

## **Additional Science B**

General Certificate of Secondary Education

Unit **B623/02**: Modules B3, C3, P3 (Higher Tier)

### **Mark Scheme for June 2012**

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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.










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## Annotations used in Scoris

| 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                         |

## Subject-specific Marking Instructions

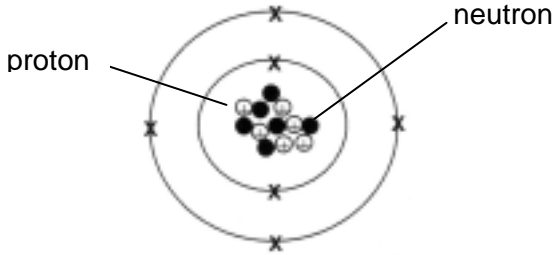
Abbreviations, annotations and conventions used in the detailed Mark Scheme.

- / = alternative and acceptable answers for the same marking point
- (1) = separates marking points
- allow = answers that can be accepted
- not = answers which are not worthy of credit
- reject = answers which are not worthy of credit
- ignore = 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

| Question |     | Answer   | Marks    | Guidance  |
|----------|-----|--|----------|---|
| 1        | (a) | <p>diploid <input checked="" type="checkbox"/></p> <p>haploid <input type="checkbox"/></p> <p>meiosis <input type="checkbox"/></p> <p>mitosis <input checked="" type="checkbox"/></p> <p>multiplication <input type="checkbox"/></p> | 2        | each incorrect tick loses 1 mark down to zero   |
|          | (b) | idea that humans tend to grow to a finite size but (many) plants can grow continuously / plants have meristems and grow at the tips (1)  | 1        | <b>allow</b> humans stop growing (at adulthood) but plants don't<br><b>allow</b> humans have proportional growth<br><b>allow</b> plant growth is seasonal   |
|          | (c) | larger animals have to have longer period (for cell division to produce functional organs) / ora (1)   | 1        | <b>ignore</b> it depends on the size of the animal<br><b>ignore</b> references to complexity or numbers of cells  |
|          | (d) | able to take on new roles / AW /<br>able to become specialised /<br>able to develop into different kinds of cells (1)  | 1        | <b>allow</b> not specialised<br><b>allow</b> can turn into any cell   |
|          | (e) | (multi-cellular microorganisms are small and) have larger surface area to volume ratio / ora (1)   | 1        | <b>allow</b> surface area / volume ratio but<br><b>ignore</b> surface area unqualified<br><br><b>ignore</b> organism can be larger<br><b>ignore</b> so cells can differentiate<br><b>ignore</b> so organism can be more complex |
|          |     | <b>Total</b>   | <b>6</b> |   |

| Question     |     | Answer   | Marks    | Guidance   |
|--------------|-----|--|----------|--|
| 2            | (a) | <p>build up to form a plaque (1)</p> <p>idea that blood flow is restricted or blocked (in arteries) (1)</p>  | 2        | <p><b>not</b> veins / capillaries (penalise only once)</p> <p><b>allow</b> cholesterol sticks to walls or lining or inside of arteries</p> <p><b>allow</b> cholesterol builds up or collect in arteries or (blood) vessels</p> <p><b>allow</b> fat for cholesterol</p> <p><b>not</b> cell walls</p> <p><b>allow</b> slow down blood flow / restrict circulation of blood</p> <p><b>allow</b> blocks or clogs up arteries or (blood) vessels / makes arteries narrower / AW</p> |
|              | (b) | <p><math>(\frac{40 \times 8.5}{100} = ) 3.4</math> (mmol) (1)</p> <p><b>but</b></p> <p><math>(8.5 - 3.4 = ) 5.1</math> (mmol) (2)</p> <p><b>but</b></p> <p><math>(5.7 - 5.1 = ) 0.6</math> (mmol) (3)</p> <p><b>but</b> 0.6 (mmol per litre of blood) on its own (3)</p> | 3        | <p><b>allow</b> ecf over the 3 steps</p> <p><b>allow</b> <math>\frac{60 \times 8.5}{100} = 5.1</math> (2)</p>  |
|              | (c) | <p>idea of movement (of a substance or solute) from a high to a low concentration (1)</p>  | 1        | <p><b>allow</b> goes from a high concentration to a low concentration (1)</p> <p><b>ignore</b> breaking down from a high to a low concentration</p> <p><b>ignore</b> references to membranes</p> <p><b>not</b> movement of cells</p>   |
|              | (d) | <p><b>any two from:</b></p> <p>long / large surface area (1)</p> <p>villi / microvilli (1)</p> <p>permeable or thin cell surface or cell membrane or lining (1)</p> <p>good blood supply / many capillaries (1)</p>  | 2        | <p><b>allow</b> lining one cell thick</p> <p><b>allow</b> (intestine) walls are thin <b>but not</b> cell walls are thin</p> <p><b>ignore</b> close to the blood</p>  |
| <b>Total</b> |     |  | <b>8</b> |  |

| Question |     |      | Answer  | Marks    | Guidance  |
|----------|-----|------|---|----------|---|
| 3        | (a) | (i)  | <u>insert</u> (1)<br><u>resistance</u> (1)  | 2        |   |
|          |     | (ii) | plant cells retain ability to differentiate (1)<br><br>animal cells usually lose this ability (at an early stage) (1)   | 2        | <b>allow</b> plant cells can turn into different cells throughout their life<br><br><b>allow</b> stem cells found in developed animals have limited differentiation |
|          | (b) |      | <b>any two from:</b><br><br>base sequence or base code determines amino acid sequence (1)<br><br>each amino acid is coded for by (a sequence of) 3 bases (1)<br><br><b>sequence</b> of amino acids makes up a protein (1) | 2        |   |
|          |     |      | <b>Total</b>  | <b>6</b> |   |

| Question |     |      | Answer   | Marks    | Guidance   |
|----------|-----|------|--|----------|--|
| 4        | (a) | (i)  |   | 1        | both required for mark<br><b>ignore</b> positive and neutral   |
|          |     | (ii) | 12 / twelve (1)  | 1        |  |
|          | (b) | (i)  | <b>C</b> (1)   | 1        | <b>allow</b> correct answer ticked, circled or underlined in list if answer line is blank  |
|          |     | (ii) | covalent (1)   | 1        | <b>ignore</b> strong   |
|          | (c) |      | (low melting point) because it has weak intermolecular forces (1)<br><br>(does not conduct electricity) because it does not have any free electrons / no delocalised electrons (1) | 2        | <b>allow</b> forces / bonds / attraction between molecules for intermolecular forces<br><br><b>not</b> weak metallic bonding<br><b>not</b> forces between atoms / intramolecular forces<br>must be clear that forces are between molecules e.g. forces holding molecule together scores 0<br><br><b>ignore</b> because it is not a metal<br><b>not</b> reference to ions |
|          |     |      | <b>Total</b>   | <b>6</b> |  |

| Question |     | Answer  | Marks    | Guidance  |
|----------|-----|---|----------|---|
| 5        | (a) | all have one electron in their outer shell (1)  | 1        | <b>allow</b> all lose one electron<br><b>allow</b> they will have the same number of electrons in the outer shell   |
|          | (b) | $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$<br><br>correct reactants and products (1)<br><br>correct balancing (1) | 2        | <b>allow</b> any correct multiple, including fractions<br><b>allow</b> = / $\Rightarrow$ instead of $\rightarrow$<br><b>not</b> and / & instead of +<br><br>balancing mark is dependent on the correct formulae but<br><b>allow</b> 1 mark for a balanced equation with a minor error in subscripts / formulae<br>e.g. $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$   |
|          | (c) | (potassium) loses outer electron more easily (than sodium) (1)  | 1        | <b>allow</b> reverse argument for sodium<br><br><b>allow</b> potassium has more (shielding) shells / outer shell is further from the nucleus / outer electron is further from the nucleus<br><b>but</b> potassium has a bigger atom is not sufficient<br><br><b>allow</b> potassium has a weaker force between the nucleus and the outer electron<br><br><b>ignore</b> (potassium) loses outer electron more quickly<br><b>ignore</b> potassium has more electrons<br><br>assume unqualified answer refers to potassium |
|          |     | <b>Total</b>  | <b>4</b> |   |



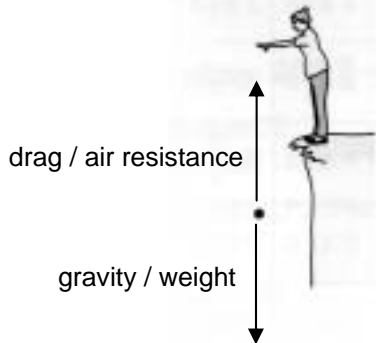
| Question     |         | Answer  | Marks    | Guidance   |
|--------------|---------|---|----------|--|
| 6            | (a)     | <p>state of chlorine – gas (1)</p> <p>colour of bromine – red / brown / orange / yellow (1)</p> <p>radius of astatine – any value between 0.160 and 0.200 (1)</p> | 3        | <p><b>allow</b> any combination of red, brown, orange and yellow (1)<br/>e.g. orange-red or red-brown</p> <p><b>allow</b> rusty red or foxy red (1)</p> <p><b>not</b> combinations where one of the colours is incorrect<br/>e.g. black-brown</p> <p><b>ignore</b> references to pale or dark</p>  |
|              | (b) (i) | bromine + sodium iodide → iodine + sodium bromide (1)   | 1        | <p><b>allow</b> = instead of →</p> <p><b>not</b> and / &amp; / instead of +</p> <p><b>allow</b> correct formulae (i.e. case and subscripts must be correct)<br/>but equation does not need to balance<br/>e.g. Br<sub>2</sub> + NaI → I<sub>2</sub> + NaBr (1)</p> <p><b>allow</b> mix of correct formulae and words</p> <p><b>not</b> Br + NaI → I + NaBr</p>   |
|              | (ii)    | <p><math>Cl_2 + 2e^- \rightarrow 2Cl^-</math></p> <p>correct reactants and products (1)</p> <p>correct balancing (1)</p>  | 2        | <p><b>allow</b> <math>Cl_2 \rightarrow 2Cl^- - 2e^-</math></p> <p><b>allow</b> any correct multiple, including fractions</p> <p><b>allow</b> = / = instead of →</p> <p><b>not</b> and / &amp; instead of +</p> <p>balancing mark is dependent on the correct formulae but<br/><b>allow</b> 1 mark for a balanced equation with a minor error in subscripts / formulae<br/>e.g. <math>Cl_2 + 2e^- \rightarrow 2Cl^-</math></p> <p><b>allow</b> <math>Cl + e^- \rightarrow Cl^-</math> or <math>Cl \rightarrow Cl^- - e^-</math> (1)</p> |
| <b>Total</b> |         |   | <b>6</b> |  |

| Question     |     | Answer   | Marks    | Guidance  |
|--------------|-----|--|----------|---|
| 7            | (a) | idea that copper (still) has a high (electrical) conductivity / idea that (electrical) conductivity of copper is similar to silver(1)<br><br>idea that copper is cheaper / ora (1) | 2        | <b>allow</b> density of copper is less than silver (1)<br><br><b>ignore</b> any comments about corrosion<br><b>ignore</b> wires are heavy<br><br><b>allow</b> because of density and cost (1) if no other mark scored |
|              | (b) | (good) conductor of heat / (good) thermal conductor (1)  | 1        | <b>allow</b> malleable<br><b>allow</b> does not corrode / does not rust<br><b>allow</b> it is lustrous<br><br><b>ignore</b> properties from the table   |
|              | (c) | metals have strong metallic bonds (1)  | 1        | <input type="checkbox"/><br><input type="checkbox"/><br><input checked="" type="checkbox"/><br><input type="checkbox"/>   |
| <b>Total</b> |     |  | <b>4</b> |   |

| Question |     | Answer  | Marks    | Guidance   |
|----------|-----|---|----------|--|
| 8        | (a) | E (1)   | 1        | more than one letter scores zero.<br>if answer line is blank allow correct answer indicated on list  |
|          | (b) | 600 (m) (1)   | 1        |  |
|          | (c) | 4500 (N) (3)<br><br><b>but if answer incorrect</b><br><br>correct calculation of acceleration as $5(\text{m/s}^2)$ (2)<br><br><b>if incorrect</b><br>$\frac{20}{4}$ (1)<br><br><b>or</b><br><br>(force =) calculated acceleration x 900 (1) | 3        | <br><br><br><br><br><br><br><br><b>allow</b> ecf for incorrectly calculated acceleration<br>e.g. $a = 4/20 = 0.25$ then $F = 900 \times 0.25 = 225$ scores 1<br><br><b>allow</b> (F =) ma or (force =) mass x acceleration (1)<br><br><b>not</b> $900 \times 20$ or $900 \times 4$ |
|          | (d) | area under graph (1)  | 1        | <b>allow</b> correct area calculation $\frac{1}{2} \times 20 \times 4 = 40$ (1)<br><b>allow</b> multiply the speed by 4 and then half it (1)   |
|          |     | <b>Total</b>  | <b>6</b> |  |

| Question     | Answer  | Marks    | Guidance  |  |   |   |  |   |  |   |   |
|--------------|---|----------|---|--|---|---|--|---|--|---|---|
| <p>9 (a)</p> | <table border="1" style="margin-left: auto; margin-right: auto;"> <tr><td></td><td style="text-align: center;">✓</td></tr> <tr><td></td><td style="text-align: center;">✓</td></tr> <tr><td style="text-align: center;">✓</td><td></td></tr> <tr><td style="text-align: center;">✓</td><td></td></tr> </table> <p style="text-align: right;">(2)</p>  |          | ✓   |  | ✓ | ✓ |  | ✓ |  | 2 | <p>all correct (2)<br/>any two horizontal lines correct (1)</p> |
|              | ✓   |          |   |  |   |   |  |   |  |   |   |
|              | ✓   |          |   |  |   |   |  |   |  |   |   |
| ✓            |   |          |   |  |   |   |  |   |  |   |   |
| ✓            |   |          |   |  |   |   |  |   |  |   |   |
| <p>(b)</p>   | <p><b>any two from:</b></p> <p>car <b>B</b> brakes after <b>A</b> / ora (1)</p> <p>idea that car <b>B</b> has not left or allowed enough braking distance / thinking distance (1)</p> <p>idea that distance between the cars is shorter than the stopping distance ora (1)</p> <p>braking (distance) starts when graph(s) curves <b>or</b> car(s) have stopped when lines are horizontal / flat (1)</p> <p><b>B</b> overtakes or goes past <b>A</b> where the graphs cross (1)</p> <p>the graph for <b>B</b> should finish up under or below the graph for <b>A</b> (1)</p> | 2        | <p><b>allow</b> car <b>B</b> driving within the braking distance of <b>A</b> (1)<br/><b>allow</b> car <b>B</b> does not start to break until it has nearly caught up with car <b>A</b> (1)<br/><b>ignore</b> car <b>B</b> is driving too close to car <b>A</b></p> <p><b>allow</b> cars would collide where graphs cross (1)</p> <p><b>allow</b> the <b>B</b> line finishes above the <b>A</b> line (1)</p> |  |   |   |  |   |  |   |   |
|              | <b>Total</b>  | <b>4</b> |   |  |   |   |  |   |  |   |   |

| Question | Answer  | Marks    | Guidance   |
|----------|---|----------|--|
| 10 (a)   | concrete barrier (no mark) because<br><br>stopping distance is small / smaller / smallest<br>or<br>time (to stop) is short / shorter / shortest (1)<br><br>(so) acceleration is large / larger / largest (1)<br><br>(so) force is large / larger / largest (1)<br><br><b>but</b><br>idea that large / larger / largest acceleration <b>or</b><br>force happens (when hitting the concrete barrier<br>as it is) when time or distance is small / smaller /<br>smallest / ora (2) | 3        | <p><b>no marks if escape lane or metal crash barrier is chosen or no safety feature chosen</b></p> <p><b>allow</b> deceleration for acceleration</p>   |
| (b)      | (if force is less) so deceleration is less (1)<br><br>(hence) time to stop or stopping distance<br>increases (1)  | 2        | <p><b>allow</b> deceleration takes longer (1)<br/> <b>allow</b> acceleration for deceleration (1)</p> <p><b>allow</b> it takes longer for the car to stop (1)</p> <p><b>allow</b> any of the following equations in any correct rearranged form<br/> <math>f = ma</math> (1)</p> <p><math>a = \frac{\text{change in speed}}{\text{time taken}}</math> or <math>\text{speed} = \frac{\text{distance}}{\text{time taken}}</math> (1)</p> |
|          | <b>Total</b>  | <b>5</b> |  |

| Question | Answer  | Marks    | Guidance  |
|----------|---|----------|---|
| 11 (a)   | arrow on ball pointing downwards <b>and</b> labelled gravity / weight (1)<br><br>arrow on ball pointing upwards <b>and</b> labelled drag / <b>air</b> resistance / <b>air</b> friction / <b>wind</b> resistance (1) | 2        |  <p><b>ignore</b> upthrust</p>   |
| (b) (i)  | forces are balanced (1)   | 1        | <p><b>allow</b> weight = drag<br/> <b>allow</b> equal and opposite</p> <p><b>allow</b> equal if forces correctly drawn and labelled in part (a)<br/> <b>not</b> equal if forces incorrectly drawn and labelled in part (a)</p> <p>if named forces used <b>allow</b> ecf from Q11(a)</p> |
| (ii)     | (gravitational potential energy) decreases (steadily) (1)<br><br>(kinetic energy) increases (steadily) until terminal velocity<br><b>or</b><br>(kinetic energy) increases (steadily) and then remains constant (1)  | 2        | <p><b>ignore</b> changes to gravitational potential energy once it hits the ground</p> <p><b>ignore</b> changes to kinetic energy once it hits the ground</p>   |
|          | <b>Total</b>  | <b>5</b> |   |

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