

**Physics B**

General Certificate of Secondary Education

Unit **B752/02**: Unit 2 – Modules P4, P5, P6 (Higher Tier)

**Mark Scheme for June 2013**

---

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.













All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

© OCR 2013

## Annotations

| Annotation  | Meaning                               |
|---|---------------------------------------|
|    | correct response                      |
|    | incorrect response                    |
|    | benefit of the doubt                  |
|    | benefit of the doubt <b>not</b> given |
|    | error carried forward                 |
|    | information omitted                   |
|    | ignore                                |
|    | reject                                |
|    | contradiction                         |
|    | Level 1                               |
|    | Level 2                               |
|  | Level 3                               |

**ADDITIONAL OBJECTS:** You **must** assess and annotate the additional objects for each script you mark. Where credit is awarded, appropriate annotation must be used. If no credit is to be awarded for the additional object, please use annotation as agreed at the SSU.

**Abbreviations, annotations and conventions used in the detailed Mark Scheme.**

|               |   |   |
|---------------|---|---|
| /             | = | alternative and acceptable answers for the same marking point   |
| <b>(1)</b>    | = | separates marking points  |
| <b>allow</b>  | = | answers that can be accepted  |
| <b>not</b>    | = | answers which are not worthy of credit  |
| <b>reject</b> | = | answers which are not worthy of credit  |
| <b>ignore</b> | = | statements which are irrelevant   |
| ( )           | = | words which are not essential to gain credit  |
| —             | = | underlined words must be present in answer to score a mark (although not correctly spelt unless otherwise stated) |
| ecf           | = | error carried forward   |
| AW            | = | alternative wording   |
| ora           | = | or reverse argument   |

## Section A

| Question |     | Answer   | Marks   | Guidance   |   |
|----------|-----|--|---|--|---|
| 1        | (a) | <p>a compression is a region of high(er) pressure / region where (air) particles are close(r) together / AW (1)</p> <p>a rarefaction is a region of low(er) pressure / region where (air) particles are far / further apart / AW (1)</p> | 2   | <p>ignore reference to waves / wavelengths / frequency</p> <p><b>allow</b> where lines are close(r) together / more concentrated (1)</p> <p><b>allow</b> area of high(er) density (1)</p> <p><b>allow</b> layers or molecules for particles (1)</p> <p><b>ignore</b> particles more dense</p> <p><b>allow</b> where lines are far / further apart / less concentrated (1)</p> <p><b>allow</b> area of low(er) density (1)</p> <p><b>allow</b> layers or molecules for particles (1)</p> <p><b>ignore</b> particles less dense</p> <p>if no marks scored allow [1] mark for correct labelling of both the compression and rarefaction on the diagram.</p> |   |
|          | (b) | (i)  | (idea that) ultrasound causes <b>vibrations / oscillations</b> (in the stone) (1)         | 1  | <p><b>allow</b> resonate (1)</p> <p>NOT gamma rays</p>  |
|          |     | (ii)   | able to produce images / scans of soft tissue / does not damage living cells / tissue (1) | 1  | <p><b>allow</b> non-ionising radiation (1)</p> <p>allow reverse arguments for X-rays.<br/>Eg X-rays cannot show soft tissue (1)<br/>Eg X-rays only show bones / hard tissues(1)</p> <p>But X-rays show bones (0)</p> <p>Ignore unqualified references to dangers.<br/>Eg. ultrasound safer / X-rays more damaging</p> |
|          |     |  | <b>Total</b>  | <b>4</b>   |   |

| Question | Answer  | Marks | Guidance  |
|----------|---|-------|---|
| 2 (a)    | <p><b>[Level 3]</b><br/>Detailed description of what the graph shows <b>AND</b> an explanation of how the information could be interpreted <b>AND</b> used.<br/>Quality of written communication does not impede communication of the science at this level<br/><b>(5–6 marks)</b></p> <p><b>[Level 2]</b><br/>Describes what the graph shows <b>AND</b> an explanation of how the information could be interpreted <b>OR</b> used.<br/>Quality of written communication partly impedes communication of the science at this level<br/><b>(3–4 marks)</b></p> <p><b>[Level 1]</b><br/>Describes what the graph shows <b>OR</b> a description of how the information could be interpreted <b>OR</b> used.<br/>Quality of written communication impedes communication of the science at this level<br/><b>(1–2 marks)</b></p> <p><b>[Level 0]</b><br/>Insufficient or irrelevant science. Answer not worthy of credit.<br/><b>(0 marks)</b></p> | 6     | <p><b>This question is targeted at grades up to C/D.</b></p> <p><b>Relevant points include:</b></p> <p><b>Description of what the graph shows.</b></p> <ul style="list-style-type: none"> <li>• level of radioactivity changes as the detector moves along the pipe.</li> <li>• radioactive level is relatively low at the start</li> <li>• as the detector moves along the pipe the level rises rapidly/reaches a peak</li> <li>• level then falls rapidly after peak</li> <li>• level is lower after the peak than it was at the start</li> </ul> <p><b>Explanation of how the information can be interpreted</b></p> <ul style="list-style-type: none"> <li>• to find where there is a problem with the pipe</li> <li>• the peak shows that tracer is leaking and indicates a crack or break</li> <li>• there is a blockage as the level after is lower than before the peak</li> <li>• the blockage is not complete as radioactivity is not zero</li> <li>• radiation used must be gamma</li> </ul> <p><b>Explanation of use of the information</b></p> <ul style="list-style-type: none"> <li>• so that workers dig in the right place</li> <li>• so that workers do not waste time/energy resources digging up the whole pipe</li> <li>• the peak shows where the problem is</li> </ul> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</b></p> |

| Question     |     | Answer  | Marks    | Guidance   |
|--------------|-----|---|----------|--|
|              | (b) | <p>half-life of <b>Y</b> is (approximately) 1 <u>hour/h/hr</u> (1)</p> <p>half-life of substance <b>X</b> is (approximately) 4 <u>hour/h/hr</u> (1)</p> <p><b>if no marks scored above:</b><br/>the idea that substance <b>Y</b> has a shorter half-life (than substance <b>X</b>) / ora for X scores (1)</p> | 2        | <p><b>allow</b> range 0.75 - 1 hour<br/>correct units required for this marking point</p> <p><b>allow</b> range 3.5 - 4 hours<br/>correct units required for this marking point<br/><b>ignore</b> 'between 3 to 4 hours'</p> <p><b>but</b> half-life of <b>X</b> is 4 x that of <b>Y</b> (2)</p> <p><b>Ignore</b> incorrect units if stated for this marking point<br/><b>ignore</b> substance X remains radioactive longer as targeting A* for 1 of the marks</p> |
| <b>Total</b> |     |   | <b>8</b> |  |

| Question     |         | Answer   | Marks    | Guidance  |
|--------------|---------|--|----------|---|
| 3            | (a) (i) | <p>0.15 (amps) (3)</p> <p><b>but if answer incorrect</b></p> <p>(I =) 0.75 / 5 (2)</p> <p><b>or</b></p> <p>5 or 4.8 to 5.2 (ohms stated as the resistance) (1)</p> | 3        | <p><b>allow</b> answer in the range of 0.144 – 0.156 (amps) (3)</p> <p><b>allow</b> 5 in range of 4.8 – 5.2</p> <p><b>allow</b> 5 (ohms) seen (even in an incorrect calculation) (1)<br/>eg. 5 / 0.75 (1)<br/>eg. 5 (taken from graph / slope of graph) (1)</p> |
|              | (ii)    | as length increases current reduces / AW / ora (1)   | 1        | <b>allow</b> inversely proportional<br><b>ignore</b> resistance / faster or stronger current  |
|              | (b)     | straight line (by eye) on graph starting at / pointing towards (0,0) with a steeper gradient than original line (1)  | 1        | curved line (by eye) scores (0)   |
| <b>Total</b> |         |  | <b>5</b> |   |





| Question |     | Answer   | Marks    | Guidance   |
|----------|-----|--|----------|--|
| 5        | (a) | <p><b>electron transfer idea:</b></p> <ul style="list-style-type: none"> <li>• <u>electrons</u> move between two insulators</li> </ul> <p><b>OR</b></p> <ul style="list-style-type: none"> <li>• <u>electrons</u> move between the socks and the trampoline (1)</li> </ul> <p><b>earthing idea:</b></p> <ul style="list-style-type: none"> <li>• electrons flow through girl / to or from earth / ground (during “shock”) (1)</li> </ul> | 2        | <p>mention of positive electrons scores (0) for <b>this</b> marking point<br/> mention of <b>movement</b> of protons scores (0) for <b>this</b> marking point<br/> <b>but</b> ‘protons stay fixed and electrons move from trampoline to sock scores’ (1)<br/> <b>allow</b> between girl and trampoline (1)</p> <p>mention of positive electrons scores (0) for <b>this</b> marking point<br/> mention of <b>movement</b> of protons scores (0) for <b>this</b> marking point</p> <p><b>allow</b> current / charge movement through girl / to or from earth / discharged to earth (1)<br/> eg negative charge goes to earth (1)</p> <p><b>ignore</b> electricity / voltage to earth</p> |
|          | (b) | <p>idea that anti-static sprays leave a conducting layer / coating of material (1)</p> <p>so charge cannot build up (1)</p>  | 2        | <p><b>Eg.</b> enables the trampoline to conduct (1)</p> <p>eg can't store electrons (1)<br/> <b>not</b> merely static electricity cannot build up.<br/> <b>but</b> static charge cannot build up (1)</p>   |
|          |     | <b>Total</b>   | <b>4</b> |  |

| Question |     | Answer   | Marks | Guidance   |
|----------|-----|--|-------|--|
| 6        | (a) | <p>particles hit rocket walls / AW (1)</p> <p>causing force / thrust / AW (1)</p>  | 2     | <p>But particles colliding <b>with each other</b> (0)<br/>Allow particles collide with each other and walls (1)</p> <p><b>ignore</b> pressure / upthrust</p> <p>Reward higher level answers in terms of action and reaction:<br/>eg particles move downwards to produce an equal and opposite force on the rocket' (2)</p>   |
|          | (b) | <p>more force and acceleration because of:</p> <ul style="list-style-type: none"> <li>• more frequent collisions / more energetic collisions / twice as many collisions (1)</li> </ul> <p>or</p> <ul style="list-style-type: none"> <li>• faster particles / more particles / more energy / more momentum (1)</li> </ul> | 1     | <p><b>but</b> more frequent collisions between gas particles scores (0)<br/><b>allow</b> more frequent collisions between gas particles and walls (1)</p> <p><b>allow</b> higher level answers in terms of kinetic theory (1)<br/><b>ignore</b> pressure<br/><b>ignore</b> more gas</p> <p><b>allow</b> force applied for longer giving greater acceleration (1)</p> |

| Question            | Answer  | Marks         | Guidance  |       |               |       |                   |         |               |        |        |         |       |       |        |                     |       |        |
|---------------------|---|---------------|---|-------|---------------|-------|-------------------|---------|---------------|--------|--------|---------|-------|-------|--------|---------------------|-------|--------|
| (c)                 | <p><b>[Level 3]</b><br/>                     Answers must give a comparison and an explanation of at least two ideas with reference to gravitational / centripetal force. (See summary chart)<br/>                     Quality of written communication does not impede communication of the science at this level.<br/>                     (5–6 marks)</p> <p><b>[Level 2]</b><br/>                     Answers must give a comparison and a description of at least two ideas.<br/>                     Quality of written communication partly impedes communication of the science at this level.<br/>                     (3–4 marks)</p> <p><b>[Level 1]</b><br/>                     Answers are limited to one simple description OR a description of an appropriate use of a satellite.<br/>                     Quality of written communication impedes communication of the science at this level.<br/>                     (1–2 marks)</p> <p><b>[Level 0]</b><br/>                     Insufficient or irrelevant science. Answer not worthy of credit.<br/>                     (0 marks)</p> | 6             | <p><b>This question is targeted at grades up to A*.</b><br/> <b>allow</b> reverse arguments for geostationary orbits throughout.<br/> <b>Indicative scientific points may include at level 3:</b></p> <ul style="list-style-type: none"> <li>• higher gravitational force <b>and</b> lower altitude for polar orbit</li> <li>• higher gravitational force <b>and</b> higher speed or acceleration for polar orbit.</li> <li>• higher gravitational force <b>and</b> shorter period for polar orbit</li> </ul> <p><b>Indicative scientific points may include at level 2:</b></p> <ul style="list-style-type: none"> <li>• lower altitudes for polar orbit</li> <li>• higher speeds for polar orbit.</li> <li>• shorter period for polar orbit</li> <li>• polar orbit over poles and geostationary orbit over equator</li> </ul> <p><b>Indicative scientific points may include at level 1:</b></p> <ul style="list-style-type: none"> <li>• short(er) time period for polar orbit</li> <li>• geostationary orbits around equator.</li> <li>• Correct use for a relevant satellite (eg polar – military, mapping, navigation, weather, etc. Geostationary – navigation, communication, weather etc.)</li> </ul> <p><b>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</b></p> <table border="1" data-bbox="1279 1114 2051 1289"> <tbody> <tr> <td>ideas</td> <td>geostationary</td> <td>polar</td> </tr> <tr> <td>orbit description</td> <td>equator</td> <td>Go over poles</td> </tr> <tr> <td>period</td> <td>longer</td> <td>shorter</td> </tr> <tr> <td>speed</td> <td>lower</td> <td>higher</td> </tr> <tr> <td>gravitational force</td> <td>lower</td> <td>higher</td> </tr> </tbody> </table> <p>At level 3 accept higher level answer in terms of acceleration</p> | ideas | geostationary | polar | orbit description | equator | Go over poles | period | longer | shorter | speed | lower | higher | gravitational force | lower | higher |
| ideas               | geostationary   | polar         |   |       |               |       |                   |         |               |        |        |         |       |       |        |                     |       |        |
| orbit description   | equator   | Go over poles |   |       |               |       |                   |         |               |        |        |         |       |       |        |                     |       |        |
| period              | longer  | shorter       |   |       |               |       |                   |         |               |        |        |         |       |       |        |                     |       |        |
| speed               | lower   | higher        |   |       |               |       |                   |         |               |        |        |         |       |       |        |                     |       |        |
| gravitational force | lower   | higher        |   |       |               |       |                   |         |               |        |        |         |       |       |        |                     |       |        |

| Question     |         | Answer  | Marks     | Guidance  |
|--------------|---------|---|-----------|---|
|              | (d) (i) | 703 (N) scores (2)<br><br>but if answer is incorrect<br><br>185 x 3.8 scores (1)  | 2         |   |
|              | (ii)    | any two from:<br><br>weight of Rover on Earth is 1850 (N) / AW (1)<br><br>too heavy (on Earth) (1)<br><br>weight too near to safe limits / more likely to break (1) | 2         | allow Rover is 50 (N) more than it can take (2)<br><br>allow heavier / weighs too much (1)<br><br>eg. Legs / wheels not able to support (1)<br><br>incorrect statement about mass scores a maximum of (1) |
| <b>Total</b> |         |   | <b>13</b> |   |

| Question             |                          | Answer  | Marks         | Guidance      |          |      |        |       |          |  |     |     |   |   |                      |                      |                 |             |               |              |  |                          |
|----------------------|--------------------------|---|---------------|---------------|----------|------|--------|-------|----------|--|-----|-----|---|---|----------------------|----------------------|-----------------|-------------|---------------|--------------|--|--------------------------|
| 7                    | (a)                      | <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;"><b>vector</b></td> <td style="width: 50%;"><b>scalar</b></td> </tr> <tr> <td>velocity</td> <td>mass</td> </tr> <tr> <td>weight</td> <td>speed</td> </tr> <tr> <td>momentum</td> <td></td> </tr> <tr> <td>(1)</td> <td>(1)</td> </tr> </table> | <b>vector</b> | <b>scalar</b> | velocity | mass | weight | speed | momentum |  | (1) | (1) | 2 | all three needed<br><br>both needed<br><br>if no marks scored 2 scalar <b>and</b> 2 vector correct scores (1)<br>eg.<br><table style="width: 100%; border: none;"> <tr> <td style="width: 50%;"><u><b>vector</b></u></td> <td style="width: 50%;"><u><b>scalar</b></u></td> </tr> <tr> <td><b>velocity</b></td> <td><b>mass</b></td> </tr> <tr> <td><b>weight</b></td> <td><b>speed</b></td> </tr> <tr> <td></td> <td><i>momentum</i> <b>X</b></td> </tr> </table> scores (1) | <u><b>vector</b></u> | <u><b>scalar</b></u> | <b>velocity</b> | <b>mass</b> | <b>weight</b> | <b>speed</b> |  | <i>momentum</i> <b>X</b> |
| <b>vector</b>        | <b>scalar</b>            |   |               |               |          |      |        |       |          |  |     |     |   |   |                      |                      |                 |             |               |              |  |                          |
| velocity             | mass                     |   |               |               |          |      |        |       |          |  |     |     |   |   |                      |                      |                 |             |               |              |  |                          |
| weight               | speed                    |   |               |               |          |      |        |       |          |  |     |     |   |   |                      |                      |                 |             |               |              |  |                          |
| momentum             |                          |   |               |               |          |      |        |       |          |  |     |     |   |   |                      |                      |                 |             |               |              |  |                          |
| (1)                  | (1)                      |   |               |               |          |      |        |       |          |  |     |     |   |   |                      |                      |                 |             |               |              |  |                          |
| <u><b>vector</b></u> | <u><b>scalar</b></u>     |   |               |               |          |      |        |       |          |  |     |     |   |   |                      |                      |                 |             |               |              |  |                          |
| <b>velocity</b>      | <b>mass</b>              |   |               |               |          |      |        |       |          |  |     |     |   |   |                      |                      |                 |             |               |              |  |                          |
| <b>weight</b>        | <b>speed</b>             |   |               |               |          |      |        |       |          |  |     |     |   |   |                      |                      |                 |             |               |              |  |                          |
|                      | <i>momentum</i> <b>X</b> |   |               |               |          |      |        |       |          |  |     |     |   |   |                      |                      |                 |             |               |              |  |                          |

| Question |     | Answer   | Marks    | Guidance  |
|----------|-----|--|----------|---|
|          | (b) | 56 (m / s) (1)   | 1        |   |
|          | (c) | 180 (m) (2)<br><b>but if answer is incorrect</b><br>$\{(56 + 4) / 2\} \times 6$ scores (1) | 2        | Allow 178 to 182. (2)<br><b>allow</b> e.c.f. from (b)<br>eg. 57 (m), 96(m) or 102(m) scores (2) |
|          |     | <b>Total</b>   | <b>5</b> |   |

| Question       |            | Answer   | Marks    | Guidance   |              |                |   |  |            |   |   |  |     |     |   |                                  |
|----------------|------------|--|----------|------------|--------------|----------------|---|--|------------|---|---|--|-----|-----|---|----------------------------------|
| 8              |            | <table border="1"> <thead> <tr> <th></th> <th>reflection</th> <th>interference</th> </tr> </thead> <tbody> <tr> <td>particle model</td> <td>✓</td> <td></td> </tr> <tr> <td>wave model</td> <td>✓</td> <td>✓</td> </tr> <tr> <td></td> <td>(1)</td> <td>(1)</td> </tr> </tbody> </table> |          | reflection | interference | particle model | ✓ |  | wave model | ✓ | ✓ |  | (1) | (1) | 2 | one mark for each correct column |
|                | reflection | interference   |          |            |              |                |   |  |            |   |   |  |     |     |   |                                  |
| particle model | ✓          |  |          |            |              |                |   |  |            |   |   |  |     |     |   |                                  |
| wave model     | ✓          | ✓  |          |            |              |                |   |  |            |   |   |  |     |     |   |                                  |
|                | (1)        | (1)  |          |            |              |                |   |  |            |   |   |  |     |     |   |                                  |
| <b>Total</b>   |            |  | <b>2</b> |            |              |                |   |  |            |   |   |  |     |     |   |                                  |

| Question     |     | Answer  | Marks    | Guidance  |
|--------------|-----|---|----------|---|
| 9            | (a) | $2.25 \times 10^8$ or $2.3 \times 10^8$ (m / s) (2)<br><b>but if answer is incorrect</b><br>$3 \times 10^8$ / 1.333 (1) | 2        | <b>allow</b> 225(056264.1) (2)<br><b>allow</b> 225 563 909.8 (2)  |
|              | (b) | glass – arsenic trisulphide (1)   | 1        |   |
|              | (c) | blue light is <b>refracted</b> more / ORA (1)<br><br>blue light slows down more (than red) / ORA (1)                    | 2        | <b>eg.</b> red refracted less than blue (1)<br><b>ignore</b> blue bends / deviates more<br><br><b>allow</b> blue has a shorter wavelength (1)<br><b>ignore</b> frequency<br><br><b>allow</b> higher level answers in terms of the equation:<br>$n = \text{speed in vacuum} / \text{speed in medium}$<br>eg smaller speed in glass has larger refractive index. Red light travels faster than blue so blue has larger n. (2) |
| <b>Total</b> |     |   | <b>5</b> |   |

| Question     |         | Answer   | Marks    | Guidance  |
|--------------|---------|--|----------|---|
| 10           | (a)     | resistance decreases (1)<br>brightness of lamp / current increases (1)   | 2        | <b>ignore</b> weaker resistance<br><b>ignore</b> faster / stronger current<br>But resistance increases (0) so brightness of lamp / current decreases (1)  |
|              | (b) (i) | 0.92 ( $\Omega$ ) (2)<br><b>but if answer is incorrect</b><br>$\frac{1}{R_T} = \frac{1}{2} + \frac{1}{3} + \frac{1}{4} \quad (1)$ <b>or</b><br>$\frac{1}{R_T} = 0.5 + 0.33 + 0.25 \quad (1)$ | 2        | <b>allow</b> 0.92(307692) (2)<br><b>allow</b> 0.9 (2)<br><b>allow</b> $\frac{12}{13}$ ( $\Omega$ ) (2)  |
|              | (ii)    | 4.3 (amps) (2)<br><b>but</b> $\frac{4}{0.92} \quad (1)$  | 2        | allow 4.30 to 4.45 (2)<br>allow ecf from bi (2)<br>eg for ecf of 1.08 - allow 3.7 (2)<br>eg for ecf of 9 - allow 0.44 or 0.4 (2)<br>allow 4 / answer to bi (1) eg 4/1.08 (1)<br><b>allow</b> 4.30 to 4.45 (2)<br><b>allow</b> $\frac{4}{\text{answer to b(i)}}$ (1) |
|              | (c)     | $I_e = 0.60 \text{ mA}$ (1)  | 1        | <b>Allow</b> 0.6 (1)  |
| <b>Total</b> |         |  | <b>7</b> |   |

| Question |         | Answer   | Marks  | Guidance  |   |        |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                       |
|----------|---------|--|--------|---|---|--------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|-----------------------|
| 11       | (a)     | diode (1)<br><br>(diode) has a high resistance in one direction and a low resistance in the other (1)  | 2      | allow LED (1)<br><br>allow current flows one way only (1)<br>allow threshold voltage / current idea (1) |   |        |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                       |
|          | (b) (i) | <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>A</th> <th>B</th> <th>C</th> <th>output</th> </tr> </thead> <tbody> <tr><td>0</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>1</td><td>0</td><td>0</td><td>1</td></tr> <tr><td>0</td><td>1</td><td>0</td><td>1</td></tr> <tr><td>1</td><td>1</td><td>0</td><td>1</td></tr> <tr><td>0</td><td>0</td><td>1</td><td>0</td></tr> <tr><td>1</td><td>0</td><td>1</td><td>0</td></tr> <tr><td>0</td><td>1</td><td>1</td><td>0</td></tr> <tr><td>1</td><td>1</td><td>1</td><td>0</td></tr> </tbody> </table> <p style="text-align: right;">(1)</p> | A      | B   | C | output | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | all four zeros needed |
| A        | B       | C  | output |   |   |        |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                       |
| 0        | 0       | 0  | 0      |   |   |        |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                       |
| 1        | 0       | 0  | 1      |   |   |        |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                       |
| 0        | 1       | 0  | 1      |   |   |        |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                       |
| 1        | 1       | 0  | 1      |   |   |        |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                       |
| 0        | 0       | 1  | 0      |   |   |        |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                       |
| 1        | 0       | 1  | 0      |   |   |        |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                       |
| 0        | 1       | 1  | 0      |   |   |        |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                       |
| 1        | 1       | 1  | 0      |   |   |        |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                       |
|          | (ii)    | dark / not light (1)<br><br>hot / wet (1)  | 2      | allow night(time) / dim (1)   |   |        |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                       |



| Question |       | Answer  | Marks    | Guidance  |
|----------|-------|---|----------|---|
|          | (iii) | <p><b>any two from:</b></p> <p>fan needs a large current / voltage to operate (1)</p> <p>logic gates use low current / voltage (1)</p> <p>logic gate would be damaged if connected (directly) to mains (1)</p> <p>relay switches on a high current / voltage by using a low current / voltage (1)</p> | 2        | <p><b>allow</b> isolation idea of logic gate from fan (1)</p> <p><b>ignore</b> power</p> <p><b>ignore</b> changes low voltage into high voltage</p> |
|          |       | <b>Total</b>  | <b>7</b> |   |

| Question | Answer  | Marks    | Guidance  |
|----------|---|----------|---|
| 12       | <p><b>[Level 3]</b><br/>Describes the construction of the transformer <b>AND</b> performs a calculation to determine the turns ratio or output current<br/><b>AND</b> explains the process of electromagnetic induction.<br/>Quality of written communication does not impede communication of the science at this level.<br/><b>(5–6 marks)</b></p> <p><b>[Level 2]</b><br/>Describes the construction of this transformer <b>AND EITHER</b> performs a simple calculation <b>OR</b> gives a partial explanation of electromagnetic induction.<br/>Quality of written communication partly impedes communication of the science at this level.<br/><b>(3–4 marks)</b></p> <p><b>[Level 1]</b><br/>Describes two features of the basic construction of a transformer.<br/>Quality of written communication does impede communication of the science at this level.<br/><b>(1–2 marks)</b></p> <p><b>[Level 0]</b><br/>Insufficient or irrelevant science. Answer not worthy of credit.<br/><b>(0 marks)</b></p> | 6        | <p><b>This question is targeted at grades up to A.</b><br/><b>Level 3 relevant points:</b></p> <ul style="list-style-type: none"> <li>• two coils wrapped around core made of iron secondary less turns than primary</li> <li>• 46 x more turns on primary or calculate current = 2300mA</li> <li>• varying magnetic field in primary and varying magnetic field in secondary inducing an emf.</li> </ul> <p><b>Level 2 diagram or description of transformer construction:</b></p> <ul style="list-style-type: none"> <li>• two coils wrapped around (iron) core with secondary less turns than primary</li> <li>• ratio 230:5 or 2% or sensibly attempted calculation using transformer equation.</li> </ul> <p><b>Level 1 diagram or description of transformer construction:</b></p> <ul style="list-style-type: none"> <li>• two coils of wire</li> <li>• wrapped on (iron) core</li> <li>• step down transformer</li> </ul> <p><b>Use the L1, L2, L3 annotations in Scoris. Do not use ticks.</b></p> |
|          | <b>Total</b>  | <b>6</b> |   |

| Question     |     | Answer  | Marks    | Guidance   |
|--------------|-----|---|----------|--|
| 13           | (a) | ...flows from P to S and through the resistor or to T (1) | 2        | <b>ignore</b> current paths after T  |
|              |     | ...flows from R to S and through the resistor or to T(1)  |          | <b>ignore</b> current paths after T  |
|              | (b) | smoothed output (1)                                       | 1        | <b>allow</b> suitable diagram of smoothing if it shows a comparison (to the original output) (1) |
| <b>Total</b> |     |   | <b>3</b> |  |

| Question   |  | Answer   | Marks    | Guidance |
|--|--|--|----------|----------|
| 14   |  | <b>any 2 from:</b>   | 2        |          |
|  |  | must be robust (to withstand take off) / AW (1)  |          |          |
|  |  | must be reliable / if it breaks in space it cannot be easily repaired / AW (1)                             |          |          |
|  |  | must be able to operate without overheating / cooling system or heat sinks needed (during manufacture) (1) |          |          |
|  |  | must be able to withstand large variations in temperature (in space) (1)                                   |          |          |
|  |  | must be clean /dust free (1)   |          |          |
|  |  | difficult to make connection to small objects / difficult to see faults (1)                                |          |          |
| (idea that it is) difficult to obtain very pure silicon (1)                  |  |  |          |          |
| (idea that) specialised manufacturing equipment or expertise is required (1) |  | <b>allow</b> need to use specific equipment e.g. must use microscopes                                      |          |          |
| <b>Total</b>   |  |  | <b>2</b> |          |

## Section D

| Question |     |       | Answer   | Marks | Guidance  |
|----------|-----|-------|--|-------|---|
| 15       | (a) | (i)   | (idea that) the braking distance is greater (for concrete at 3mm) / AW (1)   | 1     | <b>allow</b> correct comparisons at other tyre depths<br>eg 26.5 is less than 35.5 (1)  |
|          |     | (ii)  | Any two from:<br><br>same speed / KE (1)<br><br>same driving conditions (1)<br><br><br><br>same braking force (1)<br><br><br>same mass / load in car (1) | 2     | <b>allow</b> specific examples<br>Eg. same weather conditions (1)<br>Eg. same depth of water on road (1)<br>Eg. Same driver (1)<br><b>allow</b> same tyre size / pressures (1)<br><b>ignore</b> same road surface materials<br><br><b>allow</b> same braking action (1) |
|          |     | (iii) | no with 45% (3)<br><br>45% (2)<br><br><b>but if 45% incorrect then</b><br><br>42 – 29 or 13 scores (1)   | 3     | <b>allow</b> 44% to 46% (2)<br><br>45% on its own or 'Yes with 45%' scores (2)<br><br>allow and credit reverse arguments:<br>eg. 'It goes from 29 to 42, a 50% increase would be 43.5m'<br>(2) <b>SO</b> it is an impossibility to be a 76% (2x38%) increase<br>(1).    |

| Question     |         | Answer   | Marks     | Guidance   |
|--------------|---------|--|-----------|--|
|              | (b) (i) | 30 000 (km) (3)<br><br><b>but if final answer incorrect</b><br><br><u>5.1</u><br>0.17 or 30 scores (2)<br><br><b>but if none of the above</b><br><br>5.1 (mm) scores (1) | 3         | <b>allow</b> 30001(km) (3)<br><br><b>allow</b> $\frac{5.2}{0.17}$ (2)<br><br><b>allow</b> 5.2 (mm) (1) |
|              | (ii)    | (idea that) tyres would have a large braking distance (1)<br><br>Braking distance significantly increases less than 3mm (1)  | 1         | <b>allow</b> stopping distance instead of braking distance   |
| <b>Total</b> |         |  | <b>10</b> |  |

**OCR (Oxford Cambridge and RSA Examinations)**  
**1 Hills Road**  
**Cambridge**  
**CB1 2EU**

**OCR Customer Contact Centre**

**Education and Learning**

Telephone: 01223 553998

Facsimile: 01223 552627

Email: [general.qualifications@ocr.org.uk](mailto:general.qualifications@ocr.org.uk)

**[www.ocr.org.uk](http://www.ocr.org.uk)**

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored

**Oxford Cambridge and RSA Examinations**  
is a Company Limited by Guarantee  
Registered in England  
Registered Office; 1 Hills Road, Cambridge, CB1 2EU  
Registered Company Number: 3484466  
OCR is an exempt Charity

**OCR (Oxford Cambridge and RSA Examinations)**  
Head office  
Telephone: 01223 552552  
Facsimile: 01223 552553

© OCR 2013

