p> | <p>e.g. microwaves -<br/>heating of tissue / perceived risk of cancer<br/>close oven door / hands-free cell phone /<br/>monitor<br/>exposure</p> <p>e.g. infra red –<br/>risk of skin burning / cell damage<br/>avoid hot places / reflective clothing / avoid<br/>exposure<br/>(to sun)</p> <p>e.g. visible light<br/>eye damage<br/>sun glasses / avoid exposure (to sun)</p> <p>e.g. ultraviolet –<br/>risk of {skin / eye} damage / blindness<br/>IGNORE: sunburn<br/>skin cream / sunglasses / avoid exposure (to<br/>sun)</p> <p>e.g. x-rays –<br/>risk of cancer / cell damage<br/>(lead) shielding / monitor exposure e.g. film<br/>badge /<br/>avoid exposure</p> <p>e.g. gamma -<br/>risk of cancer / cell damage<br/>(lead) shielding / monitor exposure e.g. film<br/>badge /<br/>avoid exposure</p> | <p>4</p> |
|--------------|--|--|----------|

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**Total 9 Marks**

| Question number | Answer   | Notes   | Marks          |
|-----------------|--|---|----------------|
| 3 (a)           | 16.5 ± 0.2;<br><br>cm;   | ACCEPT: 2 <sup>nd</sup> dp if in this range<br><br>ACCEPT: centimetres / cms<br>ACCEPT: 165 mm ± 2 for 2 marks<br>ACCEPT: 0.165 m ± 0.002 for 2 marks | 1<br><br><br>1 |
| (b)             | Any <b>two</b> of:<br>line up (end of) pencil with zero / any other scale mark ;<br>avoid parallax / look straight down / take reading at right angles OWTTE ;<br>use 0.5 cm scale / other side of ruler ; | REJECT: line up with end of ruler<br>IGNORE: put pencil on top of ruler<br>REJECT: use mm scale<br>IGNORE: repeat readings / average                  | 2              |

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**Total 4 Marks**

| Question number | Answer  | Notes   | Marks |
|-----------------|---|---|-------|
| 4 (a)           | Any <b>two</b> of:<br>current (in the coil) ;<br><br>{ in / produces } a magnetic field ;<br>(resultant) force / interaction of magnetic fields ;   | IGNORE: electrical to kinetic energy / induced current<br>IGNORE: unqualified refs to LHR<br>IGNORE: refs to push / pull  | 2     |
| (b)             | Any <b>two</b> of:<br>increase current / more cells (in battery) ;<br><br>stronger magnet(s) ;<br><br>more turns (on coil) ;  | ACCEPT: stronger current / more (battery) voltage<br>REJECT: 'larger' batteries<br>REJECT: 'bigger' magnet<br>IGNORE: magnets closer together<br>REJECT: more coils | 2     |
| (c)             | Any <b>two</b> of:<br>coil / wire cuts through (magnetic) field ;<br>induced voltage / current ;<br><br>current <u>in lamp</u> / complete circuit ;<br>correct refs to an energy transfer e.g. kinetic to electrical (to light) ; | ACCEPT: coil moves / breaks field<br>ACCEPT: 'electromagnetic induction'<br>ACCEPT: generated / produced OWTTE<br>IGNORE: "lights lamp"                             | 2     |

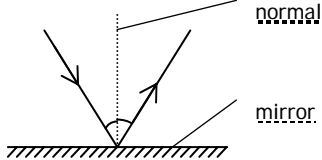
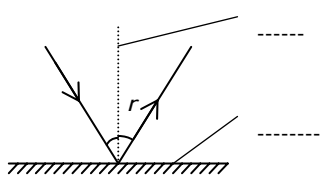
**Total 6 Marks**

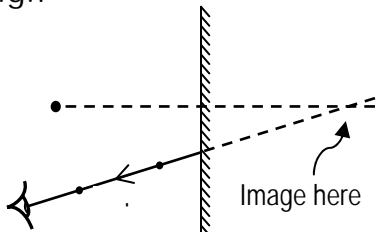


| Question number | Answer  | Accept  | Reject                               | Marks |
|-----------------|---|---|--------------------------------------|-------|
| 5 (a) (i)       | moment = force x distance   | Correct equivalent e.g.<br>moment = F x d<br><br>If (i) is blank, but correct equation written in (ii), then credit.            | m for moment<br>equation "triangles" | 1     |
| (ii)            | Substitution      4.2 x 0.25;<br>Calculation        1.05 (N m);                             | Correct answer gets both marks<br>ACCEPT: 1.1 (N m)   |                                      | 2     |
| (b)             | (Moment of ) weight of lid;<br><br>Acts in same direction as closing force / anticlockwise; | Pull / force of gravity<br><br>Acts downwards<br><br>Reverse argument related to opening lid<br>IGNORE: any reference to energy | Bald "gravity" for weight            | 2     |

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**Total 5 Marks**

| Question number  | Answer  | Notes     | Marks |  |   |  |  |                              |  |   |   |  |  |   |   |
|--|---|-----------|-------|--|---|--|--|------------------------------|--|---|---|--|--|---|---|
| 6 (a)  | <table border="1"> <tr> <td data-bbox="394 331 1055 371">statement</td> <td data-bbox="1055 331 1155 371">tick</td> </tr> <tr> <td data-bbox="394 371 1055 411">the image in a plane mirror is virtual</td> <td data-bbox="1055 371 1155 411">✓</td> </tr> <tr> <td data-bbox="394 411 1055 483">light from the object passes through the image in a plane mirror</td> <td data-bbox="1055 411 1155 483"></td> </tr> <tr> <td data-bbox="394 483 1055 523">light waves are longitudinal</td> <td data-bbox="1055 483 1155 523"></td> </tr> <tr> <td data-bbox="394 523 1055 595">the angle of incidence equals the angle of reflection</td> <td data-bbox="1055 523 1155 595">✓</td> </tr> <tr> <td data-bbox="394 595 1055 667">the incident ray is at right angles to the reflected ray</td> <td data-bbox="1055 595 1155 667"></td> </tr> </table> | statement | tick  | the image in a plane mirror is virtual | ✓ | light from the object passes through the image in a plane mirror |  | light waves are longitudinal |  | the angle of incidence equals the angle of reflection | ✓ | the incident ray is at right angles to the reflected ray |  | <p>Three ticks – max 1 mark<br/> Four or more ticks – no mark</p> | 2 |
| statement  | tick  |           |       |  |   |  |  |                              |  |   |   |  |  |   |   |
| the image in a plane mirror is virtual                           | ✓   |           |       |  |   |  |  |                              |  |   |   |  |  |   |   |
| light from the object passes through the image in a plane mirror |   |           |       |  |   |  |  |                              |  |   |   |  |  |   |   |
| light waves are longitudinal                                     |   |           |       |  |   |  |  |                              |  |   |   |  |  |   |   |
| the angle of incidence equals the angle of reflection            | ✓   |           |       |  |   |  |  |                              |  |   |   |  |  |   |   |
| the incident ray is at right angles to the reflected ray         |   |           |       |  |   |  |  |                              |  |   |   |  |  |   |   |
| (b) (i)  |    |           | 2     |  |   |  |  |                              |  |   |   |  |  |   |   |
| (ii)   |   |           | 1     |  |   |  |  |                              |  |   |   |  |  |   |   |

| Question number | Answer  | Notes   | Marks                         |
|-----------------|---|---|-------------------------------|
| 6 (c) (i)       | <p>First suitable line extended;<br/>Second suitable line extended;</p> <p>Image indicated correctly <u>at crossing point of suitable lines</u> ;</p> <p>e.g.:</p>   | <p>Suitable lines include:<br/>sighting pin line<br/>line from object perpendicular to mirror<br/>candidates own sighting line from another position</p> <p>Image may be indicated with any clear mark or label</p> | <p>1<br/>1<br/>1</p> <p>2</p> |
| (ii)            | <p>EITHER</p> <p>Appropriate additional drawing;<br/>e.g. extend perpendicular / second sighting line<br/>check line passes through image;</p> <p>OR</p> <p>Measure distance(s) (to mirror);<br/>Object distance = image distance;</p> <p>OR</p> <p>pin placed in image position;<br/>method of no parallax named or described;</p> | <p>Any additional drawing should be complementary to 6(c)(i) answer</p>   | 2                             |

**Total 10 marks**

| Question number | Answer   | Accept  | Reject               | Marks |
|-----------------|--|---|----------------------|-------|
| 7 (a)           | B  |   |                      | 1     |
| (b)             | Any <b>two</b> of<br>Energy transfer from supply / electrical energy;<br>Energy transfer to thermal energy (heat) / particle vibration;<br>There is a current (in the heating element);<br>Heating effect of resistance /a resistor; | Electrical → thermal /heat for 2 marks<br><br>IGNORE: electricity   |                      | 2     |
| (c) (i)         | Power = current x voltage;   | Or equivalent, e.g.<br>Power = voltage x current<br>Voltage = power ÷ current<br>Current = power ÷ voltage<br>P= I x V<br><br>If (i) is blank, but correct equation written in (ii), then credit. | equation "triangles" | 1     |
| (ii)            | Substitution      2000 / 230;<br>Calculation        8.7 (A);   | ACCEPT: 8.69 (A)  |                      | 2     |
| (iii)           | 13 A;<br>Only one above working current; dop   | OWTTE<br>ORA e.g the others would blow  |                      | 2     |

**Total 8 marks**

| Question number | Answer  | Accept   | Reject | Marks |
|-----------------|---|--|--------|-------|
| 8 (a) (i)       | (average) speed = distance / time;  | <p>Or equivalent –<br/> distance = speed x time,<br/> time = distance ÷ speed,<br/> or correct symbols<br/> e.g. <math>v = d / t</math></p> <p>If (i) is blank, but correct equation written in (ii), then credit.</p> |        | 1     |
| (ii)            | Substitution      9000 / 900;<br>Calculation        10;<br>Unit                    m/s;   | ACCEPT:<br>e.g. $9/15 = 0.6$ km/minute<br>$9/0.25 = 36$ km/hour<br>$9000/15 = 600$ m/min<br>$9/900 = 0.01$ km/s<br>i.e. any unit that is consistent with the number  |        | 2     |
| (iii)           | Any <b>two</b> from:<br>speed not constant ; OWTTE<br>slow at (some) points / stations ;<br>fast at (other) points / between stations ; | ACCEPT: this idea implied e.g <u>slower</u> (1) at stations (1)  |        | 2     |

|           |  |  |  |                            |
|-----------|--|--|--|----------------------------|
| 8 (b) (i) | <p>use of acceleration = change in velocity / time (taken)<br/>OR<br/>attempt at use of gradient ;</p> <p>Substitution 30 / 100 ;<br/>Calculation 0.3 (m/s<sup>2</sup>) ;</p>          | <p>Or equivalent –<br/>Change in vel = accn x time<br/>Time = change in vel ÷ accn</p> <p>Bald answer gets 3 marks</p>   |  | <p>1</p> <p>1</p> <p>1</p> |
| (ii)      | <p>Area under graph (clear evidence of attempt);<br/>(<math>\frac{1}{2} \times 30 \times 100</math>) + (30 x 100) + (<math>\frac{1}{2} \times 30 \times 100</math>);<br/>6000 (m);</p> | <p>ACCEPT: trapezium method<br/><math>\frac{1}{2} \times (300 + 100) \times 30</math><br/>ACCEPT: answers where the unit is consistent with the number.<br/>Bald answer gets all three marks</p> |  | 3                          |

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**Total 12 marks**

| Question number | Answer   | Notes   | Marks |
|-----------------|--|---|-------|
| 9 (a) (i)       | (gravitational potential) energy = $m \times g \times h$ ;   | ACCEPT: $E = \text{mass} \times \text{gravity} \times \text{height}$<br>REJECT: $E = W \times h$                                | 1     |
| (ii)            | Substitution $18 \times 10 \times 5$ ;<br>Calculation $900 \text{ (J)}$ ;  | If (i) is blank, but correct equation written in (ii), then credit.<br>ACCEPT: $882 \text{ (J)}$                                | 2     |
| (iii)           | equal / the same / =   | ACCEPT: equivalent<br>REJECT: proportional<br>IGNORE: $900 \text{ J}$   | 1     |
| (b)             | Up to five marks in all – up to two for each mechanism<br><br>Conduction<br>air / gas is a poor conductor / insulator ;<br>air molecules are (relatively) far apart ;<br>fibres are insulating ;<br><br>Convection<br>air / gas (between fibres) cannot move ;<br>thus no / reduced convection <u>currents</u> ;<br><br>Radiation<br>aluminium foil / shiny surface is a poor radiator ;<br>thermal energy / heat/ / radiation is reflected (back inside) ;<br>aluminium foil / shiny surface is poor absorber ; | IGNORE: conductor of electricity<br>ACCEPT: particles cannot transfer energy as they don't collide often<br><br>ACCEPT: emitter | 5     |

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**Total 9 marks**

| Question number | Answer  | Notes   | Marks |
|-----------------|---|---|-------|
| 10 (a)          | (i) thermistor labelled correctly   | ACCEPT: ringed thermistor   | 1     |
|                 | (ii) correct voltmeter symbol ;<br>connected in parallel with thermistor ;  | REJECT: connected in parallel with battery  | 2     |
| (b)             | (i) voltage = current x resistance  | Or equivalent –<br>resistance = voltage ÷ current<br>$V = I \times R$   | 1     |
|                 | (ii) Substitution $12 = 0.002 \times R$ ;<br>Calculation $R = 12 / 0.002 = 6000 (\Omega)$ ;   | If (i) is blank, but correct equation written in (ii), then credit.<br>$12 = 2 \times R = 6 (\Omega)$ gets 1 mark<br>Bald answer 2 marks<br>6 k $\Omega$ gets 2 marks | 2     |
|                 | (iii) Suitable size chosen (>50% of grid used);<br>Axes labelled with quantities and units (either way around);<br>Plotting to nearest half square (minus one for each plotting error);;<br>Curved line of best fit acceptable; | ACCEPT: ° OR C<br><br>REJECT: joining the dots<br>Bar chart for 4 max   | 5     |
|                 | (iv) current increases with temperature ;<br>non-linear relationship OWTTE ;  | ACCEPT: positive correlation  | 2     |
|                 | (v) Any <b>two</b> of<br>student is wrong ;<br>because current increases with temp (for constant voltage) ;<br>so resistance decrease with temp ;   | "student is correct" scores 0 marks<br>Because it is an ntc thermistor for 1 mark<br>ACCEPT: relevant use of figures for resistance from graph/table                  | 2     |

**Total 15 marks**



| Question number | Answer  | Notes   | Marks |
|-----------------|---|---|-------|
| 11 (a)          | Mass of cylinder + unit = 325 ;<br>Mass of cylinder = 106 ;<br>Mass of liquid in cylinder = 219 ;<br>Volume of liquid = 176 ;<br>Mass unit: g ;<br>Volume unit: cm <sup>3</sup> / ml ;                            | ACCEPT: ecf on M1 and M2<br><br>ACCEPT: either unit used appropriately at least once                                | 6     |
| (b)             | Any <b>two</b> from:<br>equation;<br>correct substitution made or correct mass indicated;<br>density = between 1.24 and 1.25;<br>density unit (g/cm <sup>3</sup> OR g/ml);  | ecf from 11(a)<br><br>Correct and consistent alternative e.g. 1240 kg/m <sup>3</sup><br>1.24 kg/dm <sup>3</sup>     | 2     |
| (c)             | Any <b>two</b> from:<br>more sensitive equipment ;<br>check balance zero ;<br>calibrate any equipment ;<br>avoid parallax when reading measuring cylinder / bottom of meniscus ;<br>use larger volume of liquid ; | ACCEPT: measure to more dp / use burette<br><br>IGNORE: repeat experiment<br>IGNORE: refs to "use more accurate..." | 2     |

**Total 10 marks**

| Question number | Answer  | Notes  | Marks |
|-----------------|---|--|-------|
| 12              | <p>M1 pressure greater in the full cup / less in the half-full cup ;</p> <p>M2 reference to equation / <math>p = W \div A</math> / <math>p = h \times \rho \times g</math></p> <p>M3 ;</p> <p>M4 {depth / mass / weight} of liquid / force different in each cup ;</p> <p>density / <math>g</math> / area the same for each cup ;</p> | <p>ACCEPT: F in place of W</p> <p>IGNORE: amount of coffee different</p> | 4     |

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**Total 4 marks**

| Question number | Answer   | Notes  | Marks |
|-----------------|--|--|-------|
| 13 (a) (i)      | 77   |  | 1     |
| (ii)            | 115  |  | 1     |
| (b)             | (nuclei with) same number of protons / same atomic number / same element ;<br>different numbers of {neutrons / nucleons} / different mass number;  | ACCEPT: atoms / elements for nuclei<br>REJECT: molecules / substances for nuclei<br>IGNORE: electrons                            | 2     |
| (c)             | 192;<br>78;  |  | 2     |
| (d)             | alpha not penetrating enough (of the tumour) / ionises before reaching whole tumour ;<br><br>gamma too penetrating / travels straight through / too weakly ionising / OWTTE ;<br><br>beta will penetrate the tumour but no further / stays in tumour and doesn't affect horse / ionises within tumour (but no further) / OWTTE ; | IGNORE: doesn't penetrate skin<br><br>IGNORE: bald 'weak' or 'strong'<br><br>IGNORE: general properties of alpha, beta and gamma | 3     |
| (e) (i)         | C  |  | 1     |
| (ii)            | activity decreases over time ;<br>relate activity to situation e.g. C remains sufficiently active (over the treatment) / A and B not effective over period of treatment / A and B would need source to be replaced / D continues to be radioactive / cause damage (after treatment) ;  | ACCEPT: calculation of period of activity<br>IGNORE: bald 'weak' or 'strong'   | 2     |

**Total 12 marks**

| Question number | Answer   | Notes  | Marks |
|-----------------|--|--|-------|
| 14 (a)          | two protons labelled ;<br>two neutrons labelled ;  | ACCEPT: a proton and a neutron for 1 mark<br>ACCEPT: correct labels inside circles   | 2     |
| (b) (i)         | Any <b>two</b> of:<br>to avoid / reduce absorption / ionisation / loss of energy of alpha particles ;<br>to avoid / reduce chance of collisions between air molecules and alpha particles ;<br>to allow sufficient range for alpha particles / would stop in few cm of air / does not reach foil ; | ACCEPT: ideas of alpha particle absorption, collision and range expressed in other words<br><br>IGNORE: speed of alpha particles | 2     |
| (ii)            | Any <b>two</b> of:<br>electrostatic (force) ;<br>repulsion ;<br>between like charges ;   | ACCEPT: electric (force)<br>IGNORE: magnetic / poles   | 2     |

|              |  |                                   |   |
|--------------|--|-----------------------------------|---|
| 14 (b) (iii) | <p>Any <b>five</b> of:</p> <p>Undelected alpha particles show –<br/>there are gaps between nuclei/atoms mostly empty space;</p> <p>Deflections show –<br/>a repulsive force operates;<br/>(if electrostatic force) then nuclei have same charge as alpha particles (or both positive charge);<br/>(only some) deflected so nuclei are a <u>small</u> target;</p> <p>Large deflections show –<br/>nuclei have enough mass for alphas to bounce back;<br/><u>mass</u> of a nucleus is <u>more</u> than the mass of an alpha particle;<br/><u>high</u> density related to mass and <u>small</u> size;</p> | ACCEPT: correct reverse arguments | 5 |
|--------------|--|-----------------------------------|---|

**Total 11 marks**  
**PAPER TOTAL: 120 MARKS**

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