



## **General Certificate of Education**

# **Biology 1411**

**BIOL2      The Variety of Living Organisms**

## **Mark Scheme**

*2009 examination – June 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.

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**Quality of Written Communication (QWC)**

Although specific marks are not awarded in questions 1 – 7, marks awarded will take in to account the quality of written communication. Credit will only be awarded where candidates have presented information clearly and coherently and have used the specialist vocabulary indicated in the mark scheme for this unit. Specific references to quality of written communication are marked **Q** in this mark scheme.

| Question                      | Part     | Sub Part | Marking Guidance                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Mark    | Comments                                                                |          |        |        |         |                               |         |         |                               |      |      |        |      |      |       |        |      |       |                                                                                                             |
|-------------------------------|----------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------------------------------------------------------------------|----------|--------|--------|---------|-------------------------------|---------|---------|-------------------------------|------|------|--------|------|------|-------|--------|------|-------|-------------------------------------------------------------------------------------------------------------|
| 1                             | (a)      |          | Arrows on all five vessels in correct direction;                                                                                                                                                                                                                                                                                                                                                                                                                           | 1       |                                                                         |          |        |        |         |                               |         |         |                               |      |      |        |      |      |       |        |      |       |                                                                                                             |
| 1                             | (b)      | (i)      | D;                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1       |                                                                         |          |        |        |         |                               |         |         |                               |      |      |        |      |      |       |        |      |       |                                                                                                             |
| 1                             | (b)      | (ii)     | E;                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1       |                                                                         |          |        |        |         |                               |         |         |                               |      |      |        |      |      |       |        |      |       |                                                                                                             |
| 1                             | (c)      |          | <table border="1"> <thead> <tr> <th>Feature</th> <th>Vessel C</th> <th>Vessel E</th> </tr> </thead> <tbody> <tr> <td>Valves</td> <td>Absent</td> <td>Present</td> </tr> <tr> <td>(Relative) thickness of walls</td> <td>Thicker</td> <td>Thinner</td> </tr> <tr> <td>Elastin/elastic tissue/fibres</td> <td>More</td> <td>Less</td> </tr> <tr> <td>Muscle</td> <td>More</td> <td>Less</td> </tr> <tr> <td>Lumen</td> <td>Narrow</td> <td>Wide</td> </tr> </tbody> </table> | Feature | Vessel C                                                                | Vessel E | Valves | Absent | Present | (Relative) thickness of walls | Thicker | Thinner | Elastin/elastic tissue/fibres | More | Less | Muscle | More | Less | Lumen | Narrow | Wide | 2 max | Two marks for two correct rows<br><br>Accept any pair of contrasting terms with same meaning as those used. |
| Feature                       | Vessel C | Vessel E |                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |         |                                                                         |          |        |        |         |                               |         |         |                               |      |      |        |      |      |       |        |      |       |                                                                                                             |
| Valves                        | Absent   | Present  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |         |                                                                         |          |        |        |         |                               |         |         |                               |      |      |        |      |      |       |        |      |       |                                                                                                             |
| (Relative) thickness of walls | Thicker  | Thinner  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |         |                                                                         |          |        |        |         |                               |         |         |                               |      |      |        |      |      |       |        |      |       |                                                                                                             |
| Elastin/elastic tissue/fibres | More     | Less     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |         |                                                                         |          |        |        |         |                               |         |         |                               |      |      |        |      |      |       |        |      |       |                                                                                                             |
| Muscle                        | More     | Less     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |         |                                                                         |          |        |        |         |                               |         |         |                               |      |      |        |      |      |       |        |      |       |                                                                                                             |
| Lumen                         | Narrow   | Wide     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |         |                                                                         |          |        |        |         |                               |         |         |                               |      |      |        |      |      |       |        |      |       |                                                                                                             |
| 1                             | (d)      |          | Contracts;<br><br>(Causing) vasoconstriction/narrows lumen;                                                                                                                                                                                                                                                                                                                                                                                                                | 2       |                                                                         |          |        |        |         |                               |         |         |                               |      |      |        |      |      |       |        |      |       |                                                                                                             |
| 1                             | (e)      |          | (Elastic tissue) stretches when pressure is high;<br><br>Springs back/recoils/returns to normal;                                                                                                                                                                                                                                                                                                                                                                           | 2 max   | <b>Q</b> Do not credit references to contracting, relaxing or expanding |          |        |        |         |                               |         |         |                               |      |      |        |      |      |       |        |      |       |                                                                                                             |

| Question | Part | Sub Part | Marking Guidance                                                                   | Mark  | Comments                                                                                                                       |
|----------|------|----------|------------------------------------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------------------------------|
| 2        | (a)  |          | Phosphate;<br><br>Deoxyribose;                                                     | 2     | <b>Q</b> Candidates must specify deoxyribose. This term is a specification requirement. Ignore anything that is not incorrect. |
| 2        | (b)  |          | 4;                                                                                 | 1     |                                                                                                                                |
| 2        | (c)  | (i)      | 14;                                                                                | 1     |                                                                                                                                |
| 2        | (c)  | (ii)     | 36;                                                                                | 1     | If (c)(i) incorrect accept [50 – (c)(i)]                                                                                       |
| 2        | (d)  |          | Different proteins;<br><br>Different genes;<br><br>Different (DNA) base sequences; | 2 max |                                                                                                                                |

| Question | Part | Sub Part | Marking Guidance                                                                                                                                             | Mark | Comments                                                                                             |
|----------|------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------------------------------------------------------------------------------------------------------|
| 3        | (a)  |          | (Prokaryotic DNA) is circular/in a loop/not associated with proteins/not in chromosomes/does not contain introns/does not contain junk DNA/shorter;          | 1    | It refers to prokaryote                                                                              |
| 3        | (b)  | (i)      | <u>Horizontal</u> transmission;<br>Plasmid/DNA/gene for resistance;<br>(Plasmid/gene/DNA) passed on by conjugation;                                          | 3    | <b>Q</b> To gain first marking point, reference must be made to horizontal                           |
| 3        | (b)  | (ii)     | DNA/gene/plasmid is replicated/copied;<br>Passed on to B and C when cell A divides/vertical gene transmission;                                               | 2    | <b>Q</b> Reject second marking point if candidate refers to mitosis.<br><br>Accept clones/multiplies |
| 3        | (c)  |          | Penicillin kills non-resistant bacteria/resistant bacteria survive/are not destroyed;<br><br>Resistant bacteria reproduce <u>and</u> increase in proportion; | 2    | Ignore ref to mitosis.<br>Penalise ref to immunity once only.                                        |

| Question                                              | Part | Sub Part | Marking Guidance                                                                                                                                                                                                                                                                                    | Mark                  | Comments                                                              |                             |                         |     |     |                   |     |     |   |  |
|-------------------------------------------------------|------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-----------------------------------------------------------------------|-----------------------------|-------------------------|-----|-----|-------------------|-----|-----|---|--|
| 4                                                     | (a)  |          | <table border="1"> <thead> <tr> <th>Nucleus</th> <th>Number of chromosomes</th> <th>Mass of DNA/arbitrary units</th> </tr> </thead> <tbody> <tr> <td>At telophase of mitosis</td> <td>26;</td> <td>30;</td> </tr> <tr> <td>From a sperm cell</td> <td>13;</td> <td>15;</td> </tr> </tbody> </table> | Nucleus               | Number of chromosomes                                                 | Mass of DNA/arbitrary units | At telophase of mitosis | 26; | 30; | From a sperm cell | 13; | 15; | 4 |  |
|                                                       |      |          | Nucleus                                                                                                                                                                                                                                                                                             | Number of chromosomes | Mass of DNA/arbitrary units                                           |                             |                         |     |     |                   |     |     |   |  |
|                                                       |      |          | At telophase of mitosis                                                                                                                                                                                                                                                                             | 26;                   | 30;                                                                   |                             |                         |     |     |                   |     |     |   |  |
| From a sperm cell                                     | 13;  | 15;      |                                                                                                                                                                                                                                                                                                     |                       |                                                                       |                             |                         |     |     |                   |     |     |   |  |
| Cancer cells often have faulty/damaged DNA;           |      |          |                                                                                                                                                                                                                                                                                                     |                       |                                                                       |                             |                         |     |     |                   |     |     |   |  |
| Protein/p53 faulty/not made;                          |      |          |                                                                                                                                                                                                                                                                                                     |                       |                                                                       |                             |                         |     |     |                   |     |     |   |  |
| Cell (with faulty /DNA) divides/completes cell cycle; |      |          |                                                                                                                                                                                                                                                                                                     |                       |                                                                       |                             |                         |     |     |                   |     |     |   |  |
| Uncontrolled division produces cancer;                |      |          |                                                                                                                                                                                                                                                                                                     |                       |                                                                       |                             |                         |     |     |                   |     |     |   |  |
| 4                                                     | (b)  |          |                                                                                                                                                                                                                                                                                                     | 3                     | p53 refers to the protein so do not accept reference to p53 mutating. |                             |                         |     |     |                   |     |     |   |  |
| 4                                                     | (c)  | (i)      | Interphase/S phase/synthesis phase;                                                                                                                                                                                                                                                                 | 1                     |                                                                       |                             |                         |     |     |                   |     |     |   |  |
| 4                                                     | (c)  | (ii)     | Anaphase/ <b>A</b> ;                                                                                                                                                                                                                                                                                | 1                     |                                                                       |                             |                         |     |     |                   |     |     |   |  |

| Question | Part | Sub Part | Marking Guidance                                                                                                                                                                                                                                                                 | Mark  | Comments                                                 |
|----------|------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|----------------------------------------------------------|
| 5        | (a)  |          | (Group of) similar/identical cells/cells with a common origin;                                                                                                                                                                                                                   | 1     | <b>Q</b> Ignore references to function                   |
| 5        | (b)  | (i)      | Add iodine/stain specific for starch to the slide/cells/tissue/<br>/add iodine/stain specific for starch and examine under microscope;<br><br>Blue-black/blue/black/purple;                                                                                                      | 2     | Reject sample                                            |
| 5        | (b)  | (ii)     | Need a single layer of cells/only a few cells thick/not too many layers;<br><br>Light must be able to pass through;<br><br>Detail obscured by cells underneath;                                                                                                                  | 2 max |                                                          |
| 5        | (c)  |          | Both are polymers/made of monomers;<br><br>Joined by condensation/molecules can be broken down by hydrolysis;<br><br>Both have 1-4 links;<br><br>Contain C(arbon), H(ydrogen) and O(xygen)/both made up of glucose;<br><br>Both insoluble;<br><br>Both contain glycosidic bonds; | 2 max | Accept other valid answers.<br>Ignore ref to unbranched. |

| Question | Part | Sub Part | Marking Guidance                                                                                                                                                          | Mark | Comments                                    |
|----------|------|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---------------------------------------------|
| 6        | (a)  |          | Kingdom/phylum/class;                                                                                                                                                     | 1    |                                             |
| 6        | (b)  | (i)      | 6;                                                                                                                                                                        | 1    |                                             |
| 6        | (b)  | (ii)     | Family;                                                                                                                                                                   | 1    |                                             |
| 6        | (b)  | (iii)    | The two species of <i>Mirounga</i> shared a common ancestor more recently than they did with <i>Monarchus tropicalis</i> ;                                                | 1    |                                             |
| 6        | (c)  |          | Difference in DNA/base sequence/alleles/genes;                                                                                                                            | 1    |                                             |
| 6        | (d)  | (i)      | Genetic bottleneck linked to low genetic diversity/smaller gene pool;<br><br>Reference to very low seal population/population in 1910/ under 100 seals/caused by hunting; | 2    | Must refer to data provided for second mark |
| 6        | (d)  | (ii)     | New colonies formed by small number (of seals)/ small number of founders;<br><br>Founders have different/fewer alleles/genes / have smaller gene pool;                    | 2    |                                             |



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| Question | Part | Sub Part | Marking Guidance                                                                                                                                            | Mark  | Comments       |
|----------|------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|----------------|
| 7        | (a)  | (i)      | 2;                                                                                                                                                          | 1     | Allow 1.75     |
| 7        | (a)  | (ii)     | 30 / 60 ÷ answer to part (i) if incorrect;                                                                                                                  | 1     | Allow 34(.315) |
| 7        | (b)  |          | Song characteristic of species/differs between species;<br>Song linked to courtship at night/living underground;                                            | 2     |                |
| 7        | (c)  |          | Females not attracted to call of male/does not recognise male;<br>Because of differences in song;<br>Necessary precursor to mating;<br>Hybrids are sterile; | 2 max |                |

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| Question | Part | Sub Part | Marking Guidance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Mark  | Comments                                                                                                                                                                                                                                |
|----------|------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8        | (a)  |          | <p>1 Large surface area provided by lamellae/filaments;</p> <p>2 Increases diffusion/makes diffusion efficient;</p> <p>3 Thin epithelium/distance between water and blood;</p> <p>4 Water and blood flow in opposite directions/counter-current;</p> <p>5 (Point 4) maintains concentration gradient (along gill) /equilibrium not reached;</p> <p>6 As water always next to blood with lower concentration of oxygen;</p> <p>7 Circulation replaces blood saturated with oxygen;</p> <p>8 Ventilation replaces water (as oxygen removed);</p> | 6 max | <p><b>Q</b> Candidates are required to refer to lamellae or filaments. Do not penalise for confusion between two</p> <p>5 Not enough to say gives steep concentration gradient</p> <p>6-8 Accept answers relating to carbon dioxide</p> |
| 8        | (b)  |          | <p>Mixing of air and water (at surface);</p> <p>Air has higher concentration of oxygen than water;</p> <p>Diffusion into water;</p> <p>Plants/seaweeds near surface/in light;</p> <p>Produce oxygen by photosynthesis;</p>                                                                                                                                                                                                                                                                                                                     | 2 max |                                                                                                                                                                                                                                         |
| 8        | (c)  |          | <p>Not much oxygen near sea bed;</p> <p>Toadfish haemoglobin (nearly) saturated/loads readily at /has higher affinity for oxygen at low partial pressure (of oxygen);</p>                                                                                                                                                                                                                                                                                                                                                                      | 2     |                                                                                                                                                                                                                                         |

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|   |     |      |                                                                                                                                                                          |   |  |
|---|-----|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|--|
| 8 | (d) | (i)  | The chimpanzee and the bonobo are more closely related (than to the gorilla);<br><br>They have identical amino acids/one of the amino acids is different in the gorilla; | 2 |  |
| 8 | (d) | (ii) | (Chimpanzee) orang-utan;<br><br>Amino acids different so bases different;<br><br>Few hydrogen bonds;                                                                     | 3 |  |

| Question | Part | Sub Part | Marking Guidance                                                                                                                                                                                                                                                                 | Mark  | Comments                                                                                   |
|----------|------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------------------------------------------------------------------------------------------|
| 9        | (a)  |          | Randomly collected/collected from many ponds/same species/same time of year;                                                                                                                                                                                                     | 1     | Accept other answers providing they might reasonably impact on data                        |
| 9        | (b)  |          | 9;                                                                                                                                                                                                                                                                               | 1     |                                                                                            |
| 9        | (c)  |          | Curve/line of best fit;<br><br>Shows upward slope/positive correlation/description of positive correlation;<br><br>Correlation does not necessarily mean causation;<br><br>Some other factor might be involved;<br><br>Some ponds had no worms but had frogs with deformed legs; | 4 max | Q No mark awarded for “yes” or “no”                                                        |
| 9        | (d)  | (i)      | Sample too small to establish a pattern/to be representative/ to identify anomalies;                                                                                                                                                                                             | 1     |                                                                                            |
| 9        | (d)  | (ii)     | Must compare like with like/must be a fair test;<br><br>Some factors differ in mountains/named factor differs in mountains;                                                                                                                                                      | 2     | Note that fair test is acceptable if used in context defined in How Science Works glossary |
| 9        | (e)  |          | 27% of the frogs had deformed legs in pond 2;<br><br>Agricultural run-off and cage mesh diameter of 500 $\mu\text{m}$ ;                                                                                                                                                          | 2     |                                                                                            |

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|   |     |  |                                                                                                                                                                                                                                                                                                                                                                                        |       |  |
|---|-----|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--|
| 9 | (f) |  | Worms cause deformed legs;<br><br>Deformed legs in 500 $\mu\text{m}$ mesh cages /deformed legs when worms in cage;<br><br>Run off (on its own) does not cause deformed legs;<br><br>No deformed legs with run off and 75 $\mu\text{m}$ mesh/no worms;<br><br>When run off present makes effect of worms worse;<br><br>Quantitative statement e.g. increased by factor of 7 to 8 times; | 4 max |  |
|---|-----|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--|

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