



# General Certificate of Secondary Education

## Science 3860

*3860/2F Science for the Needs of Society*

## Mark Scheme

*2006 examination – January series*

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

| question     | answers                                                                                                                                                                                               | extra information                                                                                                                   | marks    |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|----------|
| 1(a)         | cotton                                                                                                                                                                                                | allow wrong spellings as long as it is clear                                                                                        | 1        |
| (b)          | penicillin                                                                                                                                                                                            |                                                                                                                                     | 1        |
| (c)          | wool                                                                                                                                                                                                  |                                                                                                                                     | 1        |
| (d)          | leather                                                                                                                                                                                               |                                                                                                                                     | 1        |
| <b>Total</b> |                                                                                                                                                                                                       |                                                                                                                                     | <b>4</b> |
| 2(a)         | fossil fuel:<br>natural gas / oil / coal                                                                                                                                                              |                                                                                                                                     | 1        |
|              | renewable:<br>wind / solar / HEP                                                                                                                                                                      | <b>must</b> be one of these three                                                                                                   | 1        |
| (b)          | <b>Fossil fuel</b> disadvantages<br>any <b>two</b> from:                                                                                                                                              |                                                                                                                                     | 2        |
|              | <ul style="list-style-type: none"> <li>global warming / pollution / acid rain / poisonous gas released / CO<sub>2</sub> / carbon monoxide / SO<sub>2</sub></li> </ul>                                 | do <b>not</b> allow vague statements                                                                                                |          |
|              | <ul style="list-style-type: none"> <li>limited deposits <b>or</b> non-renewable <b>or</b> it is running out <b>or</b> once it's gone it's gone</li> <li>danger in use <b>or</b> extraction</li> </ul> | do <b>not</b> allow can't be used again                                                                                             |          |
|              | <b>Renewable</b> disadvantages                                                                                                                                                                        | must relate to fuel chosen<br>allow marks if they have given a different renewable source i.e. tidal<br>ignore cost<br>ignore marks |          |
|              | <ul style="list-style-type: none"> <li>unreliable or relevant explanation</li> </ul>                                                                                                                  | accept only makes a small amount of electricity                                                                                     | 1        |
|              | <ul style="list-style-type: none"> <li>example of effect on environment</li> </ul>                                                                                                                    | accept kills birds                                                                                                                  | 1        |
| <b>Total</b> |                                                                                                                                                                                                       |                                                                                                                                     | <b>6</b> |

| question     | answers                                                                     | extra information                                                                                                                 | marks    |
|--------------|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|----------|
| 3(a)         | lowest                                                                      |                                                                                                                                   | 1        |
|              | cooler                                                                      |                                                                                                                                   | 1        |
|              | liquid                                                                      |                                                                                                                                   | 1        |
| (b)          | flammable liquid <b>or</b> risk of fire<br><b>or</b> more controllable heat | do <b>not</b> accept Bunsen has an open flame<br><br>accept risk of explosion                                                     | 1        |
| (c)(i)       | e.g. polyethene                                                             | accept phonetic spelling of a known polymer<br><br>do <b>not</b> allow biologically based polymers e.g. cellulose or just plastic | 1        |
| (c)(ii)      | e.g. making plastic bags                                                    | use must be linked to polymer given in part (i)<br><br>allow mark for use of plastic<br><br>e.g. (i) plastic ✗<br><br>(ii) bags ✓ | 1        |
| <b>Total</b> |                                                                             |                                                                                                                                   | <b>6</b> |

| question     | answers                                                                                                                                                                                           | extra information                                                                                                                             | marks    |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 4(a)(i)      | C                                                                                                                                                                                                 | four independent marks                                                                                                                        | 1        |
| (ii)         | (nitrates) needed for growth                                                                                                                                                                      |                                                                                                                                               | 1        |
| (b)(i)       | B                                                                                                                                                                                                 |                                                                                                                                               | 1        |
| (ii)         | (magnesium needed for)<br>chlorophyll / green colour                                                                                                                                              |                                                                                                                                               | 1        |
| (c)          | any <b>two</b> from: <ul style="list-style-type: none"> <li>• phosphorus / phosphate</li> <li>• potassium</li> <li>• sulphate</li> <li>• iron</li> <li>• calcium</li> <li>• zinc</li> </ul>       | allow phonetic spelling<br>allow symbols e.g. K/K <sup>+</sup>                                                                                | 2        |
| (d)          | fertilizer / manure / compost                                                                                                                                                                     | allow named fertilizer                                                                                                                        | 1        |
| (e)(i)       | e.g. herbicides / pesticides /<br>fungicides / greenhouse / irrigation<br>/ specified organic method e.g.<br>weeding / beneficial insects <b>or</b><br>increased CO <sub>2</sub> / light / warmth | do <b>not</b> accept inorganic or organic<br>fertilizer here<br><br>accept genetic engineering<br>accept use up hormones<br>accept more space | 1        |
| (e)(ii)      | e.g. kills weeds (that compete with<br>crops) etc                                                                                                                                                 | explanation must be linked to<br>answer in (e)(i)                                                                                             | 1        |
| <b>Total</b> |                                                                                                                                                                                                   |                                                                                                                                               | <b>9</b> |

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| <b>question</b> | <b>answers</b>                                             | <b>extra information</b>                     | <b>marks</b> |
|-----------------|------------------------------------------------------------|----------------------------------------------|--------------|
| <b>5(a)</b>     | neutron                                                    |                                              | 1            |
|                 | electron                                                   |                                              | 1            |
| <b>(b)</b>      | Ca                                                         | accept if not in table                       | 1            |
|                 | Zn                                                         | must be correct upper and lower case letters | 1            |
| <b>(c)</b>      | accept any sensible use for one of the metals in the table | accept calcium to build bones                | 1            |
| <b>(d)</b>      | points plotted accurately                                  | accept $\pm \frac{1}{2}$ square              | 2            |
| <b>(e)</b>      | calcium does not fit the pattern or wtte                   | ignore yes or no given                       | 1            |
| <b>Total</b>    |                                                            |                                              | <b>8</b>     |

| question     | answers                                                                                                                                                                                                                                                                                                                                                                      | extra information                                                                                                                                                           | marks    |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 6(a)         | oxygen (released)                                                                                                                                                                                                                                                                                                                                                            | allow unambiguous symbols                                                                                                                                                   | 1        |
|              | carbon dioxide (from the air)                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                             | 1        |
|              | water (from the roots)                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                             | 1        |
| (b)          | chlorophyll                                                                                                                                                                                                                                                                                                                                                                  | accept phonetic spelling<br><br>do <b>not</b> allow chloroplast                                                                                                             | 1        |
| (c)          | glucose / sugar / starch                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                             | 1        |
| (d)          | any <b>four</b> from: <ul style="list-style-type: none"> <li>• at least two plants <b>or</b> use the same plant twice</li> <li>• fair test specified e.g. same size <b>or</b> leave for same amount of time</li> <li>• at least two different lighting conditions</li> <li>• measure or compare</li> <li>• repeat experiment <b>or</b> take an average of results</li> </ul> | ignore experiments for germinating seeds<br><br>do <b>not</b> accept leaves if detached from plant (but can score other marks)<br><br>accept check differences between them | 4        |
| <b>Total</b> |                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                             | <b>9</b> |

| question | answers                                                                                                                                                                            | extra information                                                                                               | marks |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|-------|
| 7(a)     | making steel or any large scale use of iron or steel<br>e.g. bridges / cars / buildings / ships / nails                                                                            |                                                                                                                 | 1     |
| (b)      | poor conductor of heat                                                                                                                                                             |                                                                                                                 | 1     |
|          | high melting point                                                                                                                                                                 | negate mark(s) if extra box(es) ticked                                                                          | 1     |
| (c)      | Fe <sub>2</sub> O <sub>3</sub> / Fe <sub>3</sub> O <sub>4</sub> / FeO                                                                                                              | accept OFe<br>do <b>not</b> allow FeO <sub>2</sub> / FeO <sub>3</sub><br>symbols correct <b>not</b> superscript | 1     |
|          | carbon                                                                                                                                                                             |                                                                                                                 | 1     |
|          | calcium carbonate                                                                                                                                                                  |                                                                                                                 | 1     |
|          | compound                                                                                                                                                                           | do <b>not</b> allow non-metal compound                                                                          | 1     |
| (d)(i)   | gives out heat / energy <b>or</b><br>creates / produces heat                                                                                                                       | do <b>not</b> allow gets hotter<br>allow heat is lost                                                           | 1     |
| (d)(ii)  | any <b>one</b> from:<br><ul style="list-style-type: none"><li>• provides heat / high temperature</li><li>• speeds up reaction</li><li>• produces the reducing agent (CO)</li></ul> | do <b>not</b> allow to separate iron from iron ore                                                              | 1     |

| question     | answers                                                                                                                                                                                                                                                                                                                                                                                                            | extra information                                                                        | marks     |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-----------|
| 7(e)(i)      | mined / quarried / dug up /<br>extracted from the ground                                                                                                                                                                                                                                                                                                                                                           | do <b>not</b> accept from the ground<br>only <b>or</b> extracted only                    | 1         |
| (e)(ii)      | CaCO <sub>3</sub>                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                          | 1         |
|              | CaO                                                                                                                                                                                                                                                                                                                                                                                                                | -1 for incorrect balancing                                                               | 1         |
|              | CO <sub>2</sub>                                                                                                                                                                                                                                                                                                                                                                                                    | formulae must be correct                                                                 | 1         |
| (f)          | <ul style="list-style-type: none"> <li>by reduction / displacement</li> </ul>                                                                                                                                                                                                                                                                                                                                      |                                                                                          | 1         |
|              | <ul style="list-style-type: none"> <li>removal of oxygen (from iron oxide)</li> </ul>                                                                                                                                                                                                                                                                                                                              |                                                                                          | 1         |
|              | <ul style="list-style-type: none"> <li>using carbon / carbon monoxide / coke or using<br/>reducing agent</li> </ul> <p>second and third bullet points can be scored from<br/>word <b>or</b> symbol equation</p> <p>e.g.</p> <p>FeO + CO → Fe + CO<sub>2</sub> = 2 marks</p> <p>FeO + CO → Fe = 1 mark (reducing agent)</p> <p>FeO → Fe + CO<sub>2</sub> = 1 mark (removal of oxygen)</p> <p>FeO → Fe = 0 marks</p> |                                                                                          | 1         |
| (g)(i)       | gold / sulphur                                                                                                                                                                                                                                                                                                                                                                                                     | accept silver / copper / diamond /<br>carbon / platinum<br><br>do <b>not</b> accept coal | 1         |
| (g)(ii)      | lead / zinc / copper / tin                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                          | 1         |
| <b>Total</b> |                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                          | <b>18</b> |



| question | answers                                                                                                                                                                                                                                                                    | extra information                                                                                                                                         | marks                      |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
| 8(a)(i)  | <p><b>A</b> healthier pigs</p> <p><b>B</b> eat more food / put on weight<br/>or move about less / lose less energy</p> <p><b>C</b> less energy used up keeping warm or pig won't lose energy / weight keeping warm</p>                                                     | <p>anything that implies healthy</p> <p>allow get fat</p>                                                                                                 | <p>1</p> <p>1</p> <p>1</p> |
| (a)(ii)  | pigs under controlled conditions / pigs in pens / crowded conditions / small space / indoors                                                                                                                                                                               | <p>no mark for intensive</p> <p>do <b>not</b> accept organic but give error carried forward for (b)</p>                                                   | 1                          |
| (b)      | <p>any <b>two</b> from:</p> <ul style="list-style-type: none"> <li>• low labour cost / cheaper</li> <li>• space saved / mass production</li> <li>• more meat produced / higher yield</li> <li>• pigs easier to monitor / control</li> <li>• safe from predators</li> </ul> | <p>if organic as answer (a)(ii) healthier / happier animals / more humane (1)</p> <p>better quality meat / no chemicals (in meat) / tastes better (1)</p> | 2                          |
| (c)      | <p>any <b>one</b> from:</p> <ul style="list-style-type: none"> <li>• outdoors / free range / humane / better conditions</li> <li>• no artificial additives in feed / organic feed</li> </ul>                                                                               |                                                                                                                                                           | 1                          |

| question     | answers                                                                                                                                                                                                                                                     | extra information          | marks    |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|----------|
| 8(d)         | any <b>two</b> from: <ul style="list-style-type: none"> <li>• longer body / more meat / heavier</li> <li>• <b>no</b> tusks</li> <li>• tamer / less aggressive</li> <li>• not so much hair / fur</li> <li>• smaller snout</li> <li>• smaller tail</li> </ul> | do <b>not</b> allow fatter | 2        |
| <b>Total</b> |                                                                                                                                                                                                                                                             |                            | <b>9</b> |

| question | answers                                                                                                                                                                 | extra information                                 | marks      |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|------------|
| 9(a)(i)  | greatest amount of sun <b>or</b> more light <b>or</b> more heat                                                                                                         |                                                   | 1          |
| (a)(ii)  | any <b>one</b> from <ul style="list-style-type: none"> <li>• larger surface area (for heat transfer)</li> <li>• small tubes heat up quicker / easier to heat</li> </ul> |                                                   | 1          |
| (a)(iii) | absorbs / takes in heat / light / energy <b>or</b> gets hotter than white<br><br>by radiation                                                                           | do <b>not</b> accept attracts heat                | 1<br><br>1 |
| (b)(i)   | good (heat) conductor<br><br><b>or</b><br><br>does not corrode                                                                                                          |                                                   | 1          |
| (b)(ii)  | convection (currents in the water)<br><br><b>or</b><br><br>conduction (from the heat exchanger to the water)                                                            | accept an explanation<br><br><br>accept conductor | 1          |
| (b)(iii) | fibreglass / lagging / insulation                                                                                                                                       |                                                   | 1          |

| question     | answers       | extra information                                                                                                                                   | marks                    |
|--------------|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| 9(c)(i)      | $3 \times 4$  |                                                                                                                                                     | 1                        |
|              | = 12 (kWh)    | <p><b>two</b> marks for correct answer only</p> <p>answer of 12 000 from <math>3\ 000 \times 4</math><br/>= 1 mark</p> <p>(12 000 Wh = 2 marks)</p> | 1                        |
| (c)(ii)      | $12 \times 7$ | allow ecf                                                                                                                                           | 1                        |
|              | = 84 (p)      |                                                                                                                                                     | 1                        |
| <b>Total</b> |               |                                                                                                                                                     | <b>11</b>                |
|              |               |                                                                                                                                                     | <b>Overall mark = 80</b> |