



National
Qualifications
2015

2015 Biology

New Higher

Finalised Marking Instructions

© Scottish Qualifications Authority 2015

The information in this publication may be reproduced to support SQA qualifications only on a non-commercial basis. If it is to be used for any other purposes written permission must be obtained from SQA's NQ Assessment team.

Where the publication includes materials from sources other than SQA (secondary copyright), this material should only be reproduced for the purposes of examination or assessment. If it needs to be reproduced for any other purpose it is the centre's responsibility to obtain the necessary copyright clearance. SQA's NQ Assessment team may be able to direct you to the secondary sources.

These Marking Instructions have been prepared by Examination Teams for use by SQA Appointed Markers when marking External Course Assessments. This publication must not be reproduced for commercial or trade purposes.



General Marking Principles for Higher Biology

This information is provided to help you understand the general principles you must apply when marking candidate responses to questions in this paper. These principles must be read in conjunction with the detailed marking instructions, which identify the key features required in candidate responses.

- (a) Marks for each candidate response must always be assigned in line with these General Marking Principles and the Detailed Marking Instructions for this assessment.
- (b) Marking should always be positive. This means that, for each candidate response, marks are accumulated for the demonstration of relevant skills, knowledge and understanding: they are not deducted from a maximum on the basis of errors or omissions.
- (c) If a specific candidate response does not seem to be covered by either the principles or detailed Marking Instructions, and you are uncertain how to assess it, you must seek guidance from your Team Leader.
- (d) There are no half marks awarded.
- (e) Where a candidate makes an error at an early stage in a multi stage calculation, credit should normally be given for correct follow on working subsequent stages, unless the error significantly reduces the complexity of the remaining stages. The same principle should be applied in questions which require several stages of non-mathematical reasoning.
- (f) Unless a numerical question specifically requires evidence of working to be shown, full marks should be awarded for a correct final answer (including units) on its own.
- (g) Bulleted lists should not be used for extended response questions. Candidates must respond to the “command” word as appropriate and write extended answers in order to communicate fully their knowledge and understanding. Candidate responses in the form of bulleted lists may not be able to access the full range of available marks.
- (h) In the mark scheme, if a word is **underlined** then it is essential; if a word is **(bracketed)** then it is not essential.
- (i) In the mark scheme, words separated by / are **alternatives**.
- (j) If two answers are given that contradict one another the first answer should be taken. However, there are occasions where the second answer negates the first and no marks are given. There is no hard and fast rule here, and professional judgement must be applied.
- (k) Clear indication of understanding is what is required so:
 - if a description or explanation is asked for, a one word answer is not acceptable
 - if the question asks for **letters** and the candidate gives words and they are correct, then give the mark
 - if the question asks for a word to be **underlined** and the candidate circles the word, then give the mark
 - if the result of a calculation is in the space provided and not entered into a table and is clearly the answer, then give the mark
 - **chemical formulae** are acceptable eg CO₂, H₂O
 - contractions used in the Arrangements document eg DNA, ATP are acceptable
 - words not required in the syllabus can still be given credit if used appropriately eg metaphase of meiosis.

- (l) Incorrect **spelling** is given, sound out the word(s):
- if the term is recognisable then give the mark
 - if the term can easily be confused with another biological term then **do not** give the mark eg ureter and urethra
 - if the term is a mixture of other biological terms then **do not** give the mark, eg mellum, melebrum, amniosynthesis
- (m) **Presentation of data:**
- if a candidate provides two graphs or bar charts, in response to one question (eg one in the question and another at the end of the booklet), mark both and give the higher score
 - if a question asks for a particular type of graph/chart and the wrong type is given, then do not give the mark(s). Credit can be given for eg correctly labelling the axes, plotting the points, joining the points either with straight lines or curves (best fit rarely used), constructing the height of the bars
 - if the x and y data are transposed, then do not give the mark
 - if the graph used less than 50% of the axes, then do not give the mark
 - if 0 is plotted when no data is given, then do not give the mark (ie candidates should only plot the data given)
 - no distinction is made between bar charts and histograms for marking purposes. (For information: bar charts should be used to show discontinuous features, have descriptions of the x axis and have separate columns; histograms should be used to show continuous features, have ranges of numbers on the x axis and have continuous columns)
 - where data is read off a graph it is often good practice to allow for acceptable minor error. An answer may be 7.3 ± 0.3 .
- (n) Marks are awarded only for a valid response to the question asked. For example, in response to questions that ask candidate to:
- **identify, name, give or state**, they need only name or present in brief form;
 - **describe**, they must provide a statement or structure of characteristics and/or features;
 - **explain**, they must relate cause and effect and/or make relationships between things clear;
 - **compare**, they must demonstrate knowledge and understanding of the similarities and/or differences between things;
 - **calculate**, they must determine a number from given facts, figures or information;
 - **predict**, they must suggest what may happen based on available information;
 - **evaluate**, they must make a judgement based on criteria;
 - **suggest**, they must apply their knowledge and understanding of biology to a new situation. Marks will be awarded for any suggestions that are supported by knowledge and understanding of biology.

Detailed Marking Instructions for each question

Section 1

| Question | Answer | Mark |
|----------|--------|------|
| 1. | D | 1 |
| 2. | B | 1 |
| 3. | D | 1 |
| 4. | A | 1 |
| 5. | D | 1 |
| 6. | B | 1 |
| 7. | C | 1 |
| 8. | C | 1 |
| 9. | B | 1 |
| 10. | C | 1 |
| 11. | D | 1 |
| 12. | A | 1 |
| 13. | A | 1 |
| 14. | D | 1 |
| 15. | B | 1 |
| 16. | C | 1 |
| 17. | A | 1 |
| 18. | B | 1 |
| 19. | C | 1 |
| 20. | A | 1 |

Section 2

| Question | | | Expected Answer(s) | Max Mark | Additional Guidance |
|----------|-----|-------|--|----------|--|
| 1. | (a) | (i) | ADP + Pi/phosphate/inorganic phosphate Both required | 1 | NOT - P |
| | | (ii) | NAD | 1 | NOT - FAD |
| | | (iii) | It is a net/overall energy gain (following an energy investment at an earlier stage) OR More ATP/energy is produced/released than is used/invested (earlier/in stage1) | 1 | Quantification acceptable ie 2 ATP used but 4 ATP produced |
| | (b) | (i) | Increases the surface area for (action of) bacteria/ <i>Lactobacillus</i> OR Bursts cells to release more substrate/cell contents for bacterial action | 1 | |
| | | (ii) | Acidic conditions/low pH/change in pH/decreased pH/anaerobic conditions/low oxygen inhibits/kills/other/most bacteria OR pH/oxygen levels optimum for <i>Lactobacillus</i> but not for other/most bacteria | 1 | |

| Question | | Expected Answer(s) | Max Mark | Additional Guidance |
|----------|---------|--|----------|---|
| 2. | (a) | Same/complementary sticky ends OR Complementary/matching base sequence/bases | 1 | NOT - enzyme cuts in same place in plasmid and chromosome NOT - same bases/base sequence |
| | (b) | (DNA) ligase | 1 | |
| | (c) | In the presence of antibiotic only these/modified bacteria grow/survive OR Converse | 1 | NOT - modified plasmids survive in presence of antibiotic |
| | (d) | Origin of replication | 1 | |
| | (e) (i) | Lack of post-translational modifications OR It/protein/polypeptide is folded incorrectly | 1 | NOT - bacteria is a prokaryote and this is a eukaryote gene |
| | (ii) | Use yeast/put modified plasmid into yeast OR chemically modify protein | 1 | |

| Question | | | Expected Answer(s) | Max Mark | Additional Guidance |
|----------|-----|------|---|----------|--|
| 3. | (a) | (i) | lactose concentration/percentage | 1 | |
| | | (ii) | Temperature/concentration of yeast/pH | 1 | |
| | (b) | | As lactose increases (from 4%) to 16%, ethanol (concentration) increases 1 From 16% (to 20%) ethanol remains constant/levels off 1 As lactose (concentration) increases, ethanol (concentration) increases then levels off = 1 mark | 2 | Both variables must be named at least once to gain any marks Must mention 16% as change point (not 2.8 g/cm ³ ethanol) |
| | (c) | | 37.5 | 1 | NOT - 38 |
| | (d) | | Aerobic respiration does not produce ethanol OR Aerobic respiration produces water not ethanol OR No/less fermentation so less ethanol produced | 1 | |

| Question | | Expected Answer(s) | Max Mark | Additional Guidance |
|----------|-----|---|----------|--|
| 4. | (a) | 112 | 1 | |
| | (b) | 08:00-12:00 Time of lowest metabolic rate | 1 1 | 2 NOT - low metabolic rate |
| | (c) | Energy saved/conserved OR uses less energy OR energy not wasted | 1 | |
| | (d) | Dormancy OR Hibernation OR Aestivation OR A correct description of one of these terms | 1 | eg lungfish burrows into mud to escape drought |

| Question | | Expected Answer(s) | Max Mark | Additional Guidance |
|----------|---|--|----------------|---|
| 5. | A | 1. Amphibian heart has 2 atria and 1 ventricle | 1 | For full marks to be awarded candidates must give at least 1 correct point for bird and at least 1 for amphibian. |
| | | 2. Bird heart has 2 atria and 2 ventricles | 1 | |
| | | 3. Birds have a higher metabolic rate (or converse) | 1 | |
| | | 4. No mixing of oxygenated and deoxygenated blood in bird heart (or converse) | 1 | |
| | | 5. More efficient oxygen delivery to bird cells/ muscles/tissues (or converse) | 1 | |
| | | | (max 4) | |
| | B | 1. A competitive inhibitor binds to/blocks the active site | 1 | Allosteric site is acceptable as an alternative to not on the active site |
| | | 2. Competitive inhibition is reversed/reduced by increasing substrate concentration | 1 | |
| | | 3. Non-competitive inhibition is where a molecule binds to the enzyme not on the active site | 1 | |
| | | 4. Non-competitive inhibitor changes (the shape of) the active site | 1 | |
| | | 5. Non-competitive inhibition is irreversible/not affected by substrate concentration | 1 | |
| | | | (max 4) | |

| Question | | | Expected Answer(s) | Max Mark | Additional Guidance |
|----------|-----|------|---|----------|--|
| 6. | (a) | (i) | Enzyme X: RuBisCO 1 Substance Y: G3P/glyceraldehyde-3-phosphate 1 | 2 | |
| | | (ii) | Glucose: for respiration/ATP (production)/cellulose formation/starch formation/ other biosynthetic pathways/ processes 1 RuBP: for continuation of the cycle/to allow cycle to occur/ repeat 1 OR to make G3P/intermediate substances | 2 | Accept examples of biosynthetic pathways eg formation of fats/fatty acids/proteins/amino acids/glycerol/DNA/nucleic acid |
| | (b) | (i) | ATP: increases 1 NADPH: increases 1 | 2 | |
| | | (ii) | Procedure: randomisation of plots/treatments 1 Explanation: reduces/eliminates bias 1 OR Procedure: replication/number of replicates Explanation: to take account of variability/reduce the effect of atypical results OR Procedure: selection of treatments/inclusion of both GM and non GM crops Explanation: to make/ensure a (fair) comparison | 2 | |

| Question | | Expected Answer(s) | Max Mark | Additional Guidance |
|----------|-----|---|----------|---|
| 7. | (a) | Parasite/it/ <i>Schistosoma</i> gets energy/gets nutrients/benefits/gains AND host/human is harmed (by loss of resources) | 1 | |
| | (b) | Secondary host: (fresh water) snails 1 Benefit: allows development into free swimming parasite 1 OR allows them/immature parasites to complete life cycle | 2 | NOT - allow eggs to develop/parasites to mature |
| | (c) | Prevent urine/faeces/eggs from entering (fresh) water OR stop people entering the affected water OR control the population of fresh water snails OR medication given to kill the eggs/mature parasite/parasite in humans | 1 | |

| Question | | Expected Answer(s) | Max Mark | Additional Guidance |
|----------|-----|---|----------|---------------------|
| 8. | (a) | Biological (control) | 1 | |
| | (b) | Harlequin ladybird has spread (rapidly) AND native populations/ladybirds are decreasing (and may be eliminated) | 1 | |
| | (c) | May have alternative prey/food source/niche/resources OR Not competing with the Harlequin ladybird OR Less competition with other native species OR Not preyed upon by Harlequin ladybirds | 1 | |
| | (d) | Free from its usual predators/parasites/pathogens /disease/competitors | 1 | |

| Question | | | Expected Answer(s) | Max Mark | Additional Guidance |
|----------|-----|-------|---|------------|--|
| 9. | (a) | (i) | 1. From 0 - 60 kg per hectare increase from 3 - 8.4 tonnes per hectare 2. Remains at 8.4 between 60 and 80 3. Between 80 and 100 decreases from 8.4 - 7.9/7.8 | 2 | 1 mark for each correct response to a maximum of 2 marks Full units only needed once for both variables Differences acceptable eg increase of 5.4 tonnes per hectare from 3 Correct values for 2 statements but no units = 1 mark |
| | | (ii) | 208 - 216 | 1 | |
| | | (iii) | 840 | 1 | |
| | (b) | (i) | The use of 10/a large number of cattle (in each group) | 1 | NOT - calculate an average alone |
| | | (ii) | 0.6 | 1 | |
| | | (iii) | 20 Increasing the phosphate/fertiliser level increases the growth rate | 1 1 | |
| | (c) | | Energy lost at each level/stage of a food chain OR Energy lost at/between trophic level(s) | 1 | NOT - crop plants produce more food/energy per unit area than cattle |

| Question | | Expected Answer(s) | Max Mark | Additional Guidance |
|----------|-----|---|----------|---------------------------------|
| 10. | (a) | Horizontal Rapid | 1 1 | 2 |
| | (b) | Resistant survive (or converse) AND transfer/pass on the (antibiotic) resistance gene/allele to next generation OR transfer/pass on resistance gene vertically/horizontally | 1 1 | 2 |
| | (c) | (i) Growth/bacteria/MRSA/colonies would be present on all plates | 1 | |
| | | (ii) Vitamins/fatty acids/beef extract | 1 | NOT - glucose, amino acids, fat |

| Question | | Expected Answer(s) | Max Mark | Additional Guidance |
|----------|---------|---|----------|------------------------|
| 11. | (a) | 0.24 | 1 | |
| | (b) | 32 | 1 | |
| | (c) | Inclusive scale and axes labels copied exactly from table headings 1 Points plotted and joined with a ruler 1 | 2 | |
| | (d) | Only donor 2 is suitable OR donor 2 is most suitable | 1 | |
| | (e) (i) | TACTGTTTAGC | 1 | |
| | (ii) | Separates strands/splits up DNA strands/breaks H bonds between strands/denatures DNA/unzips DNA 1 Any temperature from 50 - 65 1 | 2 | NOT - splits DNA alone |

| Question | | Expected Answer(s) | Max Mark | Additional Guidance |
|----------|-----|---|----------|-------------------------------------|
| 12. | (a) | Increase in stroke volume/volume of blood pumped out of heart per heartbeat (in patients given the treatment) 1 No effect on heart rate (of patients given the treatment) 1 | 2 | |
| | (b) | 1190 | 1 | |
| | (c) | (i) Embryonic stem cells differentiate/develop into all/many types of cell AND adult/tissue stem cells differentiate/develop into less/narrower range of/limited cell types OR Adult stem cells are more differentiated/specialised than embryonic stem cells | 1 | |
| | | (ii) They express/switch on the genes characteristic of that type of cell OR Certain genes/some genes are expressed/switched on (and other genes are switched off) | 1 | NOT - genes are switched on and off |
| | (d) | Provide information on gene regulation/cell growth/cell differentiation/cell division/cell ageing/disease development OR Use as model cells to study how diseases develop OR For drug testing | 1 | |

| Question | | | Expected Answer(s) | Max Mark | Additional Guidance |
|--|---|-----|--|----------|---------------------|
| 13. | A | (i) | 1. RNA polymerase unzips/ unwinds DNA or separates DNA into two strands | 1 | |
| | | | 2. Hydrogen bonds between strands/base pairs break | 1 | |
| | | | 3. RNA polymerase aligns/brings in/joins/attaches RNA nucleotides with their complementary nucleotides/bases on DNA (template) | 1 | |
| | | | OR | | |
| | | | A to U and T to A and C to G in diagram | | |
| | | | 4. a primary transcript is produced | 1 | |
| | | | 5. exons are coding and introns are non-coding (regions of the primary transcript) | 1 | |
| 6. introns/non-coding regions are removed OR exons/coding regions are retained | 1 | | | | |
| 7. exons are spliced/joined together to form mature mRNA)/transcript | 1 | | | | |

| Question | | Expected Answer(s) | Max Mark | Additional Guidance |
|----------|------|---|----------------|---------------------|
| | (ii) | a. tRNA has an anticodon and an amino acid attachment site | 1 | |
| | | b. tRNA binds/joins to/carries/collects specific/correct amino acid | 1 | |
| | | c. tRNA carries (specific) amino acid to ribosomes | 1 | |
| | | d. anticodons are complementary/pair with codons on mRNA | 1 | |
| | | e. there are start and stop codons | 1 | |
| | | f. peptide bonds form between amino acids | 1 | |
| | | OR | | |
| | | a polypeptide forms | | |
| | | | (max 4) | |

| Question | | Expected Answer(s) | Max Mark | Additional Guidance | |
|----------|----------|--------------------|--|---------------------|---|
| | B | (i) | 1. (single gene) mutations are random changes in DNA sequences/genes/alleles/the genome | 1 | When describing mutations acceptable terms are one/two/three/a few base(s)/base pair(s)/nucleotide(s) - not a sequence of bases |
| | | | 2. single gene mutation name AND description substitution - base/base pair/nucleotide is replaced/substituted by another insertion - base/base pair/nucleotide is added/inserted deletion - base/base pair/nucleotide is removed/deleted | 1 | |
| | | | 3. another single gene mutation name AND description | 1 | |
| | | | 4. If 2 or 3 not awarded - all 3 mutation names | 1 | |
| | | | 5. Insertion/deletion results in a frameshift mutation/expansion of a nucleic acid sequence | 1 | |
| | | | 6. (single nucleotide) substitutions include missense, nonsense and splice site mutations | 1 | |
| | | | 7. splice site mutations can alter the mature mRNA OR result in exon removal OR result in introns remaining present | 1 | |
| | | | (max 4) | | |

| Question | | Expected Answer(s) | Max Mark | Additional Guidance |
|----------|------|---|----------|--------------------------------------|
| | (ii) | a. chromosome mutation can involve changes to chromosome number/structure | 1 | |
| | | b. chromosome mutation name AND description; Translocation: genes/sections of chromosome from one chromosome become attached to another chromosome Deletion: genes/sections of chromosome deleted from chromosome Inversion: genes/sections of chromosome/rotate through 180°/flipped Duplication: genes/sections of chromosome/pieces of chromosome are duplicated/repeated | 1 | |
| | | c. another chromosome mutation name AND description | 1 | |
| | | d. If b or c not awarded - all 4 names but no descriptions | 1 | |
| | | e. polyploidy results from errors during the separation of chromosomes/non-disjunction/spindle failure during cell division/meiosis/mitosis/gamete formation | 1 | NOT - more than 1 set of chromosomes |
| | | f. polyploidy is the possession of complete extra sets/double/triple the number of chromosomes OR a whole genome duplication OR 2n becomes 3n | 1 | |
| | | g. polyploidy is important in evolution of food crops OR duplication provides material upon which natural selection can work/is important in evolution | 1 | |
| | | h. polyploid crops/plants/named example show desirable features/higher yields/other appropriate examples of desirable features | 1 | |
| | | | (max 5) | |

[END OF MARKING INSTRUCTIONS]