



**General Certificate of Secondary Education  
January 2013**

**Additional Science / Biology**

**BL2HP**

**(Specification 4408 / 4401)**

**Unit: Biology 2**

**Final**

***Mark Scheme***

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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 events which all examiners participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for standardisation each examiner analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, examiners encounter unusual answers which have not been raised 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 students' 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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## Information to Examiners

### 1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

### 2. Boldening

- 2.1** In a list of acceptable answers where more than one mark is available ‘any **two** from’ is used, with the number of marks boldened. Each of the following bullet points is a potential mark.
- 2.2** A bold **and** is used to indicate that both parts of the answer are required to award the mark.
- 2.3** Alternative answers acceptable for a mark are indicated by the use of **or**. Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.

### 3. Marking points

#### 3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that ‘right + wrong = wrong’.

Each error / contradiction negates each correct response. So, if the number of error / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as \* in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

| Student | Response | Marks awarded |
|---------|----------|---------------|
| 1       | green, 5 | 0             |
| 2       | red*, 5  | 1             |
| 3       | red*, 8  | 0             |

Example 2: Name two planets in the solar system. (2 marks)

| Student | Response                    | Marks awarded |
|---------|-----------------------------|---------------|
| 1       | Neptune, Mars, Moon         | 1             |
| 2       | Neptune, Sun, Mars,<br>Moon | 0             |

### 3.2 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

### 3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, without any working shown.

However, if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column or by each stage of a longer calculation.

### 3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

### 3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

### 3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

### 3.7 Brackets

(.....) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

### 3.8 Ignore / Insufficient / Do not allow

Ignore or insufficient is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

## Quality of Written Communication and levels marking

In Question 1(c) students are required to produce extended written material in English, and will be assessed on the quality of their written communication as well as the standard of the scientific response.

Students will be required to:

- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

The following general criteria should be used to assign marks to a level:

### Level 1: basic

- Knowledge of basic information
- Simple understanding
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail
- The spelling, punctuation and grammar are very weak.

### Level 2: clear

- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

### Level 3: detailed

- Knowledge of accurate information appropriately contextualised
- Detailed understanding, supported by relevant evidence and examples
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar.

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**Question 1**

| question        | Answers   | extra information  | mark |
|-----------------|---|--|------|
| <b>1(a)</b>     | any <b>one</b> from:<br><ul style="list-style-type: none"> <li>• add a water bath</li> <li>• heat screen</li> <li>• use LED</li> <li>• low energy bulb / described</li> </ul> | ignore 'check temperature'   | 1    |
| <b>1(b)(i)</b>  | rate / number of bubbles decreases<br><br><b>or</b><br>less oxygen / gas released   | accept converse with reference to increasing light <b>or</b> shorter distance<br><br>ignore reference to rate of photosynthesis  | 1    |
| <b>1(b)(ii)</b> | temperature / CO <sub>2</sub> (concentration)   | accept 'it was too cool' <b>or</b> not enough CO <sub>2</sub><br>accept number of chloroplasts / amount of chlorophyll<br>allow heat<br>allow CO <sub>2</sub><br>do <b>not</b> allow CO <sup>2</sup> | 1    |

**Question 1 continues on the next page . . .**

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**Question 1 continued . . .**

| question  | Answers  | extra information   | mark   |  |
|---|--|---|--|--|
| 1(c)  | Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking. |   | 6  |  |
|   | <b>0 marks</b>   | <b>Level 1 (1-2 marks)</b>  | <b>Level 2 (3-4 marks)</b>   | <b>Level 3 (5-6 marks)</b>   |
|   | No relevant content.   | There is a brief description of at least 1 tissue <b>or</b> at least 1 function of an indicated part of the leaf.<br><br>The account lacks clarity or detail. | There is a clear description which includes at least 1 named tissue and at least 1 correct function described for an indicated part of the leaf. | There is a detailed description of most of the structures and their functions. |
| <p><b>examples of responses:</b></p> <ul style="list-style-type: none"> <li>• epidermis</li> <li>• cover the plant</li> <li>• mesophyll / palisade</li> <li>• photosynthesises</li> <li>• phloem</li> <li>• xylem</li> <li>• transport.</li> </ul> <p><b>The following points are all acceptable but beyond the scope of the specification:</b></p> <ul style="list-style-type: none"> <li>• (waxy) cuticle – reduce water loss</li> <li>• epidermis – no chloroplasts so allows light to penetrate</li> <li>• stomata / guard cells – allow CO<sub>2</sub> in (and O<sub>2</sub> out) <b>or</b> controls water loss</li> <li>• palisade (mesophyll) – <u>many</u> chloroplasts to trap light<br/>– near top of leaf for receiving more light</li> <li>• spongy (mesophyll) – air spaces for rapid movement of gases</li> </ul> |  |   |  |  |
| <b>Total</b>  |  |   | <b>9</b>   |  |

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**Question 2**

| question        | Answers  | extra information  | mark             |
|-----------------|--|--|------------------|
| <b>2(a)(i)</b>  | directly proportional<br><b>or</b> 0.1 rise in rate for 1% rise in concentration   | gains full marks<br><br>accept increased concentration: increased rate <b>or</b> positive correlation <b>or</b> proportional for <b>1</b> mark | 2                |
| <b>2(a)(ii)</b> | 0.6  | allow $\pm 0.01$   | 1                |
| <b>2(b)</b>     | (0.5% trypsin) cheaper<br>(35 °C) faster reaction<br><br>so takes less time to make product<br><br>extra heating cost outweighed by savings on enzyme cost | ignore more profit<br>allow (35 °C) optimum / best temperature   | 1<br>1<br>1<br>1 |
| <b>2(c)(i)</b>  | any <b>two</b> from:<br>• breaks down / digests food<br><br>• from protein into amino acids / peptides<br><br>• makes soft(er) / runni(er)                 | allow pre-digests protein / food<br>allow easier for baby to digest<br><br>allow description of texture change<br>allow make (more) soluble    | 2                |

**Question 2 continues on the next page . . .**



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**Question 2 continued . . .**

| question        | answers   | extra information   | mark       |
|-----------------|---|---|------------|
| <b>2(c)(ii)</b> | correct named enzyme<br>correct function<br>Eg<br>carbohydrase<br>starch → sugar <b>or</b> lactose →<br>glucose <b>or</b> making sugar syrup<br><b>or</b><br>isomerase<br>glucose → fructose <b>or</b> making<br>slimming foods<br><b>or</b><br>lipase<br>fats / oils → fatty acids <b>or</b><br>removal of grease stains | to gain <b>2</b> marks function must<br>relate to correctly named enzyme<br><br>accept amylase / maltase /<br>lactase<br><br><br>accept other correct example | 1<br><br>1 |
| <b>Total</b>    |   |   | <b>11</b>  |

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**Question 3**

| <b>question</b>  | <b>answers</b>   | <b>extra information</b>  | <b>mark</b> |
|------------------|--|---|-------------|
| <b>3(a)(i)</b>   | mitochondrion / mitochondria                                 | must be phonetically correct  | 1           |
| <b>3(a)(ii)</b>  | carbon dioxide / CO <sub>2</sub><br>water / H <sub>2</sub> O | in either order   | 1           |
|                  |  | accept CO <sub>2</sub> but <b>not</b> CO <sup>2</sup><br>accept H <sub>2</sub> O <b>or</b> HOH but not H <sup>2</sup> O | 1           |
| <b>3(a)(iii)</b> | diffusion  |   | 1           |
|                  | high to low concentration                                    | allow down a concentration gradient   | 1           |
|                  | through (cell) membrane <b>or</b><br>through cytoplasm       | do <b>not</b> accept cell wall  | 1           |
| <b>3(b)</b>      | ribosomes make proteins / enzymes                            |   | 1           |
|                  | using amino acids  |   | 1           |
|                  | part A / mitochondria provide the energy for the process     | allow ATP<br>do <b>not</b> accept produce or make energy  | 1           |
| <b>Total</b>     |  |   | <b>9</b>    |

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**Question 4**

| <b>question</b> | <b>answers</b>  | <b>extra information</b>                      | <b>mark</b> |
|-----------------|---|---|-------------|
| <b>4(a)(i)</b>  | meiosis   | allow mieosis                                 | 1           |
| <b>4(a)(ii)</b> | testis / testes   | allow testicle                                | 1           |
| <b>4(b)(i)</b>  | 23  |   | 1           |
| <b>4(b)(ii)</b> | fuses / joins with cell D / with egg cell <b>or</b> used in fertilisation                                 | allow fuse with another cell                  | 1           |
|                 | prevents doubling of chromosome number / restores original no. / 46 / diploid no. / normal no. / full no. | accept 23 from each parent / from each gamete | 1           |
| <b>Total</b>    |   |   | <b>5</b>    |

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**Question 5**

| question         | answers   | extra information  | mark     |
|------------------|---|--|----------|
| <b>5(a)</b>      | use of quadrat / point frame  | allow description  | 1        |
|                  | randomly placed / random sampling   | ignore reference to transects                                      | 1        |
| <b>5(b)(i)</b>   | 6   |  | 1        |
| <b>5(b)(ii)</b>  | more <u>light</u> in A / in field / where sunny   | ignore sun   | 1        |
|                  | more / better / faster photosynthesis in A / with more light  | allow converse   | 1        |
| <b>5(b)(iii)</b> | use light meter / measure light <u>intensity</u> in both habitats   |  | 1        |
|                  | take many measurements at same time of the day<br><b>or</b><br>laboratory / field investigation with 2 batches high light and low light (1)<br>count or number of flowers in each (1) | counting point is dependent on investigation point                 | 1        |
| <b>5(c)</b>      | more glucose / energy available   | allow other named product eg protein                               | 1        |
|                  | for growth  | allow if more energy produced<br>dependent on 1 <sup>st</sup> mark | 1        |
| <b>Total</b>     |   |  | <b>9</b> |

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**Question 6**

| question  | answers   | extra information   | mark |
|-----------|---|---|------|
| 6(a)(i)   | allele expressed even when other allele present <b>or</b> expressed if just one copy of allele is present <b>or</b> expressed if heterozygous   | if present other allele not expressed   | 1    |
| 6(a)(ii)  | <u>2</u> affected <u>parents</u> have unaffected child <b>or</b> <u>1</u> and <u>2</u> → <b>5 / 6</b><br><b>or</b> if recessive all of <b>1</b> and <b>2</b> 's children would have CADASIL |   | 1    |
| 6(a)(iii) | heterozygous – has unaffected children <b>or</b> because if homozygous all children would have CADASIL  |   | 1    |
| 6(b)      | genetic diagram including:<br>correct gametes:<br><b>D</b> and <b>d</b><br><b>and d</b> (and <b>d</b> )   | accept alternative symbols, if defined<br>ignore 7 / 8 or male / female                         | 1    |
|           | derivation of offspring genotypes:<br><b>Dd Dd dd dd</b>  | allow just <b>Dd dd</b> if $\frac{1}{2}$ -diagram<br>allow ecf if correct for student's gametes | 1    |
|           | identification of <b>Dd</b> as CADASIL<br><b>or dd</b> as unaffected  | allow ecf if correct for student's gametes  | 1    |
|           | correct probability: 0.5 / $\frac{1}{2}$ / 1 in 2<br>/ 50% / 1 : 1  |   | 1    |
| 6(c)(i)   | stem cells can differentiate <b>or</b> are undifferentiated / unspecialised   |   | 1    |
|           | can form blood <u>vesse</u> l cells / brain cells<br><b>or</b><br>stem cells can divide   |   | 1    |

Question 6 continues on the next page . . .

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**Question 6 continued . . .**

| question     | answers   | extra information                                     | mark      |
|--------------|---|---|-----------|
| 6(c)(ii)     | ethical argument – eg no risk of damage to embryo <b>or</b> adult can give consent for removal of cells <b>or</b> adult can re-grow skin<br><br><b>or</b><br>if from a relative then less chance of rejection <b>or</b> if from self then no chance of rejection<br><br><b>or</b><br>skin cells more accessible | more ethical qualified<br>ignore religion unqualified | 1         |
| <b>Total</b> |   |   | <b>10</b> |

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**Question 7**

| question     | answers  | extra information                              | mark     |
|--------------|--|--|----------|
| <b>7(a)</b>  | organisms that can breed together  | accept converse points re. 2 different species | 1        |
|              | successfully   | accept produces fertile offspring              | 1        |
| <b>7(b)</b>  | any <b>two</b> from:<br>(live at)  |  | 2        |
|              | <ul style="list-style-type: none"> <li>• different pH of soil</li> <li>• different height above sea level</li> <li>• different flowering times</li> </ul>                                  |  |          |
|              | <b>AND</b><br>genetic variation / mutation / different alleles (produced in isolated populations)  |  | 1        |
|              | natural selection acts differently on the two populations<br><b>or</b> different characteristics in the two populations survive<br><b>or</b> different alleles passed on in the two groups |  | 1        |
|              | eventually resulting in interbreeding no longer possible   |  | 1        |
| <b>Total</b> |  |  | <b>7</b> |

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