

**Physics B J645**

**Gateway Science Suite**

General Certificate of Secondary Education

**Mark Scheme for the Units**

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**January 2010**

**J645/MS/R/10J**

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### GCSE Gateway Physics B J645

#### MARK SCHEMES FOR THE UNITS

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# Mark Scheme Guidance

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

/ = alternative and acceptable answers for the same marking point

(1) = separates marking points

**not** = answers which are not worthy of credit

**reject** = answers which are not worthy of credit

**ignore** = statements which are irrelevant

**allow** = answers that can be accepted

( ) = words which are not essential to gain credit

= underlined words must be present in answer to score a mark

ecf = error carried forward

AW = alternative wording

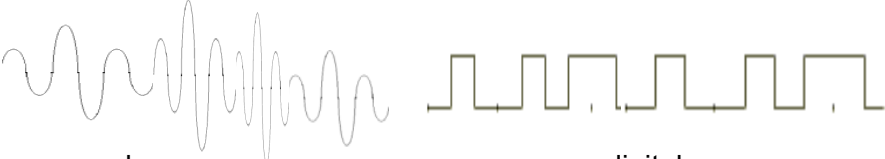
ora = or reverse argument

## B651/01 Unit 1: Modules P1, P2 and P3 Foundation Tier

| Question     |     | Expected Answers   | Marks      | Additional Guidance   |
|--------------|-----|--|------------|---|
| 1            | (a) | <p><b>any two from</b><br/>(increased) energy use / electricity (1)</p> <p>(more) carbon dioxide / CO<sub>2</sub> (1)</p> <p>deforestation (1)</p> <p>increased population (1)</p> | 2          | <p><b>allow</b> (more) industrialisation / factories<br/><b>allow</b> (more) cars / transport / air travel / fuel use</p> <p><b>allow</b> carbon emissions<br/><b>allow</b> (more) greenhouse gas / (more) methane</p> <p><b>allow</b> less carbon dioxide used up / less oxygen produced</p> |
|              | (b) | (i)  | 1          |   |
|              |     | (ii)   | 1          | <p><b>allow</b> sun stroke<br/><b>not</b> cancer or burn<br/><b>ignore</b> skin damage</p> <p><b>allow</b> damage to eyes</p>   |
|              |     | (iii)  | 1          | <p><b>allow</b> use sun (tan) lotion / sun cream / protection</p> <p><b>allow</b> cover up / wear clothing (e.g. hat)</p>   |
| <b>Total</b> |     |  | <b>[5]</b> |   |

| Question |     | Expected Answers  | Marks      | Additional Guidance   |
|----------|-----|---|------------|---|
| 2        | (a) | insulator (1)<br>conduction (1)   | 2          | this order only   |
|          | (b) | <b>any two from:</b><br>double glazing (1)<br>reflective foil behind radiators (1)<br>curtain lining (1)<br>underlay (1)<br>loft insulation (1)<br>draught proofing (1) | 2          | <b>allow</b> secondary / triple glazing<br><br><b>allow</b> curtains<br><b>allow</b> carpets / underfloor insulation<br><br><b>allow</b> 'door sausage' / fill gaps / keep doors or windows closed<br><b>allow</b> turn down thermostat / reduce heating                                |
|          | (c) | how long it takes for savings (on energy) to equal initial outlay / AW (1)  | 1          | <b>allow</b> time it takes to break even / how long it takes to get your money back / time for something to pay for itself<br><b>ignore</b> any calculation<br><b>not</b> pay back cost (of installation) or pay back loan for having insulation put in or pay off cost of installation |
|          |     | <b>Total</b>  | <b>[5]</b> |   |

| Question |     |       | Expected Answers  | Marks      | Additional Guidance                                    |
|----------|-----|-------|---|------------|--|
| 3        | (a) | (i)   | A in top right box (1)                                      | 1          | any letter in incorrect box loses mark for that letter |
|          |     | (ii)  | C in top left box (1)                                       | 1          | any letter in incorrect box loses mark for that letter |
|          |     | (iii) | T in bottom right box (1)                                   | 1          | any letter in incorrect box loses mark for that letter |
|          |     | (iv)  | W in bottom left box (1)                                    | 1          | any letter in incorrect box loses mark for that letter |
|          | (b) |       | 0.75 (2)<br><br>but if answer incorrect<br><br>0.15 x 5 (1) | 2          |  |
|          |     |       | <b>Total</b>  | <b>[6]</b> |  |

| Question     | Expected Answers  | Marks      | Additional Guidance   |
|--------------|---|------------|---|
| 4 (a)        | <p><b>any one from</b><br/>                     available anywhere (there is a signal) / AW (1)<br/>                     no wiring needed / plug / mains supply / AW (1)<br/>                     portable / AW (1)</p> | 1          | <p><b>allow</b> so do not trip over the cable</p>   |
| (b)          | <p><u>analogue</u> signal continuously variable / can have any value (within a range) (1)</p> <p><u>digital</u> can have two values or 2 states / 0, 1 / high, low / on, off / pulsed (1)</p>                           | 2          | <p><b>allow</b> has a range of values<br/> <b>ignore</b> vary in amplitude</p> <p><b>allow</b> a series of binary codes (1)<br/> <b>not</b> a range between 0 and 1 / 2 settings / 2 variables<br/> <b>not</b> can be turned or switched on and off<br/> <b>not</b> any two values<br/> <b>allow</b> correct diagrams only if there is no writing on the answer line or the answer is neutral, if written answer is incorrect diagrams <b>cannot</b> score e.g.</p> <div style="text-align: center;">  <p style="display: flex; justify-content: space-around; margin-top: 5px;"> <span>analogue</span> <span>digital</span> </p> </div> <p><b>ignore</b> idea that digital carry more information or interference is less</p> |
| (c)          | <p>broadcasting on similar frequency / wavelength (1)</p>   | 1          | <p><b>allow</b> same frequency / wavelength<br/> <b>ignore</b> references to waves overlapping or other descriptions of what interference is</p>  |
| <b>Total</b> |   | <b>[4]</b> |   |



| Question     |     | Expected Answers   | Marks      | Additional Guidance  |
|--------------|-----|--|------------|--|
| 5            | (a) | Sun (1)  | 1          | <b>not</b> light / sunlight  |
|              | (b) | <b>any two from</b><br>increase the speed of movement of coil or magnet / AW (1)<br>more turns / coils (1)<br>stronger magnets (1) | 2          | <b>not</b> increase current / voltage / power<br><br><b>ignore</b> just move faster<br><br><b>ignore</b> bigger magnet<br><b>allow</b> stronger field / more powerful magnet / moving magnet closer / add another magnet |
| <b>Total</b> |     |  | <b>[3]</b> |  |

| Question     |     | Expected Answers  | Marks      | Additional Guidance  |
|--------------|-----|---|------------|--|
| 6            | (a) | battery / cell / fuel cell (1)  | 1          | <b>allow</b> <u>DC</u> generator<br><b>not</b> solar panels / solar cell   |
|              | (b) | goes to the atmosphere / air / river / cooling tower / surroundings / chimney (1)<br><br>heat (1) | 2          | <b>ignore</b> any reference to pollution other than heat pollution (1)<br><br><b>ignore</b> contributes to global warming<br><b>ignore</b> sound |
| <b>Total</b> |     |   | <b>[3]</b> |  |

| Question     |     | Expected Answers | Marks      | Additional Guidance |
|--------------|-----|------------------|------------|---------------------|
| 7            | (a) | kettle (1)       | 1          |                     |
|              | (b) | iron (1)         | 1          |                     |
| <b>Total</b> |     |                  | <b>[2]</b> |                     |

| Question     |     |      | Expected Answers   | Marks      | Additional Guidance  |
|--------------|-----|------|--|------------|--|
| 8            | (a) | (i)  | idea that the radiation causes cancer / mutations (1)  | 1          | <b>allow</b> higher level answers eg kill or harm body cells or DNA / <b>radiation</b> poisoning or sickness / ionising<br><b>allow</b> could kill (lowest limit of acceptability)<br><b>ignore</b> references to harm or harmful or its radioactive |
|              |     | (ii) | it can be used to make (nuclear / atomic) bombs / AW (1)   | 1          | <b>allow</b> <u>nuclear</u> weapons / dirty bombs<br><b>ignore</b> reference to terrorists or weapons of mass destruction  |
|              | (b) |      | <b>any two from</b><br>tongs/ remote handling / distance (1)<br>short exposure time (1)<br>film badge / monitoring / screening / AW (1)<br>shielding (1) | 2          | <b>ignore</b> protective clothing eg gloves goggles / lead apron<br><br><b>allow</b> safety screen<br><b>allow</b> wash thoroughly after contact with radioactive material   |
| <b>Total</b> |     |      |  | <b>[4]</b> |  |

| Question     |     |     | Expected Answers                                       | Marks      | Additional Guidance  |
|--------------|-----|-----|--|------------|--|
| 9            | (a) |     | <b>both required for one mark</b><br>Mercury Venus (1) | 1          | this order only<br><b>allow</b> correct answers on the diagram if answer lines blank |
|              |     | (b) | gravity (1)  | 1          | <b>allow</b> gravitational / centripetal / gravitational pull<br><b>not</b> weight   |
|              | (c) |     | magnetic (1)<br>compass (1)<br>iron (1)                | 3          | this order only  |
| <b>Total</b> |     |     |  | <b>[5]</b> |  |

| Question |     | Expected Answers   | Marks      | Additional Guidance  |
|----------|-----|--|------------|--|
| 10       | (a) | <b>any two from</b><br>ejection of hot rocks (1)<br>fires (1)<br>dust clouds (1)<br>climate change (1)<br><br>species extinction / kills animals (1)<br>tsunamis (1)<br>earthquake (1) | 2          | <b>allow</b> ice age<br><b>not</b> global warming / heating Earth<br><b>allow</b> specific examples eg dinosaurs or humans<br><br><b>allow</b> change Earth's orbit<br><b>ignore</b> references to damage to buildings |
|          | (b) | there is nothing <b>living</b> on board /AW (1)  | 1          | <b>allow</b> idea that <b>living</b> things need food / water to survive<br><b>not</b> just unmanned or no one onboard   |
|          |     | <b>Total</b>   | <b>[3]</b> |  |

| Question |     |      | Expected Answers  | Marks      | Additional Guidance   |
|----------|-----|------|---|------------|---|
| 11       | (a) | (i)  | stopwatch / stopclock (1)                                       | 1          | <b>not</b> watch  |
|          |     | (ii) | tape measure / trundle wheel (1)                                | 1          | <b>ignore</b> ruler   |
|          | (b) | (i)  | David (1)   | 1          | more than one answer scores 0<br><b>allow</b> ringed answer in table if no answer on line |
|          |     | (ii) | 6 (2)<br><br><b>but</b> if answer incorrect<br><br>360 / 60 (1) | 2          | <b>ignore</b> other calculations of speed eg speed that David runs                        |
|          |     |      | <b>Total</b>  | <b>[5]</b> |   |

| Question     |     | Expected Answers                     | Marks      | Additional Guidance                          |
|--------------|-----|--------------------------------------|------------|--|
| 12           | (a) | energy <b>and</b> work (1)           | 1          | both needed<br>more than two ringed scores 0 |
|              | (b) | force (1)<br>energy (1)<br>power (1) | 3          | must be this order                           |
| <b>Total</b> |     |                                      | <b>[4]</b> |  |

| Question     |     | Expected Answers   | Marks      | Additional Guidance   |
|--------------|-----|--|------------|---|
| 13           | (a) | A  | 1          | <b>allow</b> correct answer underlined, circled or ticked in list if answer line is blank   |
|              | (b) | (gravitational) potential energy reduces or it reduces (1)<br><br>kinetic energy increases (1)<br><br><b>but</b><br><br>(gravitational) potential energy or it converted to kinetic energy (2) | 2          | <b>allow</b> one additional marking point for higher level answers eg work done against friction / energy to move water out of the way / energy to displace water |
|              | (c) | correct reference to friction <b>and</b> weight / gravity (1)<br><br>idea of less friction on water slide / water acts as a lubricant / water reduces friction / AW (1)                        | 2          | <b>allow</b> drag force<br><br><b>ignore</b> gravity but allow higher level answer in terms of gravity being greater than friction (1)                            |
| <b>Total</b> |     |  | <b>[5]</b> |   |

| Question |     | Expected Answers         | Marks      | Additional Guidance   |
|----------|-----|--------------------------|------------|---|
| 14       | (a) | petrol (1)<br>diesel (1) | 2          | <b>allow</b> LPG<br><b>allow</b> biodiesel<br><b>allow</b> gasoline         |
|          | (b) | Ford Fiesta              | 1          | <b>allow</b> tick beside or ring around Ford Fiesta if answer line is blank |
|          |     | <b>Total</b>             | <b>[3]</b> |   |

| Question |     | Expected Answers | Marks      | Additional Guidance  |
|----------|-----|------------------|------------|--|
| 15       | (a) | thinking         | 1          | <b>allow</b> correct answer in key box if answer line is blank |
|          | (b) | 75               | 1          |  |
|          | (c) | 96               | 1          |  |
|          |     | <b>Total</b>     | <b>[3]</b> |  |

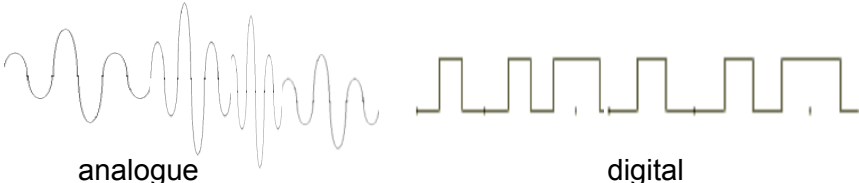
## B651/02 Physics B: Unit 1 Modules P1, P2, P3 Higher Tier

| Question |     | Expected Answers  | Marks      | Additional Guidance  |
|----------|-----|---|------------|--|
| 1        | (a) | <p><b>any two from (any order)</b><br/>boiling / at boiling point (1)</p> <p>melting (1)</p> <p>subliming (1)</p> | 2          | <p><b>allow</b> higher level answers eg (inter) <u>molecular</u> bonds being broken as an additional marking point</p> <p><b>allow</b> change of state but not in addition to boiling or melting eg melting.....change of state (1)</p> <p><b>but</b> change of state..... molecular bonds broken (2)</p> <p><b>not</b> freezing as alternative to melting</p> <p><b>ignore</b> evaporating</p> <p><b>ignore</b> exothermic or endothermic</p> <p>if no mark awarded description of solid to liquid or liquid to gas (1)</p> |
|          | (b) | <p>(temperature) hotness <b>and</b> chosen (1)</p> <p>(heat) energy <b>and</b> absolute (1)</p>                   | 2          | <p><b>both</b> answers in correct order for 1 mark</p> <p><b>both</b> answers in correct order for 1 mark</p> <p>if no mark gained <b>allow</b> hotness <b>and</b> energy in first two parts of answers or chosen <b>and</b> absolute in second two</p>  |
|          |     | <b>Total</b>  | <b>[4]</b> |  |

| Question |     | Expected Answers  | Marks      | Additional Guidance  |
|----------|-----|---|------------|--|
| 2        | (a) | idea of (kinetic or movement or KE) <b>energy</b> passed on from one particle to another (1)  | 1          | <b>ignore</b> passing on vibrations  |
|          | (b) | <b>use ✓'s in this question</b><br><br><b>any two from</b><br>reduces / eliminates radiation (from wall) (1)<br><br>reference to air (in foam) being stationary / trapped (1)<br><br>idea of reduced convection (1) | 2          | <b>not</b> foam reflects heat back<br><br><b>allow</b> idea of foam having pockets of air<br><br><b>allow</b> no convection  |
|          | (c) | how long it takes for savings (on energy) to equal initial outlay (1)   | 1          | <b>allow</b> time it takes to break even / how long it takes to get your money back / time for something to pay for itself<br><b>ignore</b> any calculation<br><b>not</b> pay back cost (of installation) or pay loan for having insulation put in or pay off cost of installation |
|          | (d) | put foil or shiny surface or reflecting material on wall or behind or on radiator /<br><br>reflection of IR / heat / radiation (1)  | 1          | <b>allow</b> move radiator to an inside wall but <b>not just</b> move radiator   |
|          |     | <b>Total</b>  | <b>[5]</b> |  |

| Question |     | Expected Answers  | Marks      | Additional Guidance   |
|----------|-----|---|------------|---|
| 3        | (a) | 0.75 (2)<br><br><b>but if answer is incorrect</b><br><br>0.15 x 5 (1)   | 2          |   |
|          | (b) | radio waves cannot be seen / more secure or<br>can be transmitted or travel further / (or may)<br>carry more information or signals (1) | 1          | <b>ignore</b> quicker<br><b>allow</b> can diffract<br><b>allow</b> bend around hills / objects<br><b>allow</b> don't have to be in line of sight / ora for light<br><b>allow</b> multiplexing<br><b>ignore</b> can be transmitted more easily |
|          |     | <b>Total</b>  | <b>[3]</b> |   |



| Question |     | Expected Answers  | Marks      | Additional Guidance   |
|----------|-----|---|------------|---|
| 4        | (a) | laptop / mobile phone (1)   | 1          | <b>allow</b> TV / walkie talkie / Bluetooth / printer / mouse / router / blackberry / pager / PDA / remote (control) (1)<br><b>ignore</b> references to internet or intranet  |
|          | (b) | <b>use ✓'s in this question</b><br><u>analogue</u> signal continuously variable / can have any value (within a range) (1)<br><br><u>digital</u> can have two values or 2 states / 0, 1 / high, low / on, off / pulsed (1) | 2          | <b>allow</b> has a range of values<br><b>ignore</b> vary in amplitude<br><br><b>allow</b> a series of binary codes (1)<br><b>not</b> a range between 0 and 1 / 2 settings / 2 variables<br><b>not</b> can be turned or switched on and off<br><b>not</b> any two values<br><b>allow</b> correct diagrams only if there is no writing on the answer line or the answer is neutral, if written answer is incorrect diagrams <b>cannot</b> score e.g.<br><br><br><b>ignore</b> idea that digital carry more information or interference is less |
|          | (c) | broadcasting on similar frequency / wavelength (1)  | 1          | <b>allow</b> same frequency / wavelength<br><b>ignore</b> references to waves overlapping or other descriptions of what interference is   |
|          |     | <b>Total</b>  | <b>[4]</b> |   |

| Question |     | Expected Answers   | Marks      | Additional Guidance  |
|----------|-----|--|------------|--|
| 5        | (a) | risk of / possible damage to <b>health</b> (1)   | 1          | <b>allow</b> specific health damage eg cancer / tumours / (body) cells / tissue<br><b>allow</b> could heat (water in) the brain / brain damage / headaches<br><b>allow</b> could cause (health) problems for people in the future eg there would be long term effects on people (1) (lowest limit of acceptability)<br><b>ignore</b> references to <b>just</b> harm or harmful or damage |
|          | (b) | <b>any two from</b><br>no or very little diffraction (of microwaves) (1)<br><br>reflection from buildings / blocked by buildings or obstacles / objects in the way (1)<br><br>interference from two transmitters (1)<br><br>idea of satellite signals being more powerful or terrestrial ones weaker (1) | 2          | <b>not just</b> microwaves diffract or microwaves diffract causing loss of signal<br><br><b>ignore</b> references to line of sight   |
|          | (c) | <b>ignore</b> 'M' on diagram (no mark; the mark is for the explanation)<br>(choice is) highest building / so signals can reach more places / reduce signal loss (1)  | 1          | <b>allow</b> idea of high(er) up   |
|          |     | <b>Total</b>   | <b>[4]</b> |  |

| Question |     | Expected Answers   | Marks      | Additional Guidance |
|----------|-----|--|------------|---------------------|
| 6        | (a) | white dwarf / red giant / planetary nebula (1)<br><br><b>for second mark any two from</b><br><br>black hole<br><br>supernova<br><br>neutron star (1) | 2          |                     |
|          | (b) | (thermo) <u>nuclear fusion</u> (1)   | 1          | <b>not</b> fission  |
|          |     | <b>Total</b>   | <b>[3]</b> |                     |

| Question |     |      | Expected Answers   | Marks      | Additional Guidance   |
|----------|-----|------|--|------------|---|
| 7        | (a) | (i)  | idea that the radiation causes cancer / mutations (1)  | 1          | <b>allow</b> higher level answers eg kill or harm (body) cells or DNA / <b>radiation</b> poisoning or sickness / ionising<br><b>allow</b> could kill (lowest limit of acceptability)<br><b>ignore</b> references to harm or harmful or it's radioactive |
|          |     | (ii) | it can be used to make (nuclear / atomic) bombs / AW (1)   | 1          | <b>allow</b> <u>nuclear</u> weapons / dirty bombs<br><b>ignore</b> reference to terrorists or weapons of mass destruction   |
|          | (b) |      | landfill sites if qualified eg low level waste /<br>taken out to or pumped into the sea /<br>encased or vitrified in glass /<br>reprocessed /<br>stored in steel or concrete or lead or glass or sealed containers /<br>idea of stored <b>deep</b> underground (1) | 1          | <b>allow</b> fired into space<br><b>ignore</b> just put underwater but <b>allow</b> under <b>deep</b> water<br><br><b>allow</b> strong but not just containers<br><br><b>allow</b> in mines<br><br><b>ignore</b> references to earthquake sites         |
|          |     |      | <b>Total</b>   | <b>[3]</b> |   |

| Question |     |      | Expected Answers   | Marks      | Additional Guidance  |
|----------|-----|------|--|------------|--|
| 8        | (a) | (i)  | <p>use ✓'s in this question</p> <p>charged or ionising <u>particles</u> (1)</p> <p>ejected at <b>high</b> speed or <b>high</b> energy (1)</p>                                    | 3          | <p><b>allow</b> protons / hydrogen (nuclei) / electrons / ions / alpha / <math>\alpha</math> / helium nuclei / beta / <math>\beta</math> for particles</p> <p><b>not</b> just quick or lots of energy</p> <p><b>ignore</b> beams or rays</p> <p><b>ignore</b> just from Sun / space</p> <p><b>ignore</b> interfering with satellite signals</p>  |
|          |     | (ii) | <p>interferes with <u>signal or waves</u> / disturbs or distorts the <u>signal or waves</u> / scrambles the <u>signal or waves</u> / destroys the <u>signal or waves</u> (1)</p> | 1          | <p><b>ignore</b> references to orbit or affects the satellite</p> <p><b>allow</b> blocks / interrupts / knocks out the <u>signal or waves</u></p> <p><b>allow</b> damages <u>signal or waves</u> (lowest limit of acceptability)</p> <p><b>allow</b> causes communication or transmission blackout / <b>loss</b> of communication or transmission / stops or blocks communication / transmission or 'it' or 'them'</p> |
|          | (b) |      | <p><b>both required</b></p> <p>Mercury Venus (1)</p>   | 1          | <p>must be correct order</p> <p><b>allow</b> correct answers on the diagram if answer lines blank</p>  |
|          | (c) |      | <p>gravity (1)</p>   | 1          | <p><b>allow</b> gravitational / gravitational pull / centripetal</p> <p><b>not</b> weight</p>  |
|          |     |      | <b>Total</b>   | <b>[6]</b> |  |

| Question     | Expected Answers   | Marks    | Additional Guidance  |
|--------------|--|----------|--|
| <p>9 (a)</p> | <p><b>in this question put * beside incorrect answers then enter mark</b></p> <p><b>coal</b><br/>                     advantage – idea of currently readily available</p> <p>disadvantage – produces CO<sub>2</sub> / increases carbon emissions / acid gases / adds to global warming or greenhouse effect (1)</p> <p><b>nuclear</b><br/>                     advantage – no CO<sub>2</sub> produced / no carbon emissions / no sulphur dioxide / SO<sub>2</sub> / acid rain / small amount of fuel required / does not add to global warming or greenhouse effect (1)</p> <p>disadvantage – produces <u>radioactive waste</u> / difficult or expensive to dispose of <b>waste</b> / to decommission / expensive to build power station / remains radioactive or gives out radiation for a long time (1)</p> <p><b>wood</b><br/>                     advantage – renewable source / (relatively) carbon neutral / idea of plentiful supply</p> <p>disadvantage – limited supplies available at present / produces CO<sub>2</sub> / increases carbon emissions (1)</p> | <p>3</p> | <p>6 correct answers = (3)<br/>                     5 / 4 correct = (2)<br/>                     3 / 2 correct = (1)<br/>                     1 correct = (0)</p> <p><b>ignore</b> references to site / maintenance costs or amount of energy released / pollution for all 3 energy sources</p> <p><b>allow</b> non-renewable or idea of finite supply / millions of years to form<br/> <b>allow</b> produces sulphur dioxide / SO<sub>2</sub> / acid rain<br/> <b>ignore</b> smoke or reference to fossil fuel</p> <p><b>allow</b> no greenhouse gases no polluting / toxic gases emitted<br/> <b>allow</b> not a fossil fuel or conserves fossil fuels<br/> <b>ignore</b> carbon neutral</p> <p><b>allow</b> terrorist threat<br/> <b>allow</b> non-renewable or idea of finite supply<br/> <b>ignore</b> nuclear accidents</p> <p><b>allow</b> can re-grow / plant more trees / sustainable<br/> <b>allow</b> not a fossil fuel or conserves fossil fuels</p> <p><b>allow</b> uses lots of land / adds to global warming or greenhouse effect / ruins habitats / produces deforestation but <b>not just</b> loss of trees<br/> <b>ignore</b> reduces oxygen in atmosphere</p> |

|  |     |   |            |  |
|--|-----|---|------------|--|
|  | (b) | <p><b>must have correct advantage and disadvantage for one mark</b></p> <p><b>advantage</b> energy can be stored / idea of lower cost to consumer</p> <p><b>disadvantage</b> available at inconvenient times / only available at night / not available 24 hours / extra wiring or meter needed / higher standing charge</p> | 1          | <p><b>allow</b> answers giving an idea of balancing supply and demand eg spreads demand / encourages use when demand is low / avoids shut down of power stations at night / takes the strain of the demand / AW</p> <p><b>allow</b> it is more cost effective as it allows the power station to keep running</p> |
|  |     | <b>Total</b>  | <b>[4]</b> |  |

| Question |     | Expected Answers  | Marks      | Additional Guidance   |
|----------|-----|---|------------|---|
| 10       | (a) | <p>use ✓'s in this question</p> <p><b>idea that</b><br/>current falls as distance increases or light intensity decreases / ora (1)</p> <p>(current) falls quickly near the photocell <b>and</b> less rapidly further away (2)</p> | 2          | <p><b>allow</b> as an additional marking point<br/>less electrons released in photocell with lower light intensity or greater distance from the light source / ora (1)<br/><b>ignore</b> weaker or stronger current or reference to power</p> <p><b>allow</b> higher level answers<br/>eg if distance doubles current more than halves / inverse square relationship / as distance doubles intensity goes down by a factor of 4 (2)</p> |
|          | (b) | <p><b>any two from</b><br/>increase the speed of movement of coil or magnet / AW (1)</p> <p>more turns / coils (1)</p> <p>stronger magnets (1)</p>  | 2          | <p><b>not</b> increased current / voltage / power<br/><b>ignore</b> just move faster</p> <p><b>ignore</b> bigger magnet<br/><b>allow</b> stronger field / more powerful magnet / moving magnet closer or add another magnet</p>   |
|          | (c) | <p>(the number) of cycles or waves or oscillations or vibrations each second or minute or per unit or given time (1)</p>  | 1          | <p><b>allow</b> references to current alternating<br/>eg amount of times the current alternates per second (1)</p>  |
|          |     | <b>Total</b>  | <b>[5]</b> |   |



| Question |         | Expected Answers  | Marks      | Additional Guidance  |
|----------|---------|---|------------|--|
| 11       | (a)     | 6 (2)<br><br>but if answer is incorrect<br><br>360 / 60 (1) | 2          | <b>ignore</b> other calculations of speed eg speed that David runs   |
|          | (b) (i) | increasing / accelerating / getting faster (1)              | 1          | <b>allow</b> going up  |
|          | (ii)    | straight line / constant gradient or slope (1)              | 1          | <b>allow</b> line is not a curve<br><b>allow</b> proportional<br><b>allow</b> steady line or slope<br><b>ignore</b> positive correlation |
|          |         | <b>Total</b>  | <b>[4]</b> |  |

| Question |     | Expected Answers  | Marks      | Additional Guidance  |
|----------|-----|---|------------|--|
| 12       | (a) | power station / plant (1)   | 1          | <b>ignore</b> from plug or battery or National Grid or generator<br><b>ignore</b> from fossil fuel / uranium / alternative energy source   |
|          | (b) | pollution or waste is caused at the power station / by (burning) fuels / when the electricity is made (1)   | 1          | <b>allow</b> noise pollution<br><b>allow</b> disposal problems<br><b>ignore</b> pollution in making the car<br><b>ignore</b> charging the battery<br><b>ignore</b> references to the car and 'at point of use'<br><b>ignore</b> environmental damage |
|          | (c) | Tracey does not have to take her eyes off the road (to adjust the radio) / keep hands on steering wheel / does not have to reach across / can concentrate on driving / less distracting / ora (1) | 1          | <b>allow</b> does not have to look down or keeps looking at the road<br><b>ignore</b> references to active and passive safety features<br><b>ignore</b> easier to stop the car   |
|          |     | <b>Total</b>  | <b>[3]</b> |  |

| Question |     | Expected Answers  | Marks      | Additional Guidance   |
|----------|-----|---|------------|---|
| 13       | (a) | 25 (2)<br><br><b>but if answer incorrect</b><br><br>12 500 / 50x10 (1)  | 2          |   |
|          | (b) | (gravitational) potential energy or it reduces (1)<br><br>kinetic energy increases (1)<br><br><b>but</b> (gravitational) potential energy is converted to kinetic energy (2)  | 2          | <b>allow</b> one additional marking point for higher level answers eg work done against friction / energy to move water out of the way / energy to displace water   |
|          | (c) | <b>use ✓'s in this question</b><br><br>more drag / friction / resistance / grip (1)<br><br>because of more weight / mass (1)<br><br><br><br>idea of more energy lost / converted / transferred as heat so resulting KE is lower (1) | 2          | <b>ignore</b> aerodynamic<br><br><b>allow</b> weighed heavier or heavier mass but <b>not just</b> heavier on its own<br><b>allow</b> larger surface <u>area</u><br><b>allow</b> idea of reduced resultant force eg accelerating or driving force is less because of higher friction (2) |
|          |     | <b>Total</b>  | <b>[6]</b> |   |

| Question |     | Expected Answers  | Marks      | Additional Guidance  |
|----------|-----|---|------------|--|
| 14       | (a) | change in direction (1)   | 1          | <b>ignore</b> just it goes round in a circle / circular motion<br><b>allow</b> turning / not going in a straight line  |
|          | (b) | 8.75 / 8.8 (2)<br><br><b>but if answer incorrect</b><br><br>28 / 3.2 (1)  | 2          | <b>not</b> 9 but can still score the working mark  |
|          | (c) | decrease acceleration or deceleration /<br>increased stopping distance /<br>increased stopping time /<br>longer to stop (1) | 1          | <b>allow</b> slows the driver down slower<br><b>allow</b> makes the acceleration / deceleration longer<br><b>allow</b> slows down collision or prolongs collision (between air bag and passenger or driver)<br><b>allow</b> brings to a stop (more) slowly<br><b>allow</b> slows down the deceleration or acceleration / decelerates or accelerates more slowly<br><br><b>ignore</b> cushions or absorbs impact / force / collision<br><b>ignore</b> references to energy<br><b>ignore</b> slows down movement |
|          |     | <b>Total</b>  | <b>[4]</b> |  |

| Question |     | Expected Answers   | Marks      | Additional Guidance  |
|----------|-----|--|------------|--|
| 15       | (a) | 75 (1)   | 1          |  |
|          | (b) | 96 (1)   | 1          |  |
|          | (c) | reduced friction or less grip (between tyres and road) / stopping or braking distance increases or is longer (1) | 1          | <b>ignore</b> road is slippery / tyres or car skids<br><b>ignore</b> no friction<br><b>not</b> thinking distance increases<br><b>not</b> time<br><b>not</b> just longer or 'it's' longer |
|          |     | <b>Total</b>   | <b>[3]</b> |  |

## B652/01 Unit 2: Modules P4, P5 and P6 Foundation Tier

| Question |     |      | Expected Answers  | Marks      | Additional Guidance   |
|----------|-----|------|---|------------|---|
| 1        | (a) | (i)  | attracted (to duster) (1)                                     | 1          | <b>allow</b> moves to duster / collects on duster / stuck to duster<br><b>allow</b> brushed off onto the duster but <b>not just</b> brushed off   |
|          |     | (ii) | positive and negative (1)                                     | 1          | <b>both</b> needed <b>allow</b> +/-ve and -/-ve either order  |
|          | (b) |      | negative and positive (1)<br><br>attracted (1)<br>knocked (1) | 3          | <b>allow</b> negative followed by positive or positive followed by negative for first two responses   |
|          | (c) |      | idea of shock / sparks (1)                                    | 1          | <b>allow</b> higher level answers eg interference with electrical / electronic systems / in atmosphere where explosions could occur / where large amounts of current could flow to earth<br><b>ignore</b> unqualified fire<br><b>ignore</b> electrocution |
|          |     |      | <b>Total</b>  | <b>[6]</b> |   |

| Question |     |     | Expected Answers   | Marks      | Additional Guidance  |
|----------|-----|-----|--|------------|--|
| 2        | (a) |     | idea of causes a break in the circuit / current stops flowing (when it blows) / the circuit is broken / incomplete (1) | 1          | <b>ignore</b> it does not work<br><b>ignore</b> isolates circuit<br><b>ignore</b> current too high<br><b>ignore</b> reference to electricity / voltage / power<br><b>not</b> circuit stops / electricity stops / broken down<br><b>not</b> short circuit / cut off / cut out |
|          |     | (b) | 8( $\Omega$ ) (2)<br><br><b>but if answer incorrect</b><br>12 $\div$ 1.5 (1)   | 2          |  |
|          |     |     | <b>Total</b>   | <b>[3]</b> |  |

| Question                            |   | Expected Answers  | Marks      | Additional Guidance |                   |   |                                   |   |                                 |   |                                     |  |                  |  |   |  |  |   |     |  |   |   |  |   |  |
|-------------------------------------|---|---|------------|---------------------|-------------------|---|-----------------------------------|---|---------------------------------|---|-------------------------------------|--|------------------|--|---|--|--|---|-----|--|---|---|--|---|--|
| 3                                   | (a)   | <p>can have three uses <b>or</b> two uses with an acceptable explanation description<br/> <b>max</b> of three marks from</p> <table border="0"> <tr> <td style="text-align: center;"><b>use</b></td> <td style="text-align: center;"><b>description</b></td> </tr> <tr> <td>idea of scans (1)</td> <td>to diagnose problem / monitor fetus / reflects off tissue (1)</td> </tr> <tr> <td>to break down (kidney) stones (1)</td> <td>vibration of particles (in the stone) (1)</td> </tr> <tr> <td>measure speed of blood flow (1)</td> <td>(micro) waves hit blood cells / frequency change / Doppler effect (1)</td> </tr> <tr> <td>cleaning (surgical) instruments (1)</td> <td>idea of particles shaken off / vibrated / AW (1)</td> </tr> <tr> <td>treat cancer (1)</td> <td>intense beam of ultrasound aimed at tumour (1)</td> </tr> </table> | <b>use</b> | <b>description</b>  | idea of scans (1) | to diagnose problem / monitor fetus / reflects off tissue (1) | to break down (kidney) stones (1) | vibration of particles (in the stone) (1) | measure speed of blood flow (1) | (micro) waves hit blood cells / frequency change / Doppler effect (1) | cleaning (surgical) instruments (1) | idea of particles shaken off / vibrated / AW (1) | treat cancer (1) | intense beam of ultrasound aimed at tumour (1) | 3 | <p>must have at least two uses to score all three marks</p> <p>scan the liver / scan a pregnancy (2)</p> |  |   |     |  |   |   |  |   |  |
| <b>use</b>                          | <b>description</b>  |   |            |                     |                   |   |                                   |   |                                 |   |                                     |  |                  |  |   |  |  |   |     |  |   |   |  |   |  |
| idea of scans (1)                   | to diagnose problem / monitor fetus / reflects off tissue (1)         |   |            |                     |                   |   |                                   |   |                                 |   |                                     |  |                  |  |   |  |  |   |     |  |   |   |  |   |  |
| to break down (kidney) stones (1)   | vibration of particles (in the stone) (1)                             |   |            |                     |                   |   |                                   |   |                                 |   |                                     |  |                  |  |   |  |  |   |     |  |   |   |  |   |  |
| measure speed of blood flow (1)     | (micro) waves hit blood cells / frequency change / Doppler effect (1) |   |            |                     |                   |   |                                   |   |                                 |   |                                     |  |                  |  |   |  |  |   |     |  |   |   |  |   |  |
| cleaning (surgical) instruments (1) | idea of particles shaken off / vibrated / AW (1)                      |   |            |                     |                   |   |                                   |   |                                 |   |                                     |  |                  |  |   |  |  |   |     |  |   |   |  |   |  |
| treat cancer (1)                    | intense beam of ultrasound aimed at tumour (1)                        |   |            |                     |                   |   |                                   |   |                                 |   |                                     |  |                  |  |   |  |  |   |     |  |   |   |  |   |  |
|                                     | (b)   | <table border="1"> <thead> <tr> <th>statement</th> <th>true</th> <th>false</th> </tr> </thead> <tbody> <tr> <td>1</td> <td></td> <td>✓</td> </tr> <tr> <td>2</td> <td></td> <td>✓</td> </tr> <tr> <td>3</td> <td></td> <td>(✓)</td> </tr> <tr> <td>4</td> <td>✓</td> <td></td> </tr> <tr> <td>5</td> <td>(✓)</td> <td></td> </tr> <tr> <td>6</td> <td>✓</td> <td></td> </tr> </tbody> </table>  | statement  | true                | false             | 1   |                                   | ✓   | 2                               |   | ✓                                   | 3  |                  | (✓)  | 4 | ✓  |  | 5 | (✓) |  | 6 | ✓ |  | 3 | <p>4 correct (3)<br/>                 2/3 correct (2)<br/>                 1 correct (1)</p> |
| statement                           | true  | false   |            |                     |                   |   |                                   |   |                                 |   |                                     |  |                  |  |   |  |  |   |     |  |   |   |  |   |  |
| 1                                   |   | ✓   |            |                     |                   |   |                                   |   |                                 |   |                                     |  |                  |  |   |  |  |   |     |  |   |   |  |   |  |
| 2                                   |   | ✓   |            |                     |                   |   |                                   |   |                                 |   |                                     |  |                  |  |   |  |  |   |     |  |   |   |  |   |  |
| 3                                   |   | (✓)   |            |                     |                   |   |                                   |   |                                 |   |                                     |  |                  |  |   |  |  |   |     |  |   |   |  |   |  |
| 4                                   | ✓   |   |            |                     |                   |   |                                   |   |                                 |   |                                     |  |                  |  |   |  |  |   |     |  |   |   |  |   |  |
| 5                                   | (✓)   |   |            |                     |                   |   |                                   |   |                                 |   |                                     |  |                  |  |   |  |  |   |     |  |   |   |  |   |  |
| 6                                   | ✓   |   |            |                     |                   |   |                                   |   |                                 |   |                                     |  |                  |  |   |  |  |   |     |  |   |   |  |   |  |

| Question     |     | Expected Answers | Marks                              | Additional Guidance                                      |
|--------------|-----|------------------|------------------------------------|--|
|              | (c) | (i)              | (idea of) tracer (1)               | 1<br><b>allow</b> tracker                                |
|              |     | (ii)             | decreases / weakens / AW (1)       | 1<br><b>allow</b> decays<br><b>not</b> wears out         |
|              |     | (iii)            | <u>nucleus</u> / <u>nuclei</u> (1) | 1<br><b>not</b> nuclear<br><b>ignore</b> middle / centre |
| <b>Total</b> |     |                  | <b>[9]</b>                         |  |

| Question     |     | Expected Answers | Marks             | Additional Guidance   |
|--------------|-----|------------------|-------------------|---|
| 4            | (a) |                  | uranium (1)       | 1<br><b>allow</b> plutonium<br><b>allow</b> correct chemical symbol |
|              | (b) |                  | produce steam (1) | 1<br><b>allow</b> boil water<br><b>allow</b> turn turbines          |
| <b>Total</b> |     |                  | <b>[2]</b>        |   |



| Question |     | Expected Answers   | Marks      | Additional Guidance  |
|----------|-----|--|------------|--|
| 5        | (a) | gravity / gravitational (1)  | 1          | <b>allow</b> (higher level answer) centripetal<br><b>not</b> centrifugal / weight  |
|          | (b) | <b>any two from</b><br>weather forecasting (1)<br><br>spying / military (1)<br><br>scientific / telescope (1)<br><br>GPS / SATNAV / AW (1)<br><br>Earth observation / mapping (1)<br><br>radio (broadcasts) / TV (broadcasts) (1)<br><br>mobile (phones) / telecommunications / AW (1) | 2          | mark both answers together<br><b>ignore</b> unqualified weather  |
|          | (c) | microwaves (1)   | 1          | more than one answer scores (0)<br><b>allow</b> correct answer underlined, circled or ticked in list if answer line is blank |
|          |     | <b>Total</b>   | <b>[4]</b> |  |

| Question |     |      | Expected Answers   | Marks      | Additional Guidance   |
|----------|-----|------|--|------------|---|
| 6        | (a) | (i)  | D  | 1          | more than one answer scores (0)<br><b>allow</b> correct answer underlined, circled or ticked in list if answer line is blank  |
|          |     | (ii) | between C and D / between D and C (1)                                      | 1          | <b>allow</b> either order<br><b>both</b> letters needed for the mark  |
|          | (b) |      | decreases (1)  | 1          | more than one answer scores (0)<br><b>allow</b> correct answer underlined, circled or ticked in list if answer line is blank  |
|          | (c) |      | <b>any two from</b><br>projector (1)<br>camera (1)<br>magnifying glass (1) | 2          | <b>allow</b> correct named examples e.g. telescope (1) microscope (1)<br>binoculars (1)<br>eye (1)<br>CD player (1)<br>cat's eyes (on the road) (1)<br>contact lenses / spectacles / glasses / AW (1) |
|          |     |      | <b>Total</b>   | <b>[5]</b> |   |

| Question |     |  | Section B expected Answers   | Marks      | Additional Guidance  |
|----------|-----|--|--|------------|--|
| 7        | (a) |  | 30 (m/s) (1)   | 1          | <b>allow</b> police (car) (1)  |
|          | (b) |  | <b>any one from</b><br><b>buses</b> move in <b>different / opposite</b> directions / move towards each other (1)<br><br><b>cars</b> move in <b>same</b> directions (1) | 1          | <b>allow</b> buses' (relative speed =) 11 / add the speeds together (1)<br><br><b>allow</b> cars' (relative speed =) 5 / subtract the speeds (1) |
|          |     |  | <b>Total</b>   | <b>[2]</b> |  |

| Question     |     | Expected Answers                                   | Marks      | Additional Guidance   |
|--------------|-----|--|------------|---|
| 8            | (a) | aerial / antennae / AW (1)                         | 1          | <b>ignore</b> dish / satellite<br><b>not</b> receiver   |
|              | (b) | long (wavelength) (1)<br>spread around objects (1) | 2          | <b>allow</b> reflection off buildings/hills<br><b>allow</b> higher level answers e.g. diffracts (1)<br><b>but</b> diffracts around objects scores (2) |
|              | (c) | reflects (1)                                       | 1          | <b>allows</b> TIR / refracts / bounce off<br><b>ignore</b> diffracts  |
| <b>Total</b> |     |  | <b>[4]</b> |   |

| Question     |         | Expected Answers  | Marks      | Additional Guidance  |
|--------------|---------|---|------------|----------------------|
| 9            | (a) (i) | 21 000 (2)<br><br><b>but if answer incorrect</b><br><br>7000 x 3 (1)                              | 2          |                      |
|              | (ii)    | increases / AW (1)  | 1          | <b>allow</b> goes up |
|              | (b)     | 20 (2)<br><br><b>but if answer incorrect</b><br><b>any one from</b><br><br>1.5 x 12 (1)<br>18 (1) | 2          |                      |
| <b>Total</b> |         |   | <b>[5]</b> |                      |

| Question |     | Expected Answers   | Marks      | Additional Guidance  |
|----------|-----|--|------------|--|
| 10       | (a) | <p>measurement                          unit</p> <p>current                          ohms</p> <p>voltage                          amps</p> <p>resistance                          volts</p>  | 2          | <p><b>one</b> correct (1)<br/> <b>all</b> correct (2)<br/>                     mark as incorrect any measurement with two or more lines.</p>   |
|          | (b) | <p>calculate gradient (1)<br/> <b>but</b> works out 1/gradient (2)</p> <p><b>or</b> divides value of voltage (1) by<br/> <b>corresponding</b> value of current (1)</p> <p><b>or</b> divides change in voltage (1) by<br/> <b>corresponding</b> change in current (1)</p> | 2          | <p><b>allow</b> 1 mark for finds / reads / takes value of voltage and current if no other marks awarded</p> <p><b>allow</b> divides value of current by value of voltage (1) for value of voltage/current</p> <p><b>not</b> just V/I</p> |
|          |     | <b>Total</b>   | <b>[4]</b> |  |

| Question |     |      | Expected Answers                         | Marks      | Additional Guidance              |
|----------|-----|------|--|------------|----------------------------------|
| 11       | (a) | (i)  | LDR (1)                                  | 1          | more than one answer scores zero |
|          |     | (ii) | thermistor (1)                           | 1          | more than one answer scores zero |
|          | (b) |      | capacitor / capacitance (1)<br>diode (1) | 2          | ignore LED                       |
|          |     |      | <b>Total</b>                             | <b>[4]</b> |                                  |

| Question |     |      | Expected Answers                      | Marks      | Additional Guidance  |
|----------|-----|------|---------------------------------------|------------|--|
| 12       | (a) |      | 3 (1)                                 | 1          | more than one answer scores (0)<br><b>allow</b> correct answer underlined, circled or ticked in list if answer line is blank |
|          | (b) | (i)  | increase      increase      (1)       | 1          | <b>allow</b> gets bigger/goes larger for increases<br>both needed for one mark   |
|          |     | (ii) | increase      stays the same      (1) | 1          | this order only<br><b>allow</b> does not change for stays the same<br>both needed for one mark                               |
|          |     |      | <b>Total</b>                          | <b>[3]</b> |  |

| Question |         | Expected Answers   | Marks      | Additional Guidance  |
|----------|---------|--|------------|--|
| 13       | (a)     | no output / zero / AW (1)  | 1          |  |
|          | (b) (i) | step down (1)  | 1          |  |
|          | (ii)    | (phone) chargers / laptops / radio / low voltage lighting (1)  | 1          | <b>allow</b> in substations<br><b>allow</b> any acceptable device eg bathroom shaving socket / electric toothbrush |
|          | (c)     | 12 (2)<br><br><b>but if answer incorrect<br/>any one from</b><br><br>$\frac{V_{out}}{240} = \frac{200}{4000} (1)$<br><br>$V_{out} = \frac{200 \times 240}{4000} (1)$ | 2          |  |
|          |         | <b>Total</b>   | <b>[5]</b> |  |

| Question |     | Expected Answers   | Marks      | Additional Guidance  |
|----------|-----|--|------------|--|
| 14       | (a) | low<br>high (1)  | 1          | <b>allow</b> 0 / 0V<br><b>allow</b> 1 / 5V   |
|          | (b) | once the alarm starts it stays on / AW (1)<br><br>(even if) the door is shut (1)<br><b>or</b><br>until it is reset (1) | 2          | <b>allow</b> without a latch the alarm would stop (1) when the door is closed (1)  |
|          | (c) | S (1)  | 1          | more than one answer scores (0)<br><b>allow</b> correct answer underlined, circled or ticked in list if answer line is blank |
|          |     | <b>Total</b>   | <b>[4]</b> |  |

## B652/02 Unit 2: Modules P4, P5 and P6 Higher Tier

| Question |     | Expected Answers   | Marks      | Additional Guidance   |
|----------|-----|--|------------|---|
| 1        | (a) | <b>any three from</b><br>duster has gained electrons (1)<br>dust is positive(ly) (charged) / opposite to duster(1)<br>dust has lost electrons (1)<br>opposite (charges) attract / positive attracts negative (1) | 3          | <b>allow</b> 1 mark for idea of unspecified electron movement<br><br><b>ignore</b> has gained positive charge<br>opposites attract may be there by implication<br><br><b>allow</b> + / +ve / - / -ve throughout question<br><b>allow</b> higher level answers explaining induction<br><b>ignore</b> reference to insulators rubbing |
|          | (b) | negative and positive (1)<br><br>attracted (1)<br>knocked (1)  | 3          | <b>allow</b> negative followed by positive or positive followed by negative for first two responses   |
|          |     | <b>Total</b>   | <b>[6]</b> |   |

| Question |     | Expected Answers   | Marks      | Additional Guidance  |
|----------|-----|--|------------|--|
| 2        | (a) | idea of causes a break in the circuit / current stops flowing (when it blows) / the circuit is broken / incomplete (1) | 1          | <b>ignore</b> it does not work<br><b>ignore</b> isolates circuit<br><b>ignore</b> current too high<br><b>ignore</b> reference to electricity / voltage / power<br><b>not</b> circuit stops / electricity stops / broken down<br><b>not</b> short circuit / cut off / cut out |
|          | (b) | 8( $\Omega$ ) (2)<br><br><b>but if answer incorrect</b><br>12 $\div$ 1.5 (1)   | 2          |  |
|          |     | <b>Total</b>   | <b>[3]</b> |  |



| Question |     | Expected Answers   | Marks      | Additional Guidance  |
|----------|-----|--|------------|--|
| 3        | (a) | <p>frequency (1)</p> <p>vibrate (1)</p> <p>break (up) / disintegrate / shatter / split / bust / dissolve / AW (1)</p>  | 3          | <p><b>allow</b> pitch</p> <p><b>allow</b> gain <u>kinetic energy</u></p> <p><b>ignore</b> move</p> <p><b>not</b> separate</p> <p><b>allow</b> idea of breaking up once in <b>either</b> 2nd <b>or</b> third response</p>   |
|          | (b) | <p>idea of focused (1)</p> <p>idea that all of tumour receives full dose / tumour is always in the beam / tumour attacked from all directions (1)</p> <p>idea that (healthy tissue) does not receive the full dose (of <math>\gamma</math> rays) / not always in the beam / dose spread out / less exposure for healthy tissue (1)</p> | 2          | <p>all three correct (2)</p> <p>1 or 2 correct (1)</p> <p><b>allow</b> concentrated / directed at / aimed at</p> <p><b>ignore</b> shone at</p> <p>candidates may provide reverse argument responses for 2 in 3 and for 3 in 2 without penalty – they may not score for the same argument twice</p> <p><b>ignore</b> healthy tissue not damaged</p> |
|          |     | <b>Total</b>   | <b>[5]</b> |  |

| Question |     | Expected Answers                                    | Marks      | Additional Guidance  |
|----------|-----|---|------------|--|
| 4        | (a) | atom / nucleus ..... neutron (1)<br><br>nucleus (1) | 2          | <b>both</b> needed for first marking point<br><b>not</b> molecule / particle<br><br><b>ignore</b> atom<br>if no mark gained in first box <b>allow</b> atom in second box |
|          | (b) | absorb / take in / soak up (excess) neutrons (1)    | 1          | <b>ignore</b> stops neutrons<br><b>ignore</b> pulling up / lowering of rods<br><b>not</b> slows down neutrons  |
|          | (c) | fission (1)   | 1          | <b>not</b> fusion<br>more than one answer scores (0)<br><b>allow</b> correct answer underlined, circled or ticked in list if answer line is blank                        |
|          |     | <b>Total</b>  | <b>[4]</b> |  |

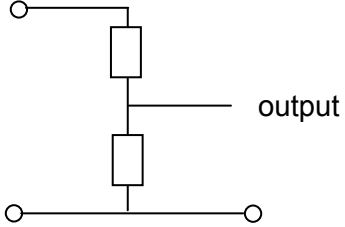
| Question |     | Expected Answers  | Marks      | Additional Guidance  |
|----------|-----|---|------------|--|
| 5        | (a) | so gamma can <b>reach the surface</b> / ora (1)   | 1          | <b>must</b> refer to detection at <b>surface</b><br><b>ignore</b> any other reference to relative penetrative properties<br><b>allow</b> so gamma can be <b>detected</b> at the <b>surface</b> / ora               |
|          | (b) | idea of (high(er)) count rate on Geiger counter before blockage / low(er) count rate after blockage (1) | 1          | <b>allow</b> idea of change in count rate or amount of radiation at / after blockage<br><b>allow</b> reference to radiation as equivalent to count rate on GM counter<br><b>allow</b> no count rate after blockage |
|          |     | <b>Total</b>  | <b>[2]</b> |  |

| Question     |     |      | Section B Expected Answers  | Marks      | Additional Guidance  |
|--------------|-----|------|---|------------|--|
| 6            | (a) | (i)  | 21 000 (2)<br><br>but if answer incorrect<br><br>7000 x 3 (1)   | 2          |  |
|              |     | (ii) | increases / AW (1)  | 1          | allow goes up  |
|              | (b) |      | 20 (2)<br><br>but if answer incorrect<br>any one from<br><br>1.5 x 12 (1)<br>18 (1)   | 2          |  |
|              | (c) |      | momentum is zero to start (1)<br><br>momentum is conserved / zero at end (1)<br><br>Bonnie has less mass so more speed / ora (1)<br><br>equal and opposite forces (1) | 4          | so total momentum is always zero (2)<br><br>allow weight<br><br>equal and opposite forces give different acceleration / speeds (2)<br><br>allow maximum 3 marks for a clear and complete correct calculation<br>e.g $2 \times 50 = 1.25 \times 80$ (2)<br>e.g $2 \times 50 = 1.25 \times 80$ so $100 = 100$ / both have same momentum (3)<br>but fourth mark cannot be gained for conservation of momentum from the equation |
| <b>Total</b> |     |      |   | <b>[9]</b> |  |

| Question |     | Expected Answers   | Marks      | Additional Guidance  |
|----------|-----|--|------------|--|
| 7        | (a) | centripetal (1)  | 1          | more than one answer scores (0)<br><b>allow</b> correct answer underlined, circled or ticked in list if answer line is blank   |
|          | (b) | (i)  | 2          | <b>allow</b> 42 000 km (1)<br><b>but</b> orbits in 24 hours like the Earth (2)<br><b>but</b> fixed over equator scores (2)<br><b>not</b> stays in same place<br><b>ignore</b> reference to high altitude |
|          |     | (ii)   | 1          | <b>allow</b> pin point same part of the Earth's surface  |
|          | (c) | <b>any one from</b><br>experience a strong(er) gravitational pull / AW (1)<br><br>to stop satellites falling to Earth / out of orbit / keep satellite in orbit (1) | 1          | <b>ignore</b> reference to uses of satellite eg so they can take better pictures or pictures more often<br><br>e.g. 'so they stay in same orbit' (1)   |
|          | (d) | microwaves (1)   | 1          | more than one answer scores (0)<br><b>allow</b> correct answer underlined, circled or ticked in list if answer line is blank   |
|          |     | <b>Total</b>   | <b>[6]</b> |  |

| Question |  | Expected Answers  | Marks      | Additional Guidance   |
|----------|--|---|------------|---|
| 8        |  | <p><b>any two from</b><br/>           (reflected) light from snow / ground is partly polarised (1)</p> <p>this light is horizontally polarised (1)</p> <p>vertically polarised glasses filter this (reflected) light / AW (1)</p> | 2          | <p>light (reflected) from the snow is horizontally polarised scores (2)</p> <p><b>allow</b> light polarised in one plane (1)</p> <p><b>allow</b> marking points from a correctly labelled diagram</p> |
|          |  | <b>Total</b>  | <b>[2]</b> |   |

| Question |     | Expected Answers  | Marks      | Additional Guidance   |
|----------|-----|---|------------|---|
| 9        | (a) | diffract / AW (1)                                       | 1          | <p><b>allow</b> diffracts more / easier to diffract</p> <p><b>allow</b> reflect from <b>upper</b> atmosphere / ionosphere</p> <p><b>not</b> merely reflect from atmosphere</p> <p><b>not</b> bounce</p> |
|          | (b) | <p>short wavelength (1)</p> <p>less diffraction (1)</p> | 2          | <p><b>allow</b> idea of concentrate the power (of the microwave) / less signal loss</p> <p><b>ignore</b> aimed easier</p>   |
|          |     | <b>Total</b>  | <b>[3]</b> |   |

| Question     | Expected Answers  | Marks      | Additional Guidance   |
|--------------|---|------------|---|
| 10 (a)       | calculate gradient (1)<br><b>but</b> works out 1/gradient (2)<br><br><b>or</b> divides value of voltage (1) by<br><b>corresponding</b> value of current (1)<br><br><b>or</b> divides change in voltage (1) by<br><b>corresponding</b> change in current (1) | 2          | <b>allow</b> 1 mark for finds / reads / takes value of voltage and current if no other marks awarded<br><br><b>allow</b> divides value of current by value of voltage (1) for value of voltage/current<br><br><b>not</b> just $V/I$ |
| (b)          | input <br><br>input across two resistors in series (1)<br><br>output between two resistors (1)   | 2          | If no diagram, max (1) for description - ie two resistors in series with input connected across both and output connected across one.   |
| <b>Total</b> |   | <b>[4]</b> |   |

| Question |     | Expected Answers  | Marks                                 | Additional Guidance   |  |
|----------|-----|---|---------------------------------------|---|--|
| 11       | (a) | <p><b>any one from</b><br/>           move magnet away from coil / turn magnet through 180 degrees (AW) <b>and move in same direction</b> (1)</p> <p>move coil away from magnet / turn coil through 180 degrees (AW) <b>and move towards magnet</b> (1)</p> <p>turn coil through 180 degrees (AW) <b>and move magnet towards coil</b> (1)</p> | 1                                     | <p><b>allow</b> move magnet to opposite side of coil linked with specifying correct way round for magnet <b>and direction of movement</b></p> <p><b>not</b> reverse connection on meter</p> |  |
|          | (b) | (i)   | increase      increase      (1)       | 1   | <b>allow</b> gets bigger/goes larger for increases<br>both needed for one mark                 |
|          |     | (ii)  | increase      stays the same      (1) | 1   | this order only<br><b>allow</b> does not change for stays the same<br>both needed for one mark |
|          |     | <b>Total</b>  |                                       | <b>[3]</b>  |  |

| Question |     | Expected Answers   | Marks      | Additional Guidance  |
|----------|-----|--|------------|--|
| 12       | (a) | <p>12 (2)</p> <p><b>but if answer incorrect<br/>any one from</b></p> $\frac{V_{\text{out}}}{240} = \frac{200}{4000} \quad (1)$ $V_{\text{out}} = \frac{200 \times 240}{4000} \quad (1)$  | 2          |  |
|          | (b) | <p><b>any three from</b></p> <p>an output voltage is induced in the secondary when a <b>changing</b> magnetic field passes through the coil (1)</p> <p>the <b>changing</b> (magnetic) field is produced by the primary coil (1)</p> <p>DC produces a steady field (1)</p> <p>AC produces a <b>changing</b> field (1)</p> | 3          | <p><b>allow</b> only AC produces a <b>changing</b> field (2)</p> |
|          |     | <b>Total</b>   | <b>[5]</b> |  |



| Question |     | Expected Answers                                    | Marks      | Additional Guidance  |
|----------|-----|---|------------|--|
| 13       | (a) | downwards (1)                                       | 1          | more than one answer scores (0)<br><b>allow</b> correct answer underlined, circled or ticked in list if answer line is blank |
|          | (b) | split ring commutator / split ring / commutator (1) | 1          | <b>not</b> slip ring / slip ring commutator  |
|          |     | <b>Total</b>  | <b>[2]</b> |  |

| Question |     | Expected Answers   | Marks      | Additional Guidance  |
|----------|-----|--|------------|--|
| 14       | (a) | 0<br>0<br>0<br>1 (1)   | 1          | this order only  |
|          | (b) | <b>any two from</b><br>fan needs large current (1)<br><br>logic gates only produce small current (1)<br><br>relay can use low input (1)<br><br>to switch large fan current (1) | 2          | <b>allow</b> voltage / power as alternative to current throughout<br><br><b>allow</b> relay isolates (fan from logic gate) |
|          | (c) | (i) decreases (1)  | 1          | <b>allow</b> ora if it is clear the temperature is decreasing.   |
|          |     | (ii) input / pd increases / goes to 1 / high / on (1)  | 1          |  |
|          |     | (iii) allows the temperature at which the fan comes on to be adjusted / AW (1)   | 1          |  |
|          |     | <b>Total</b>   | <b>[6]</b> |  |

# Grade Thresholds

General Certificate of Secondary Education  
Physics B (J645)  
January 2010 Examination Series

## Unit Threshold Marks

| Unit    |     | Maximum Mark | A* | A  | B  | C  | D  | E  | F  | G  | U |
|---------|-----|--------------|----|----|----|----|----|----|----|----|---|
| B651/01 | Raw | 60           | -  | -  | -  | 33 | 27 | 22 | 17 | 12 | 0 |
|         | UMS | 69           | -  | -  | -  | 60 | 50 | 40 | 30 | 20 | 0 |
| B651/02 | Raw | 60           | 43 | 36 | 29 | 22 | 16 | 13 | -  | -  | 0 |
|         | UMS | 100          | 90 | 80 | 70 | 60 | 50 | 45 | -  | -  | 0 |
| B652/01 | Raw | 60           | -  | -  | -  | 31 | 26 | 21 | 16 | 11 | 0 |
|         | UMS | 69           | -  | -  | -  | 60 | 50 | 40 | 30 | 20 | 0 |
| B652/02 | Raw | 60           | 40 | 34 | 27 | 21 | 15 | 12 | -  | -  | 0 |
|         | UMS | 100          | 90 | 80 | 70 | 60 | 50 | 45 | -  | -  | 0 |

## Specification Aggregation Results

Overall threshold marks in UMS (ie after conversion of raw marks to uniform marks)

|             | Maximum Mark | A*  | A   | B   | C   | D   | E   | F  | G  | U |
|-------------|--------------|-----|-----|-----|-----|-----|-----|----|----|---|
| <b>J645</b> | 300          | 270 | 240 | 210 | 180 | 150 | 120 | 90 | 60 | 0 |

The cumulative percentage of candidates awarded each grade was as follows:

|             | A*  | A   | B    | C    | D     | E     | F     | G     | U     | Total No. of Cands |
|-------------|-----|-----|------|------|-------|-------|-------|-------|-------|--------------------|
| <b>J645</b> | 6.3 | 6.3 | 31.3 | 56.3 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 16                 |

For a description of how UMS marks are calculated see:  
<http://www.ocr.org.uk/learners/ums/index.html>

Statistics are correct at the time of publication.

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