OXFORD
INTERNATIONAL
AQA EXAMINATIONS

# INTERNATIONAL A-LEVEL

# BIOLOGY

# BL04 (9610)

Unit 4 Control

Mark scheme

January 2022

Version: 1.0 Final

*221XBL04/MS*

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.

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

# Level of response marking instructions

Level of response mark schemes are broken down into levels, each of which has a descriptor. The descriptor for the level shows the average performance for the level. There are marks in each level.

Before you apply the mark scheme to a student's answer read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

## Step 1 Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level you should look at the overall quality of the answer and not look to pick holes in small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level and then use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 3 with a small amount of level 4 material it would be placed in level 3 but be awarded a mark near the top of the level because of the level 4 content.

## Step 2 Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this. The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do not have to cover all of the points mentioned in the Indicative content to reach the highest level of the mark scheme.

An answer which contains nothing of relevance to the question must be awarded no marks.

| Question | Marking guidance | Mark | Comments |
|---|---|---|---|
| **01.1** | 1. Schwann cell / myelin sheath;<br>2. Increases speed of transmission / increased frequency of depolarisation / action potentials jump from node to node / saltatory conductance / prevents passage of sodium ions / acts as (electrical) insulator; | 2 | |

| Question | Marking guidance | Mark | Comments |
|---|---|---|---|
| **01.2** | 42 ($ms^{-1}$);; | 2 | Allow 1 mark for incorrect reading of time values from graph but correct sum |

| Question | Marking guidance | Mark | Comments |
|---|---|---|---|
| **01.3** | 1. (Change in voltage) opens sodium ion/$Na^+$ channels;<br>2. Sodium ions/$Na^+$ diffuse in;<br>3. So threshold value met / depolarises the membrane; | 3 | Must refer to sodium ions/$Na^+$ at least once for mp1 and mp2<br>3. Allow description of depolarisation e.g. decreases potential difference, reverses potential, increases potential |

| Question | Marking guidance | Mark | Comments |
|---|---|---|---|
| **02.1** | Idea that the filaments cannot overlap further / slide any further<br>**OR**<br>Opposite actin filament prevents correct cross-bridges; | 1 | |

| Question | Marking guidance | Mark | Comments |
|---|---|---|---|
| **02.2** | 2.1 and 3.1 μm; | 1 | Allow ranges of 2.10 to 2.15 **and** 3.05 to 3.10 |

| Question | Marking guidance | Mark | Comments |
|---|---|---|---|
| **02.3** | (Relaxed)<br>1. Larger H-zone (than in B);<br>2. Larger I-band (than in B);<br>3. Z-lines are further apart / sarcomere is longer (than in B); | 2 max | Accept converse for B<br>Less overlap of thick and thin filaments = 1 mark |

| Question | Marking guidance | Mark | Comments |
|---|---|---|---|
| **02.4** | 1. ATP is used to break the cross bridges/connections between actin and myosin;<br>2. Hydrolysis ATP re-sets the myosin heads / ATP is used for pivoting of the myosin head (to recombine with actin);<br>3. ADP (+ $P_i$) on myosin head for power stroke<br>4. ATP can be used for active transport of $Ca^{2+}$ back into sarcoplasmic reticulum; | 3 | 2. Allow breakdown of ATP or ATP → ADP + $P_i$ |

| Question | Marking guidance | Mark | Comments |
|---|---|---|---|
| **02.5** | 1. Tropomyosin cannot change shape/position;<br>2. Binding sites (on actin) not exposed;<br>3. No binding of myosin head / fewer cross bridges; | 3 | 1. Allow $Ca^{2+}$ cannot bind to troponin / troponin cannot change shape<br>2. Allow tropomyosin blocks binding site (on actin) |

| Question | Marking guidance | Mark | Comments |
|---|---|---|---|
| **02.6** | 3.40(%);; | 2 | Allow 1 mark for (sensible) incorrect value from graph with correct sum e.g. 29.2 instead of 29.4<br>Allow 1 mark for incorrect number of significant figures e.g. 3.4 or 3.401 |

| Question | Marking guidance | Mark | Comments |
|---|---|---|---|
| **02.7** | 1. Weight training increases <u>mean</u> circumference/size of biceps;<br>2. Not all individuals increased in size;<br>3. Difference between means unlikely to be significant as range bars overlap; | 2 max | 3. Allow difference is not significant<br>3. Allow sd bars, error bars |

| Question | Marking guidance | Mark | Comments |
|---|---|---|---|
| **03.1** | 925 (μm);; | 2 | Allow ± 0.5 mm on measurement of 37 mm<br>Allow 1 mark for 0.925 |

| Question | Marking guidance | Mark | Comments |
|---|---|---|---|
| **03.2** | 1. High pressure required to increase voltage (at D) / to transmit impulse / to reach threshold / to generate action potential;<br>2. Outer layers not required for an increase in voltage (at C/D) / to transmit impulse / to reach threshold / to generate action potential;<br>3. Damage at end of neurone prevents an increase in voltage (at D) / transmission of impulse<br>**OR**<br>Intact myelin sheath needed for impulse transmission; | 3 | |

| Question | Marking guidance | Mark | Comments |
|---|---|---|---|
| **03.3** | 1. Give values / units, for pressure;<br>2. Give values / units, for voltage; | 1 max | Ignore distance, age of person<br>Ignore amount unqualified |

<table>
<tr><th>Question</th><th>Marking guidance</th><th>Mark</th><th>Comments</th></tr>
<tr><td>04.1</td><td>
<table>
<tr><td>Type of stem cell</td><td>Stage of development where these stem cells are found</td><td>Property of these stem cells</td></tr>
<tr><td>Totipotent</td><td>Embryo</td><td>Can be used to make any type of cell</td></tr>
<tr><td>Unipotent</td><td>Adult / Mature</td><td>Can be used to make one type of cell</td></tr>
<tr><td>Pluripotent</td><td>Embryo</td><td>Can be used to make almost any type of cell</td></tr>
</table>
</td><td>3</td><td>Mark by row then by column for max 2<br><br>Allow fetus<br><br>Ignore embryonic membranes</td></tr>
</table>

| Question | Marking guidance | Mark | Comments |
|---|---|---|---|
| **04.2** | 1. (Adult stem cell more acceptable) as adult can give consent but embryo cannot;<br>2. (Adult stem cells) are less harmful to collect / do not kill donor / cannot form new life (as embryonic cells can);<br>3. (Adult stem cells) are easier to collect / more readily available;<br>4. (If) Stem cells taken from patient reduces the chance of rejection; | 2 max | Ignore embryonic stem cells unethical unless qualified<br><br>2 Allow any explained religious/ethical objection to using embryonic stem cells;<br><br>3 and 4. Allow reference to iPS for rejection or supply issues |

| Question | Marking guidance | Mark | Comments |
|---|---|---|---|
| **04.3** | 1. The faulty bone marrow would still produce faulty blood cells;<br>2. Bone marrow stem cells will differentiate into / produce (new) blood cells;<br>3. Stop them rejecting the donated bone marrow; | 3 | <br><br><br>3. Allow description of rejection |

| Question | Marking guidance | Mark | Comments |
|---|---|---|---|
| **05.1** | 1. (More $CO_2$/decrease in pH) detected by (chemoreceptors in walls of) carotid artery/aorta;<br>2. More nervous impulses to medulla (oblongata);<br>3. More nervous impulses via sympathetic NS;<br>4. To SAN (so heart rate increases); | 4 | Idea of more impulses needed only once for mp2 and mp3 |

| Question | Marking guidance | Mark | Comments |
|---|---|---|---|
| **05.2** | 1. Sotalol is similar shape to adrenaline **so** fits/binds/is complementary to adrenaline receptors;<br>2. Prevents adrenaline binding **or** competes with/is competitive inhibitor of adrenaline;<br>3. (Sotalol) does not make the heart beat faster (so does not increase blood pressure);<br>**OR**<br>3. Less glycogen converted to glucose so water potential of blood is not reduced/is higher (so less water enters blood and blood pressure does not increase) | 3 | 1. Do not allow same shape |

| Question | Marking guidance | Mark | Comments |
|---|---|---|---|
| **05.3** | 1. 1st pulse stimulates atrium/atria to contract (like SAN should do);<br>2. Delay allows ventricles to fill /atria to empty (of blood);<br>3. 2nd pulse (from 2nd electrode) stimulates ventricle to contract (like AVN);<br>4. 2nd electrode (at bottom of ventricle) causes heart to contract from apex<br>**OR**<br>Impulse spreads up ventricles via Purkinje fibres; | 4 | 4. Ignore bundle of His |

| Question | Marking guidance | Mark | Comments |
|---|---|---|---|
| **05.4** | Less invasive surgery to put in in first place;<br>**OR**<br>Can replace battery without opening heart; | 1 max | Ignore easier unqualified |

| Question | Marking guidance | Mark | Comments |
|---|---|---|---|
| **06.1** | (to ensure) light is from 1 direction/exclude other light sources; | 1 | |

| Question | Marking guidance | Mark | Comments |
|---|---|---|---|
| **06.2** | (It turns so) all sides of the plant are exposed to light; | 1 | |

| Question | Marking guidance | Mark | Comments |
|---|---|---|---|
| **06.3** | 1. (Fig 13 shows) IAA moves away from light side of shoot/to shaded side;<br>2. (Fig 13 shows) More IAA (on shaded side) causes more growth/cell elongation;<br>3. (Fig 14 shows) IAA evenly spread so grows straight; | 3 | 1. Allow more IAA on shaded side<br><br>2. Do not allow more cell division/mitosis |

| Question | Marking guidance | Mark | Comments |
|---|---|---|---|
| **06.4** | (In support)<br>Plant grows/bends towards light source (so it is positive);<br><br>(Against)<br>Only 1 plant/only 1 species/only for 3 days;<br>Don't know what is happening to roots/other plant parts;<br>Some plant tissues might be more influenced by gravity/water;<br>No length measurements made (so do not know if growing) | 2 max | Must have 1 in support and 1 against for full marks |

| Question | Marking guidance | Mark | Comments |
|---|---|---|---|
| **06.5** | 1. Plant in box with window / as in Figure 13;<br>2. (Idea of) individual colours of light tested separately;<br>3. Control variables;<br>4. Replicates; | 4 max | 2. Allow e.g. coloured filter, coloured light bulb, prism<br>3. e.g. same plant species/temperature/time (for response) |

| Question | Marking guidance | Mark | Comments |
|---|---|---|---|
| **06.6** | 1. ABA causes stomata to close;<br>2. Less $CO_2$ in so less photosynthesis **or** so less sugar produced; | 2 | |

| Question | Marking guidance | Mark | Comments |
|---|---|---|---|
| **07.1** | 1. The more intense the exercise the higher the body temperature gets/the more it is raised;<br>2. The more intense the exercise the longer it takes (to return to resting); | 2 | 1 and 2 Allow positive correlation |

| Question | Marking guidance | Mark | Comments |
|---|---|---|---|
| **07.2** | 1. Higher intensity raises temperature most;<br>2. Muscle temperature takes longer to return to resting for low intensity (than medium/high intensity);<br>3. No statistical test/sd so difference might not be significant;<br>4. No information on gender/age/BMI/fitness of people;<br>5. Intensity of exercise may vary within group/during exercise; | 3 max | Must have mp1 plus any 2 others for maximum marks<br><br>Ignore correlation is not causation<br>Ignore reference to group size |

| Question | Marking guidance | Mark | Comments |
|---|---|---|---|
| **07.3** | 1. (Active group have) Higher rate of/more sweating at each time point/more sweating for longer time;<br>2. Sweating cools by evaporation (of water from skin);<br>3. (So) increased sweating/evaporation causes greater heat loss / more cooling; | 3 | |

| Question | Marking guidance | Mark | Comments |
|---|---|---|---|
| **07.4** | 1. Early treatment reduces body temperature faster;<br>2. Early treatment body temperature is below critical at 47 min;<br>**OR**<br>Late treatment body temperature is below critical at 95 min;<br>3. With early treatment body temperature is below critical temperature/40.5 °C within the hour (so avoiding heat stroke)<br>**OR**<br>With late treatment body temperature is above critical temperature/40.5 °C for more than hour (so causing heat stroke) | 3 | Need to quote data for mp2<br>2. Allow range 46-48 and 95-96 mins |

| Question | Marking guidance | Mark | Comments |
|---|---|---|---|
| **07.5** | 1. Denatures enzymes;<br>2. Damages (cell) membrane; | 2 | 1. Ignore enzymes stop working<br>2. Allow examples e.g. melts phospholipids, denatures transport proteins |

| Question | Marking guidance | Mark | Comments |
|---|---|---|---|
| **07.6** | 1. Pale skin – vasodilation not occurring or vasoconstriction is occurring;<br>2. Muscle cramps – loss of water via sweat = dehydration<br>**OR**<br>Sweat contains ions and loss of ions = damage to muscles/nerves; | 2 | |