SPECIMEN MATERIAL v1.0

A-LEVEL
Biology
Paper 2
Mark scheme

7402/2
Specimen Paper (set 2)

Version 1.0

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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.

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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	C = M line/M disc/myosin filament D = mitochondrion E = myofibril	3	
01.2	Sarcomere;	1	
01.3	Answer in range 1.14–1.18;	1	
01.4	1. As a store of glucose OR To be hydrolysed to glucose; 2. For respiration/to provide ATP;	2	1. Ignore provide energy
01.5	1. Low pH changes shape of calcium ion receptors 2. Fewer calcium ions bind to tropomyosin 3. Fewer tropomyosin molecules move away; 4. Fewer binding sites on actin revealed; 5. Fewer cross-bridges can form OR Fewer myosin heads can bind;	3 max	1. Do not accept tropomyosin does not move 2. Accept troponin Must include idea of fewer at least once

Question	Marking Guidance	Mark	Comments
02.1	Only 3 neurones/nerve cells (in reflex arc)	1	
02.2	1. Rapid; 2. Protect against damage to body tissues; 3. Do not have to be learnt; 4. Help escape from predators; 5. Enable homeostatic control;	2 max	
02.3	1. Neurotransmitter only made in/stored in/released from pre-synaptic neurone; 2. (Neuro)receptors only on the post-synaptic membrane;	2	
02.4	1. Axon **P** is myelinated; 2. So shows saltatory conduction/impulses jump between nodes of Ranvier OR 3. Axon **P** has a larger diameter; 4. So less resistance to flow of ions;	2	Mark as 1 & 2 OR 3 & 4

Question	Marking Guidance	Mark	Comments
03.1	7.7(%);	1	
03.2	1. No error bars/SD; 2. To show if overlap occurs so difference (in means) is not significant/due to chance OR To show if no overlap occurs so difference (in means) is significant/is not due to chance;	2	Do not accept 'no statistical test performed' as Chi squared/Spearman's rank would be inappropriate. Ignore references to sample size as it can be assumed that scientists completed the study using appropriate methodology.
03.3	1. Reduced transfer of protons across thylakoid membrane OR Reduced chemiosomotic gradient/proton gradient across thylakoid membrane; 2. (So) less ATP produced; 3. (So) less reduced NADP produced; 4. (So) light-independent reaction slows/stops OR Less reduction of GP to triose phosphate;	4	3. Accept NADPH /$NADPH_2$/$NADPH^+$ 3. Reject reduced NAD
03.4	Idea that energy is released from high energy/excited electron/s (that were lost from chlorophyll);	1	

Question	Marking Guidance	Mark	Comments
04.1	Water is also reabsorbed;	1	
04.2	1. Concentration rises in descending limb because sodium ions enter and water lost; 2. Concentration falls in ascending limb because sodium ions (and chloride) ions actively removed; 3. But water remains (in ascending limb) because its walls are impermeable (to water);	3	
04.3	1. Concentration rises in collecting duct because it loses water by osmosis; 2. ADH increases permeability (of walls of collecting duct) to water;	2	

<table>
<tr><th>Question</th><th>Marking Guidance</th><th>Mark</th><th>Comments</th></tr>
<tr><td>05.1</td><td>1. Heritable changes in gene function;
2. Without changes to the base sequence of DNA;</td><td>2</td><td></td></tr>
<tr><td>05.2</td><td><table><tr><th>Control element</th><th>Binds with DNA</th><th>Binds with protein</th></tr><tr><td>Oestrogen</td><td></td><td>✓</td></tr><tr><td>Methyl groups</td><td>✓</td><td></td></tr><tr><td>Acetyl groups</td><td></td><td>✓</td></tr></table>;;</td><td>2</td><td>1 mark for each correct column.

Accept both boxes ticked in oestrogen row.</td></tr>
<tr><td>05.3</td><td>1. Methyl groups (could be) added to (both copies of) a tumour suppressor gene;
2. The transcription of tumour suppressor genes is inhibited;
3. Leading to uncontrolled cell division;</td><td>3</td><td></td></tr>
<tr><td>05.4</td><td>Cells of benign tumours cannot spread to other parts of the body/metastasise
OR
Cells of benign tumours cannot invade neighbouring tissues;</td><td>1</td><td>Accept answers clearly in the context of malignant tumours</td></tr>
</table>

Question	Marking Guidance	Mark	Comments
06.1	1. (Overall, data show an) increase in species richness/increase in species diversity/increase in total number of living organisms; 2. *Baetis quilleri* and/or *Pentaneurini guttipennis* are pioneers; 3. (Pioneers cause) named change of environment eg provide food for other species; 4. New species/example from data colonise once there is a change; 5. *Baetis quilleri/Pentaneurini guttipennis/Helicopsyche mexicana* decline/outcompeted/eaten as succession continues;	5	
06.2	Correct answer 5.5 = 2 marks;; Allow 1 mark for correct calculation of mean population growth rate per day for each species, ie: *Cryptolabis paradoxa* = 3.226 *Leptohyphes packeri* = 0.585	2	
06.3	1. Same species present (over long time) / stable community (over long time); 2. Abiotic factors (more or less) constant (over time); 3. Populations stable (around carrying capacity);	2 max	

Question	Marking Guidance	Mark	Comments
07.1	1. Human DNA/human gene/*HGH* gene contains introns OR Methods 2 and 3 produce DNA/*HGH* without introns; 2. *E. coli* cannot remove introns/cannot splice mRNA/cannot splice pre-mRNA;	2	
07.2	Faster to use gene machine than all the enzyme-catalysed reactions (involving reverse transcriptase);	1	Accept extra step/more steps involved in isolating mRNA
07.3	1. Cut the plasmid with a restriction endonuclease; 2. (So that) both have complementary/sticky ends; 3. (Mix together) and add ligase to join the complementary/sticky ends;	3	1. Allow 'add base sequences to blunt ends of plasmid and *HGH* gene'
07.4	1. Can quickly identify transformed bacteria using UV light;	1	
07.5	1. Arabinose alters structure of araC protein/reduces effect of araC protein; 2. So stops/reduces inhibition of promoter gene and GFP gene is transcribed; OR So stops/reduces inhibition of promoter gene and GFP is produced;	2	

Question	Marking Guidance	Mark	Comments
08.1	1. Kinesis; 2. Movement is random/non-directional OR Insect is not moving towards a particular stimulus;	2	1. Ignore any prefix
08.2	1. Less respiration so less gas exchange; 2. (So) spiracles open less so less water loss;	2	
08.3	Taxis;	1	Ignore any prefix
08.4	No (no mark), the insect does not move in circles; Shows kinesis / results similar to **Figure 6;**	2	
08.5	**For (max 1)** 1. The data show a positive correlation; 2. Large sample/number of insects so valid/reliable/representative; **Against (max 1)** 3. (however) there are overlaps in individual experiments at all humidities; 4. 70–90% humidity there is little/no change in movement/movement only increases after 76% humidity;	2 max	1. Must state this as the description is given in the stem. 4. Accept any value in this range

Question	Marking Guidance	Mark	Comments
09.1	1. Bb / suitable equivalent; 2. Both parents have bar eyes, but have some offspring with round eyes, so parents must be carriers of recessive allele for round eyes;	2	1. Reject sex linkage or superscripts
09.2	3:1;	1	
09.3	1. Fertilisation is random OR Fusion of gametes is random; 2. Small/not large population/sample; 3. Selection advantage/disadvantage/lethal alleles;	2 max	
09.4	χ^2/chi squared;	1	
09.5	Both alleles expressed in the phenotype (if both are present);	1	
09.6	0.25;	1	
09.7	304;;	2	Award 1 mark for answers which show understanding that 2pq represents heterozygous

Question	Marking Guidance	Mark	Comments
10.1	1. (Required to) make ATP/glucose phosphate, so less respiration/less energy for growth; 2. (Required to) make nucleotides, so less DNA/mRNA/tRNA for cell division/production of protein (for growth); 3. (Required to) make RuBP/NADP, so less CO_2 fixed/reduced into sugar; 4. (Required to) make phospholipids for membranes;	2 max	
10.2	1. Hydrolyse; 2. murein/glycoprotein (in cell wall);	2	1. Accept digest
10.3	1. Bind to receptor (on target plant); 2. Acts as/leads to production of a transcription factor; 3. (Which) binds to promoter OR stimulates transcription of genes OR production of mRNA (for defensive enzymes);	3	
10.4	1. Direct plant-to-plant transmission; 2. (So) localised response OR faster response OR no dilution of signal protein;	2	
10.5	0.278;;	2	Accept 1 mark for 1001.7 or $\frac{x - 450}{450} \times 100$ = 122.6

10.6	Should not use: 1. Fertilisers prevent development of mycorrhizae; 2. Mycorrhizae help plants to defend themselves (causing an increase in crop yield); 3. Mycorrhizae help plants to take up nitrates/phosphates (causing an increase in crop yield); Should use: 4. Fertilisers containing phosphate and nitrate increase gross primary production so increase yield; 5. Most soil is poor in phosphate so without fertiliser (tomato) plant might not get enough phosphate;	4 max	