

**INTERNATIONAL A-LEVEL  
BIOLOGY (9610)**

**BL04**

Unit 4 Control

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Mark scheme

June 2025

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2 5 6 X B L 0 4 / M S

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 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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# Mark scheme instructions to examiners

## 1. General

The mark scheme for each question shows:

- the marks available for each part of 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.

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
01.3	1. Changes secondary/tertiary structure (of insulin); 2. Change in named bond(s); 3. No longer complementary (to receptor);	3	1. Do not allow change in structure of receptor 1. Allow 3D shape for tertiary structure 1. Allow changes the quaternary structure of insulin 2. Do not allow peptide bonds 3. Do not allow active site or any reference to enzyme or substrate 3. Allow descriptions of complementary 3. Allow can no longer fit (into receptor)

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Question	Marking guidance	Mark	Comments
02.1	<p>1. (Sodium/potassium ions) cannot move through (phospho)lipid bilayer/membrane;</p> <p>2. As they are water soluble <b>OR</b> they are not lipid soluble <b>OR</b> they are charged/polar <b>OR</b> they are hydrophilic;</p>	2	

Question	Marking guidance	Mark	Comments
02.2	<p>1. ATP/energy used to actively transport (ions) <b>OR</b> movement (of ions) against the concentration gradient;</p> <p>2. Sodium ions out <b>and</b> potassium ions into the axon/neurone;</p> <p>3. Idea of maintaining <b>OR</b> re-establishing the resting potential;</p>	3	<p>1. Accept idea of higher concentration of potassium ions inside and higher concentration of sodium ions outside (the neurone)</p>

Question	Marking guidance	Mark	Comments
02.3	<p>1. Less/no sodium ions diffuse/move into the neurone;</p> <p>2. Idea of threshold value not reached;</p> <p>3. Less/no depolarisation/action potentials/impulses generated;</p>	3	<p>2. Allow not enough sodium ions enter to cause depolarisation</p> <p>3. Allow idea of less/no transmission (nerve impulses) to other neurones <b>OR</b> pain pathways to the brain</p>

Question	Marking guidance	Mark	Comments
03.1	1. Age; 2. Ethnicity; 2. Weight; 3. Height;	2 max	Allow other suitable control variables e.g. fitness level/smoking/medication/diet Allow BMI if MP2 and MP3 are not given Ignore sex / health / diseases / lifestyle

Question	Marking guidance	Mark	Comments
03.2	1. High(er) number of mitochondria; 2. Dense network of blood capillaries/vessels;	2 max	2. Allow appears dark(er)/red in colour Allow other suitable features e.g. <ul style="list-style-type: none"> <li>• High(er) concentration of myoglobin</li> <li>• Low(er) concentration of glycogen</li> <li>• Low(er) store of calcium ions</li> </ul>

Question	Marking guidance	Mark	Comments
03.3	1. No significant difference in the mean muscle fibre distribution for slow <b>and</b> fast fibres; 2. Significant increase/difference in SDH activity for slow fibres <b>and</b> no significant difference for fast fibres; 3. Significant increase/difference in mean CSA for slow fibres <b>and</b> no significant difference for fast fibres; 4. Idea of non-overlapping error bars to show significant difference or overlapping error bars to show no significant difference;	4 max	If no marks awarded allow <b>two</b> marks for any <b>two</b> correct descriptions of MP1, MP2 & MP3 <b>without</b> reference to significant / not significant  2. Allow no change/effect (in SDH activity) for fast fibres

Question	Marking guidance	Mark	Comments
03.4	1. Idea of slow fibres linked to endurance; 2. Increase in SDH activity (so increased rate of aerobic respiration) <b>so</b> more/higher rate of ATP production (for muscle contraction); 3. Increase in CSA increases supply of oxygen <b>so</b> higher rate of / more (aerobic) respiration  <b>OR</b> Increase in CSA increases supply of oxygen <b>so</b> delays onset of anaerobic respiration / prevents build-up of lactate / delays muscle fatigue;	3	

Question	Marking guidance	Mark	Comments
04.1	To act as a control experiment to show the effect on growth without added IAA <b>OR</b> To act as a control experiment to compare with the other groups <b>OR</b> To act as a control experiment to show normal/typical growth (without the added IAA);	1	Allow converse

Question	Marking guidance	Mark	Comments
04.2	1. IAA concentration ( $\text{mg dm}^{-3}$ ) on the x-axis and mean increase in shoot length on y-axis; 2. Logarithmic scale for x-axis/IAA concentration; 3. Plot mean values and draw curve/line of best fit;	3	If no other mark awarded, allow <b>one mark</b> for line graph as the data is continuous Max <b>one mark</b> if reference to bar chart

Question	Marking guidance	Mark	Comments
04.3	1. As IAA concentration increases mean increase in shoot length increases; 2. Slow increase up to $0.10 \text{ mg dm}^3$ and then faster increase in shoot length;	2	1. Allow (positive) correlation / (directly) proportional

Question	Marking guidance	Mark	Comments
04.4	<p>1. As the concentration of IAA increases the growth of the root tip would decrease;</p> <p>2. IAA inhibits growth/cell elongation in the roots;</p>	2	1. Allow results would show a negative correlation

Question	Marking guidance	Mark	Comments
04.5	<p>1. (As time increases) the angle of curvature for both groups of seedlings increases</p> <p><b>OR</b></p> <p>(As time increases) both groups of seedlings grow/bend in the direction of light;</p> <p>2. Response is greater for blue light;</p>	2	1. Allow all seedlings show (an increased) positive phototropism (with time)

Question	Marking guidance	Mark	Comments
04.6	<p>1. IAA moves away from the illuminated side / moves to the shaded side (of the shoot)</p> <p><b>OR</b></p> <p>Greater IAA (concentration) on the shaded side (of the shoot);</p> <p>2. (Cells on the shaded side) have greater cell elongation (so causes seedling/shoot to grow/bend towards the direction of light);</p>	2	

Question	Marking guidance	Mark	Comments
05.1	<p><b>Sensitivity:</b> 1. The amount of light required to generate an action potential</p> <p><b>OR</b> The ability to detect (very) low levels of light;</p> <p><b>Acuity:</b> The ability to distinguish/resolve two objects as separate;</p>	2	

Question	Marking guidance	Mark	Comments
05.2	<p><b>Better night vision:</b> 1. Cats have more rods (compared to humans); 2. Cats have rods with a more sensitive light-absorbing pigment; 3. Cats have more rods connected to one bipolar cell;</p> <p><b>Better peripheral vision:</b> 4. Cats have more rods/cones on the edges of the retina (compared to humans);</p> <p><b>More limited colour vision:</b> 5. Cats have fewer cones (compared to humans)</p> <p><b>OR</b> Cats do not have three types of cones;</p>	4 max	<p>Must score at least <b>one mark</b> in each section for max marks</p> <p>If MP2 &amp; MP3 not given – allow rods have a lower threshold (to generate an action potential)</p>

Question	Marking guidance	Mark	Comments
05.3	1. Both have three peaks at approximately similar wavelengths; 2. Bird has four peaks and human has three peaks; 3. Bird has an extra peak of absorption at approximately 360 nm, (humans do not); 4. Both human and bird have no absorption above 700 nm	3	

Question	Marking guidance	Mark	Comments
05.4	Idea of allowing the bird to detect predators/additional food sources;	1	

Question	Marking guidance	Mark	Comments
06.1	Genetic code is universal <b>OR</b> transcription/translation mechanisms are the same in all species;	1	

Question	Marking guidance	Mark	Comments
06.2	1. Gene and plasmid cut using same <u>restriction</u> enzyme/endonuclease; 2. Genes inserted into the plasmid using <u>ligase</u> ; 3. Reference to complementary sticky ends;	3	2. Allow references to binding/joining gene and plasmid together 2. Allow forms phosphodiester bonds 2. Do not allow references to forming hydrogen bonds

Question	Marking guidance	Mark	Comments
06.3	Allows identification of the bacteria which have successfully taken up the (modified) plasmids/gene(s) (for carotene synthesis);	1	Allow able to identify modified/transformed bacteria

Question	Marking guidance	Mark	Comments
06.4	So the rice plants are adapted to the conditions in which they will be growing;	1	

Question	Marking guidance	Mark	Comments
06.5	1. <b>Net benefits:</b> Total benefits – (Total R&D) costs; 2. <b>Benefit cost ratio:</b> Net benefit ÷ (Total R&D) costs;	2	1. Total benefits = Health benefits + Productivity benefits 2. Net benefit = profit

Question	Marking guidance	Mark	Comments
06.6	Crossing with native varieties of rice reduces carotene content <b>OR</b> Accumulation of crop pests specific to golden rice;	1	

Question	Marking guidance	Mark	Comments
06.7	(Idea of) dietary supplements of carotene/vitamin A;	1	Allow eat foods naturally high in vitamin A

Question	Marking guidance	Mark	Comments
07.1	1. Prevents the binding of transcription factors <b>OR</b> Prevents the binding of RNA polymerase <b>OR</b> Prevents binding of guanine (to DNA) during mRNA synthesis <b>OR</b> (Idea that it) causes DNA/chromatin to bind together tightly; 2. So prevents transcription of the gene;	2	2. Allow prevents formation of mRNA

Question	Marking guidance	Mark	Comments
07.2	1. Prevents transcription/expression of tumour suppressor genes; 2. (Idea that this) leads to uncontrolled cell division;	2	Do not allow reference to proto-oncogenes 1. Allow reduces/silences/inhibits for prevents 2. Allow references to reduced PCD/apoptosis 2. Do not allow references to cell growth

Question	Marking guidance	Mark	Comments
07.3	1. Binding to the DNMT alters the shape of the <u>active site</u> ; 2. Reduces/prevents the amount of DNA methylation (in tumour suppressor genes); 3. Tumour suppressor gene can be expressed/transcribed;	3	1. Allow binds to <u>active site</u> and blocks it

Question	Marking guidance	Mark	Comments
07.4	So that the results of the different treatments could be compared;	1	Allow reference to tumour size to allow noticeable change in size/able to measure

Question	Marking guidance	Mark	Comments
07.5	Not possible to weigh the tumour directly without removing it from the mouse;	1	

Question	Marking guidance	Mark	Comments
07.6	(Treatment 1) 39.2857 <b>and</b> (Treatment 2) 85.7142;	1	Accept any correctly rounded answer

Question	Marking guidance	Mark	Comments
07.7	<ol style="list-style-type: none"> <li>1. Treatment 2/Aza-TdC (more effective as it) has greater tumour growth delay;</li> <li>2. Both chemicals increased the tumour growth delay / slowed tumour growth;</li> <li>3. Investigation carried out in mice <b>so</b> may not have the same effect in humans;</li> <li>4. Group sizes were small <b>so</b> not representative;</li> <li>5. Studied for 60 days <b>so</b> long-term effects unknown;</li> <li>6. Only one type of cancer <b>so</b> may not work on all types of cancer;</li> <li>7. Only slows tumour growth <b>so</b> may not be an effective treatment;</li> <li>8. No statistical test <b>so</b> unable to determine if the difference in tumour growth delay was significant;</li> </ol>	5 max	<p>Must have MP1 or MP2 for max marks.</p> <p>4. Allow generalisable for representative</p>