

# Mark Scheme (FINAL)

## January 2009

GCE

GCE Biology (6103/03)

## General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

| Question Number    | Answer   | Mark  |         |                  |                  |                   |  |                    |                 |  |                    |                 |   |     |
|--------------------|--|---|---------|------------------|------------------|-------------------|--|--------------------|-----------------|--|--------------------|-----------------|---|-----|
| 1(a)               | <table border="1"> <thead> <tr> <th>Bacterium</th> <th>Process</th> <th>Change occurring</th> </tr> </thead> <tbody> <tr> <td><i>Rhizobium</i></td> <td>nitrogen fixation</td> <td>nitrogen to {amine compounds / eq} ;<br/><b>ACCEPT</b> ammonia / ammonium</td> </tr> <tr> <td><i>Pseudomonas</i></td> <td>denitrification</td> <td>{nitrogen compounds /eq} to nitrogen ;</td> </tr> <tr> <td><i>Nitrobacter</i></td> <td>nitrification ;</td> <td>{ammonium / ammonia} to {nitrites / nitrate (III)} / {nitrites / nitrate (III)} to {nitrates / nitrate (V)} ;</td> </tr> </tbody> </table> <p>three processes named correctly ;</p> <p>correct description linked to each process x3 ;;;</p> | Bacterium   | Process | Change occurring | <i>Rhizobium</i> | nitrogen fixation | nitrogen to {amine compounds / eq} ;<br><b>ACCEPT</b> ammonia / ammonium | <i>Pseudomonas</i> | denitrification | {nitrogen compounds /eq} to nitrogen ; | <i>Nitrobacter</i> | nitrification ; | {ammonium / ammonia} to {nitrites / nitrate (III)} / {nitrites / nitrate (III)} to {nitrates / nitrate (V)} ; | (4) |
| Bacterium          | Process  | Change occurring  |         |                  |                  |                   |  |                    |                 |  |                    |                 |   |     |
| <i>Rhizobium</i>   | nitrogen fixation  | nitrogen to {amine compounds / eq} ;<br><b>ACCEPT</b> ammonia / ammonium                                      |         |                  |                  |                   |  |                    |                 |  |                    |                 |   |     |
| <i>Pseudomonas</i> | denitrification  | {nitrogen compounds /eq} to nitrogen ;  |         |                  |                  |                   |  |                    |                 |  |                    |                 |   |     |
| <i>Nitrobacter</i> | nitrification ;  | {ammonium / ammonia} to {nitrites / nitrate (III)} / {nitrites / nitrate (III)} to {nitrates / nitrate (V)} ; |         |                  |                  |                   |  |                    |                 |  |                    |                 |   |     |

| Question Number | Answer  | Mark           |
|-----------------|---|----------------|
| 1(b)(i)         | <ol style="list-style-type: none"> <li>reference to root nodules containing <i>Rhizobium</i> ;</li> <li>idea of (extra) {nitrogen compounds / eq} being available;</li> <li>less {fertiliser /eq} needed ;</li> </ol> | maximum<br>(2) |

| Question Number | Answer  | Mark           |
|-----------------|---|----------------|
| 1(b)(ii)        | <ol style="list-style-type: none"> <li>idea of waterlogging creates {low oxygen conditions / eq} ;</li> <li>{<i>Pseudomonas</i> more active / <i>Nitrobacter</i> less active} in low oxygen conditions ;</li> <li>leads to reduction in nitrogen compounds in soil / fewer nitrates available for plants ;</li> </ol> <p><b>NOT</b> less nitrogen in soil</p> | maximum<br>(2) |

| Question Number | Answer   | Mark           |
|-----------------|--|----------------|
| 2(a)            | <ol style="list-style-type: none"> <li>1. rate of production of {biomass / organic material} in {producers / plants} ;</li> <li>2. {GPP / gross primary production} - Respiration / GPP - R ;</li> <li>3. (biomass / organic material) available for {herbivores / primary consumers} ;</li> </ol> | maximum<br>(2) |

| Question Number | Answer  | Mark |
|-----------------|---|------|
| 2 (b)           | <ol style="list-style-type: none"> <li>1. 12.4 x 365 ;</li> </ol> <p>ALLOW 360 - 369 for number of days</p> <ol style="list-style-type: none"> <li>2. 4 526 (g m<sup>-2</sup>) ;</li> </ol> | (2)  |

| Question Number | Answer   | Mark           |
|-----------------|--|----------------|
| 2(c)(i)         | <ol style="list-style-type: none"> <li>1. more light available / days longer / light intensity greater / reference to higher temperature ;</li> <li>2. leads to more photosynthesis ;</li> <li>3. {biomass / organic material} accumulates faster than it is broken down / eq ;</li> </ol> | maximum<br>(2) |

| Question Number | Answer  | Mark |
|-----------------|---|------|
| 2(c)(ii)        | {same/ optimum} conditions throughout year means no seasonal differences / eq ; | (1)  |

| Question Number | Answer   | Mark                   |
|-----------------|--|------------------------|
| 2(d)            | <ol style="list-style-type: none"> <li>1. algal culture has highest {productivity / NPP} ;</li> <li>2. algal production can be maintained throughout year / eq ;</li> <li>3. not all of {producer / plant} {eaten / digested / absorbed} / reference to better nutrient content in algae ;</li> <li>4. idea that less area needed to produce animal feed from algae than from crops ;</li> </ol> | <p>maximum<br/>(3)</p> |

| Question Number | Answer  | Mark           |
|-----------------|---|----------------|
| 3(a)            | <ol style="list-style-type: none"> <li>1. carbon dioxide removed from atmosphere / eq ;</li> <li>2. idea of {locked / stored / eq} for a long time ;</li> </ol> | maximum<br>(2) |

| Question Number | Answer   | Mark           |
|-----------------|--|----------------|
| 3(b)            | <ol style="list-style-type: none"> <li>1. fuel combustion ;</li> <li>2. does not pollute hydrosphere ;</li> <li>3. only has gaseous products / eq ;</li> <li>4. all other sources have {liquid / oil} as pollutant ;</li> </ol> <p>NB no source / incorrect source = max 2</p> | maximum<br>(3) |

| Question Number | Answer   | Mark           |
|-----------------|--|----------------|
| 3(c)            | <ol style="list-style-type: none"> <li>1. oil terminals ;</li> <li>2. only have local effect ;</li> <li>3. oil may not be passed into water / eq ;</li> <li>4. (therefore) it does not get {spread / dispersed / eq} ;</li> </ol> <p>NB no source / incorrect source = max 2</p> | maximum<br>(3) |

| Question Number | Answer   | Mark        |
|-----------------|--|-------------|
| 3(d)            | <ol style="list-style-type: none"> <li>1. general decrease in both ;</li> <li>2. reference to fluctuation in transportation and shipping, no fluctuation in land-based sources ;</li> <li>3. greater decrease in mass in land-based sources / converse ;</li> <li>4. greater decrease in % for transportation and shipping / converse / little difference in % decrease for both ;</li> <li>5. credit useful manipulation of data to support mps 3 or 4 ;</li> </ol> | maximum (3) |

| Question Number | Answer  | Mark        |
|-----------------|---|-------------|
| 3(e)(i)         | <ol style="list-style-type: none"> <li>1. less oxygen available to fish / fish suffocates / eq ;</li> <li>2. less oxygen {dissolves / diffuses} into water / oil clogs gills / eq ;</li> <li>3. (ingestion of oil) {may be toxic / reduce efficiency of {digestion / absorption}} ;</li> <li>4. reference to reduction of {plants / other food sources} leading to less food available ;</li> </ol> | maximum (2) |

| Question Number | Answer   | Mark        |
|-----------------|--|-------------|
| 3(e)(ii)        | <ol style="list-style-type: none"> <li>1. less light available / eq ;</li> <li>2. reduction in photosynthesis / eq ;</li> <li>3. {reduced growth / plants die} (context of less photosynthesis) / eq ;</li> <li>4. reference to increased CO<sub>2</sub> increases photosynthesis ;</li> </ol> | maximum (2) |

| Question Number | Answer   | Mark                   |
|-----------------|--|------------------------|
| 3(e)(iii)       | <ol style="list-style-type: none"> <li>1. {sulphur dioxide / NO<sub>x</sub>} (produced by combustion) can cause acid rain / eq ;</li> <li>2. reference to specific effect of acid rain on conifers e.g. loss of leaves, damage to root hairs, die-back (of crown) ;</li> <li>3. {reduced / stunted} growth / eq ;</li> </ol> | <p>maximum<br/>(2)</p> |

| Question Number | Answer   | Mark                   |
|-----------------|--|------------------------|
| 3(f)            | <ol style="list-style-type: none"> <li>1. gasohol is mixture of ethanol and {petrol / gasoline} ;</li> <li>2. ethanol produced from {sugar / molasses / corn syrup / eq} ;</li> <li>3. from {modern / recently grown} plants ;</li> <li>4. idea that carbon dioxide (released from ethanol) only recently removed from atmosphere / no increase in greenhouse gases ;</li> <li>5. no sulphur dioxide (from ethanol) / less sulphur dioxide from gasohol ;</li> <li>6. no nitrogen oxides (from ethanol) / less nitrogen oxides from gasohol ;</li> </ol> | <p>maximum<br/>(3)</p> |