AQA

# A-level BIOLOGY (7402/1)

Paper 1

**Mark scheme**

Mark schemes are prepared by the Lead Assessment Writer 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 associates 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 associate understands and applies it in the same correct way. As preparation for standardisation each associate 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, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

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.

Further copies of this mark scheme are available from aqa.org.uk

# Mark scheme instructions 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 in the 'Comments' column 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. Emboldening

**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 emboldened. 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 the same 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 errors / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (often prefaced by 'Ignore' in the 'Comments' column of the mark scheme) are not penalised.

## 3.2 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 usually be gained by correct substitution / working and this is shown in the 'Comments' column or by each stage of a longer calculation.

## 3.3 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.

## 3.4 Errors carried forward, consequential marking and arithmetic errors

Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation ECF or consequential in the mark scheme.

An arithmetic error should be penalised for one mark only unless otherwise amplified in the mark scheme. Arithmetic errors may arise from a slip in a calculation or from an incorrect transfer of a numerical value from data given in a question.

## 3.5 Phonetic spelling

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

## 3.6 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.

## 3.7 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.

| Question | Marking Guidance | Mark | Comments |
|---|---|---|---|
| 01.1 | Any **two** of the following;<br>Concentration of enzyme<br>Volume of substrate solution<br>pH | 1 | Allow same concentration of substrate |
| 01.2 | Ratio between 4:1 and 5:1;; | 2 | Initial rates incorrect but correctly used = 1 mark |
| 01.3 | At 60 °C:<br>1. More kinetic energy;<br>2. More E–S complexes formed; | 2 | Allow converse for 37 °C |
| 01.4 | Different times:<br>1. Higher temperature / 60 °C causes denaturation of all of enzyme;<br>2. Reaction stops (sooner) because shape of active site changed;<br>Different concentrations of product (at 60 °C)<br>3. Substrate still available (when enzyme denatured);<br>4. But not converted to product; | 4 | Accept converse for 37 °C<br>2. Reject if active site on substrate |

| Question | Marking Guidance | Mark | Comments |
|---|---|---|---|
| 02.1 | 1. Trachea and bronchi and bronchioles;<br>2. Down pressure gradient;<br>3. Down diffusion gradient;<br>4. Across alveolar epithelium;<br>5. Across capillary endothelium/epithelium; | 4 max | 4. Capillary wall neutral |
| 02.2 | (About) 80.0%; | 1 | |
| 02.3 | 1. (Group **B** because) breathe out as quickly as healthy / have similar FEV to group **A**;<br>2. So bronchioles not affected;<br>3. FVC reduced / total volume breathed out reduced; | 3 | 3. Allow this marking point for group **C** |

| Question | Marking Guidance | Mark | Comments |
|---|---|---|---|
| 03.1 | Species richness measures only number of (different) species / does not measure number of individuals; | 1 | |
| 03.2 | Trees vary in height; | 1 | |
| 03.3 | 1. Index for canopy is 3.73;<br>2. Index for understorey is 3.30;<br>3. Index in canopy is 1.13 times bigger; | 3 | If either or both indices incorrect, allow correct calculation from student's values |
| 03.4 | 1. For *Zaretis itys*, difference in distribution is probably due to chance / probability of being due to chance is more than 5%;<br>2. For all species other than *Zaretis itys,* difference in distribution is (highly) unlikely to be due to chance;<br>3. Because $P < 0.001$ which is highly significant/is much lower than 5%; | 3 | |

| Question | Marking Guidance | Mark | Comments |
|---|---|---|---|
| 04.1 | 1. Starch formed from α-glucose but cellulose formed from β-glucose;<br>2. Position of hydrogen and hydroxyl groups on carbon atom 1 inverted; | 2 | |
| 04.2 | 1. Insoluble;<br>2. Don't affect water potential;<br>***OR***<br>3. Helical;<br>4. Compact;<br>***OR***<br>5. Large molecule;<br>6. Cannot leave cell; | 2 | 3. Accept form spirals |
| 04.3 | 1. Long and straight chains;<br>2. Become linked together by many hydrogen bonds to form fibrils;<br>3. Provide strength (to cell wall); | 3 | |

| Question | Marking Guidance | Mark | Comments |
|---|---|---|---|
| 05.1 | 1. Facilitated diffusion involves channel or carrier proteins whereas active transport only involves carrier proteins;<br>2. Facilitated diffusion does not use ATP / is passive whereas active transport uses ATP;<br>3. Facilitated diffusion takes place down a concentration gradient whereas active transport can occur against a concentration gradient; | 3 | Since 'contrast', both sides of the differences needed |
| 05.2 | 3.3:1; | 2 | Correct answer = 2 marks<br>If incorrect, allow 1 mark for 470–360/60 for rate in second hour |
| 05.3 | 1. Group **A** – initial uptake slower because by diffusion (only);<br>2. Group **A** – levels off because same concentrations inside cells and outside cells / reached equilibrium;<br>3. Group **B** – uptake faster because by diffusion plus active transport;<br>4. Group **B** fails to level off because uptake against gradient/no equilibrium to be reached;<br>5. Group **B** – rate slows because few/fewer chloride ions in external solution/respiratory substrate used up; | 4 max | |

| Question | Marking Guidance | Mark | Comments |
|---|---|---|---|
| 06.1 | 1. Kingdom, Phylum, Class, Order, Family;<br>2. *Luscinia svecica*; | 2 | 1 mark for each correct column<br>Allow Genus and Species if both placed in box for species but not if both placed in genus box |
| 06.2 | Number of different alleles of each gene; | 1 | Accept number of different base sequences (found) in each gene |
| 06.3 | 1. Has greater proportion of genes / percentage of genes showing diversity;<br>2. Percentage is 35% compared with 28% / proportion is 0.35 compared with 0.28; | 2 | Allow correct figures that are not rounded up, i.e., 34.9%/0.349 and 27.8% / 0.278 |

| Question | Marking Guidance | Mark | Comments |
|---|---|---|---|
| 07.1 | (To diagnose AIDS, need to look for/at)<br>1. (AIDS-related) symptoms;<br>2. Number of helper T cells; | 2 | Neutral: 'only detects HIV antibodies' as given in the question stem |
| 07.2 | 1. HIV antibody is not present;<br>2. (So) second antibody/enzyme will not bind/is not present; | 2 | 1. Accept HIV antibodies will not bind (to antigen) |
| 07.3 | 1. Children receive (HIV) antibodies from their mothers/maternal antibodies;<br>2. (So) solution will always turn blue/will always test positive (before 18 months); | 2 | Allow 1 mark for the suggestion that the child does not produce antibodies yet so test may be negative |
| 07.4 | (Shows that)<br>1. Only the enzyme/nothing else is causing a colour change;<br>2. Washing is effective/all unbound antibody is washed away; | 2 | |

<table>
<tr><th>Question</th><th>Marking Guidance</th><th>Mark</th><th>Comments</th></tr>
<tr><td>08.1</td><td>Box around single nucleotide;</td><td>1</td><td></td></tr>
<tr><td>08.2</td><td>
<table>
<tr><th rowspan="2">DNA strand</th><th colspan="4">Percentage of each base</th></tr>
<tr><th>A</th><th>C</th><th>G</th><th>T</th></tr>
<tr><td>Strand 1</td><td>(16)</td><td>34</td><td>21</td><td>29</td></tr>
<tr><td>Strand 2</td><td>29</td><td>(21)</td><td>(34)</td><td>16</td></tr>
</table>
2 rows correct = 2 marks;<br>1 row correct = 1 mark;</td><td>2</td><td></td></tr>
<tr><td>08.3</td><td>1. Reference to DNA polymerase;<br>2. (Which is) specific;<br>3. Only complementary with/binds to 5’ end (of strand);<br>4. Only complementary with/binds with phosphate end (of the developing strand);</td><td>4</td><td>3. Reject hydrogen bonds/base pairing<br>4. Allow 3' end (of developing strand)</td></tr>
</table>

| Question | Marking Guidance | Mark | Comments |
|---|---|---|---|
| 09.1 | 1. In source/leaf sugars actively transported into phloem;<br>2. By companion cells;<br>3. Lowers water potential of sieve cell/tube and water enters by osmosis;<br>4. Increase in pressure causes mass movement (towards sink/root);<br>5. Sugars used/converted in root for respiration for storage; | 4 max | 5. Accept starch |
| 09.2 | Respiration; | 1 | |
| 09.3 | 1. (About) 30 hours;<br>2. Time between peak $^{14}C$ at top of trunk and bottom; | 2 | |
| 09.4 | Length of trunk (between top and bottom); | 1 | |

<table>
<tr><th>Question</th><th>Marking Guidance</th><th>Mark</th><th>Comments</th></tr>
<tr><td>10.1</td><td>(D)CBEA;</td><td>1</td><td></td></tr>
<tr><td>10.2</td><td><table><tr><th>Step</th><th>Reason</th></tr><tr><td>(Taking cells from the root tip)</td><td>Region where mitosis/cell division occurs;</td></tr><tr><td>(Firmly squashing the root tip)</td><td>To allow light through / make tissue layer thin;</td></tr></table></td><td>2</td><td></td></tr>
<tr><td>10.3</td><td>(Increase)<br>1. Chromosomes/DNA replicates;<br>(First decrease)<br>2. Homologous chromosomes separate;<br>(Second decrease)<br>3. Sister chromatids separate;</td><td>3</td><td></td></tr>
<tr><td>10.4</td><td>1. (DNA would) double/go to 2 (arbitrary units);</td><td>1</td><td></td></tr>
</table>

| Question | Marking Guidance | Mark | Comments |
|---|---|---|---|
| 11.1 | 1. Helicase;<br>2. Breaks hydrogen bonds;<br>3. Only one DNA strand acts as template;<br>4. RNA nucleotides attracted to exposed bases;<br>5. (Attraction) according to base pairing rule;<br>6. RNA polymerase joins (RNA) nucleotides together;<br>7. Pre-mRNA spliced to remove introns; | 6 max | |
| 11.2 | 1. Polymer of amino acids;<br>2. Joined by peptide bonds;<br>3. Formed by condensation;<br>4. Primary structure is order of amino acids;<br>5. Secondary structure is folding of polypeptide chain due to hydrogen bonding;<br>6. Tertiary structure is 3-D folding due to hydrogen bonding and ionic/disulfide bonds;<br>7. Quaternary structure is two or more polypeptide chains; | 5 max | 5. Accept alpha helix/pleated sheet |
| 11.3 | 1. Hydrolysis of peptide bonds;<br>2. Endopeptidases break polypeptides into smaller peptide chains;<br>3. Exopeptidases remove terminal amino acids;<br>4. Dipeptidases hydrolyse/break down dipeptides into amino acids; | 4 | |





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