# A-LEVEL
# Biology

Paper 1
Mark scheme

7402/1
Specimen Paper (set 2)

Version 1.3

**Keep secure**

Please be aware that centres may want to use these specimen papers as mock exams for their students. Help us to maintain the security of these papers by ensuring they are not distributed on social media or other platforms.

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

**Important - please note**

This mark scheme has not been through the full standardisation process. As such, many of the phases described above have not been completed. The Instructions for examiners are also included as a guide to how the mark scheme will function as an operational document. The layout has been kept consistent so that future operational mark schemes do not appear different from the specimen materials.

# 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

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.

A bold **and** is used to indicate that both parts of the answer are required to award the mark.

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 | A = $\beta$ glucose;<br>B = Adenosine triphosphate; | 2 | B: do not accept ATP |
| 01.2 | 1. Saturated;<br>2. Fatty acid; | 1<br>1 | |
| 01.3 | 1. Peptide bond shown correctly;<br>2. Rest of dipeptide structure shown correctly; | 2 | |
| 01.4 | Water; | 1 | |

| Question | Marking Guidance | Mark | Comments |
|---|---|---|---|
| 02.1 | Electron microscope has higher resolution (than optical microscope); | 1 | |
| 02.2 | Cytoplasm of red blood cell filled with haemoglobin; | 1 | |
| 02.3 | 1. Membrane has phospholipid bilayer;<br>2. Stain binds to phosphate/glycerol;<br>3. On inside <u>and</u> outside of membrane; | 3 | 2. Accept phospholipid head/protein |
| 02.4 | 1. Carrier/channel protein;<br>2. (Protein) specific/complementary to substance;<br>3. Substance moves down concentration gradient; | 3 | 3. Allow down electrochemical gradient<br>3. Reject 'along' concentration gradient |

| Question | Marking Guidance | Mark | Comments |
|---|---|---|---|
| 03.1 | Phylum; | 1 | |
| 03.2 | **M** placed correctly between zygote and zygospore; | 1 | |
| 03.3 | Any valid reasons, eg<br>**Asexual**<br>Fewer stages so quicker<br>OR<br>Only one parent involved so can colonise new environment<br>OR<br>Produces clone so successful (geno/pheno)type maintained;<br>**Sexual**<br>increases genetic diversity so greater chance of survival/success; | 2 | |
| 03.4 | Spores spread/dispersed further; | 1 | |
| 03.5 | 1. Measure diameter of large number of spores;<br>2. Divide measured values by 700 (to find true diameter);<br>3. Reference to using volume of sphere; | 3 | |

| Question | Marking Guidance | Mark | Comments |
|---|---|---|---|
| 04.1 | 1. Increases because more enzyme-substrate complexes formed;<br>2. Levels off because all enzyme molecules involved in enzyme-substrate complexes (at a given time)<br>OR<br>Levels off because no free active sites (at a given time)<br>OR<br>Levels off because enzyme (concentration) is limiting factor; | 2 | 1. Neutral; more collisions<br>1. and 2. Accept ES<br>2. Reject enzymes are used up |
| 04.2 | 1. Competitive inhibitor binds to active sites of enzyme but non-competitive inhibitor binds at allosteric site/away from active site;<br>*2.* (Binding of) competitive inhibitor does not cause change in shape of active site but (binding of) non-competitive does (cause change in size of active site);<br>3. So with competitive inhibitor, at high substrate concentrations (active) enzyme still available but with non-competitive inhibitor (active) enzymes no longer available;<br>4. At higher substrate concentrations likelihood of enzyme-substrate collisions increases with competitive inhibitor but this is not possible with non-competitive inhibitor; | 4 | |
| 04.3 | Reaction with non-competitive inhibitor has the same value of $K_m$ as with no inhibitor / value is 5 (g $dm^{-3}$) / reaction with competitive inhibitor has higher $K_m$ value than with no inhibitor / value is 7 (g $dm^{-3}$); | 1 | |

| Question | Marking Guidance | Mark | Comments |
|---|---|---|---|
| 05.1 | Any **two** valid reasons;<br>eg<br>1. Increase in plant diversity leads to more types of food for animals;<br>2. Increase in variety of animals leads to increase in predator species;<br>3. Increase in niche/habitat; | 2 max | |
| 05.2 | 1. Repeat soil sorting for different times and record number of species collected;<br>2. Find optimum time / time beyond which further sorting does not lead to increase in animal species found; | 2 | |
| 05.3 | 1. No data on number of individuals in each species / diversity index = $\frac{N\,(N-1)}{\sum n\,(n-1)}$ | 1 | |
| 05.4 | Principle:<br>1. Overlap of 2 × SD shows probability of differences (in means) being due to chance is greater than 0.95;<br>**Agree**:<br>2. No difference in number of earthworms and millipedes (per $m^2$);<br>3. No difference in number of species of centipedes or millipedes;<br>**Disagree**:<br>4. More beetles and woodlice in grassy strips;<br>5. More species of beetles, earthworms, woodlice in grassy strips; | 4 max | Allow converse of MP1<br>Credit MP1 wherever it appears |

| Question | Marking Guidance | Mark | Comments |
|---|---|---|---|
| 06.1 | 2 to 11; | 1 | |
| 06.2 | ± 2.0;<br>Data show great variation (around mean)<br>OR<br>4.4 ± 2 × SD includes most of the values measured; | 2 | |
| 06.3 | 1. Shows a positive correlation;<br>2. There probability of getting this correlation by chance is less than 0.0001;<br>3. Correlation is highly significant; | 3 | 2. Allow less than 0.01%<br>3. Reject 'results' are significant/not due to chance |
| 06.4 | 1. Little digestion of starch by salivary amylase<br>OR<br>starch in mouth for a short period<br>OR<br>salivary amylase inactivated by stomach acid;<br>2. Amylase also secreted by pancreas;<br>3. So (most) starch digestion occurs in small intestine; | 3 | |

| Question | Marking Guidance | Mark | Comments |
|---|---|---|---|
| 07.1 | 1. Hydrogen bonds between the base pairs holds two strands together;<br>2. Many hydrogen bonds provides strength; | 2 | 2. Reject strong hydrogen bonds |
| 07.2 | (Because) ribosomes assemble polypeptides using mRNA code<br>OR<br>DNA has two strands each with a different (complementary) base sequence; | 1 | |
| 07.3 | Codon; | 1 | |
| 07.4 | 1. (Because) some amino acids have more than one codon/mRNA code;<br>2. Correct example from table; | 2 | |
| 07.5 | 1. Stop translation;<br>2. Result in detachment of polypeptide chain from ribosome; | 2 | |
| 07.6 | CAC ATG ACC<br>Val Tyr Trp | 2 | Mark each row |

| Question | Marking Guidance | Mark | Comments |
|---|---|---|---|
| 08.1 | (Molecule contains) more than one polypeptide (chain); | 1 | Accept: has four polypeptides |
| 08.2 | $\frac{\text{oxygenated haemoglobin}}{\text{maximum saturation}} \times 100$ | 1 | |
| 08.3 | 1. At low partial pressure of oxygen, little increase in saturation as oxygen increases;<br>2. (then) rapid rise as it gets easier for oxygen to bind; | 2 | Accept use of appropriate numbers from graph |
| 08.4 | Ensures rapid/more intake of oxygen in lungs/release of oxygen in tissues; | 1 | |
| 08.5 | Volume of blood leaving heart = (0.6 x 0.6) $dm^3$ $minute^{-1}$ = 3.6 $dm^3$ $minute^{-1}$<br>Mass of haemoglobin in this volume of blood = (3.6 x 150) g = 540 g<br>Volume of oxygen at 100% saturation of this haemoglobin = (540 x 1.35) =729 $cm^3$<br>Figure 8 shows 60% of this volume of oxygen has been released to the tissues, so final answer is (729 x 0.6) = 437.4 $cm^3$ $minute^{-1}$ | 3 | |

| Question | Marking Guidance | Mark | Comments |
|---|---|---|---|
| 09.1 | 1. Sand: to ensure no boron provided;<br>2. Dark: to ensure no sucrose produced in leaves / produced by photosynthesis; | 2 | |
| 09.2 | 1. Evaporates all water<br>2. (But) does not burn (organic compounds); | 2 | |
| 09.3 | Yes because in the presence of boron<br>1. Uptake of sucrose greater;<br>2. Transport to other parts of plant greater;<br>3. Correct use of data that supports MP1 or MP2;<br>No because:<br>4. No evidence that boron reacts with sucrose/that a sucrose-borate complex is formed; | 4 | |
| 09.4 | 1. Take thin (horizontal) sections of plant tissue/stem;<br>2. Place against photographic film in dark for several hours / carry out autoradiography; | 2 | |

| Question | Marking Guidance | Mark | Comments |
|---|---|---|---|
| 10.1 | 1. Antigen/epitope on surface of *N. meninigitidis* / bacterium binds to surface protein / surface receptor on a (specific/single) B cell;<br>2. (Activated) B cell divides by mitosis / produces clone;<br>3. (Division) stimulated by cytokines / by T cells;<br>4. B cells/plasma cells release antibodies;<br>5. (Some) B cells become memory cells;<br>6. Memory cells produce plasma / antibodies faster; | 6 | If answered in context of T cell, allow:<br>1. Antigen binds to (specific/single) T cell;<br>2. (Activated) T cell releases cytokine;<br>3. (Cytokine) stimulates production of plasma cells; |
| 10.2 | 1. Mutation;<br>2. Results in Nm cell with allele for resistance to <u>one</u> antibiotic/to named antibiotic;<br>3. (This) cell survives <u>and</u> passes the allele for resistance to offspring;<br>4. Process repeated with different genes conferring resistance to each of the other (two) antibiotics; | 4 | 1. Allow horizontal gene transfer<br>2. and 3. If gene for resistance, penalise once<br>If reference made to 'resistant gene', 2 max for MP2, 3 and 4 |
| 10.3 | Any **five** contrasting statements, eg<br>1. Bacterial cell is <u>much</u> smaller than a human cell;<br>2. Bacterial cell has a cell wall but human cell does not;<br>3. Bacterial cell lacks a nucleus but human cell has a nucleus;<br>4. Bacterial cell lacks <u>membrane-bound</u> organelles but human cell has membrane-bound organelles;<br>5. Bacterial ribosomes smaller than human ribosomes / bacteria have 70S ribosomes whereas humans have 80S ribosomes;<br>6. Bacterial DNA is circular but human DNA is linear;<br>7. Bacterial DNA is 'naked' whereas human DNA is bound to histones/proteins; | 5 max | Since contrast is required, both parts of each statement must be present to gain the mark.<br>4. Accept any named membrane-bound organelle |