

# **Markscheme**

**November 2025**

**Biology**

**Higher level**

**Paper 1B**

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### Subject Details: Biology HL Paper 1B Markscheme

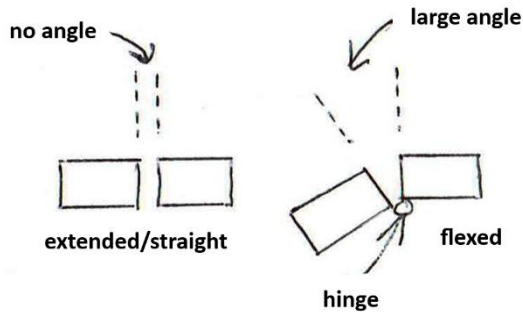
Candidates are required to answer **all** questions in Paper 1B. Maximum total = **35 marks**.

1. Each row in the “Question” column relates to the smallest subpart of the question.
2. The maximum mark for each question subpart is indicated in the “Total” column.
3. Each marking point in the “Answers” column is shown by means of a semicolon (;) at the end of the marking point.
4. A question subpart may have more marking points than the total allows. This will be indicated by “**max**” written after the mark in the “Total” column. The related rubric, if necessary, will be outlined in the “Notes” column.
5. An alternative word is indicated in the “Answers” column by a slash (/). Either word can be accepted.
6. An alternative answer is indicated in the “Answers” column by “**OR**”. Either answer can be accepted.
7. An alternative markscheme is indicated in the “Answers” column under heading **ALTERNATIVE 1** etc. Either alternative can be accepted.
8. Words inside brackets ( ) in the “Answers” column are not necessary to gain the mark.
9. Words that are underlined are essential for the mark.
10. The order of marking points does not have to be as in the “Answers” column, unless stated otherwise in the “Notes” column.
11. If the candidate’s answer has the same “meaning” or can be clearly interpreted as being of equivalent significance, detail and validity as that in the “Answers” column then award the mark. Where this point is considered to be particularly relevant in a question it is emphasized by **OWTTE** (or words to that effect) in the “Notes” column.
12. Remember that many candidates are writing in a second language. Effective communication is more important than grammatical accuracy.
13. Occasionally, a part of a question may require an answer that is required for subsequent marking points. If an error is made in the first marking point then it should be penalized. However, if the incorrect answer is used correctly in subsequent marking points then **follow through** marks should be awarded. When marking, indicate this by adding **ECF** (error carried forward) on the script.
14. Do **not** penalize candidates for errors in units or significant figures, **unless** it is specifically referred to in the “Notes” column.

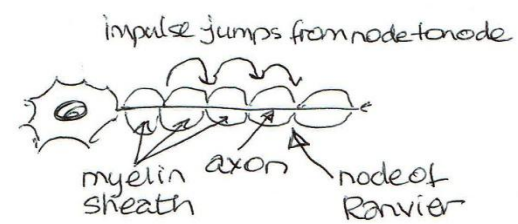
| Question |   |    | Answers                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Notes                                                                                                                               | Total |
|----------|---|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------|
| 1.       | a | i  | thymine;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <i>Name written in full required.</i>                                                                                               | 1     |
| 1.       | a | ii | <p><i>benefit: (1 max)</i></p> <p>a. models simplify complex systems</p> <p><b>OR</b></p> <p>helpful when direct observation is difficult;</p> <p>b. model can be seen from different angles/can be rotated/show 3D structure/visualize structure;</p> <p>c. can zoom in to part of it</p> <p><b>OR</b></p> <p>shows details/structures that cannot be seen otherwise / OWTTE</p> <p><b>OR</b></p> <p>can do simulations of effect of change in part of it / OWTTE;</p> <p><i>disadvantage: (1 max)</i></p> <p>d. models have limitations;</p> <p>e. assumptions need to be made;</p> <p>f. do not always show real structure/inaccurate / OWTTE;</p> <p>g. expensive;</p> | <p><i>f. Structure not shown can include base sequence, molecular bonds, exact size, processes, colours, interactions, etc.</i></p> | 2 max |

| Question |   |  | Answers                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Notes                                                                                               | Total    |
|----------|---|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|----------|
| 1.       | b |  | a. DNA molecule wrapped/coiled/supercoiled / OWTTE;<br>b. (around) a <u>core</u> of proteins/polypeptides/histones;<br>c. eight histones/proteins/polypeptides<br><b>OR</b><br>histones form an octamer/8 histones;<br>d. (DNA held together by a) 9 <sup>th</sup> /additional histone/histone H1;<br>e. linker DNA (joins nucleosomes);                                                                                                                                    |                                                                                                     | 3<br>max |
| 1.       | c |  | a. methylation of amino acids/histones;<br>b. (can cause) transcription to be inhibited/repressed/activated / OWTTE;<br>c. methylation of cytosine causes transcription to be repressed/inhibited;<br>d. (repressed as histones) restricts access to the DNA;<br>e. (activated as) allows transcription factors to bind to DNA;<br>f. methylation of promoter (DNA) represses transcription<br>g. results in decreased gene (downstream) expression/gene silencing / OWTTE; | b. Accept "transcription more difficult".<br><br>d. Accept other wording such as "less accessible". | 2<br>max |

| Question |   |    | Answers                                                                                                                                                                                                                                                                                                        | Notes                                                                                                                                                                                                                                                                                                                                                                            | Total    |
|----------|---|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 2.       | a | i  | (joint) angle;                                                                                                                                                                                                                                                                                                 | <i>Do not accept degrees alone (which are the units, not the variable).</i>                                                                                                                                                                                                                                                                                                      | 1        |
| 2.       | a | ii | outliers;                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                  | 1        |
| 2.       | b |    | yes, as the results/medians/(IQR) ranges for both are very similar;                                                                                                                                                                                                                                            | <i>Do not accept means instead of medians.</i>                                                                                                                                                                                                                                                                                                                                   | 1        |
| 2.       | c |    | <p><i>Strengths (max 1)</i></p> <p>a. large sample/range of results for both methods;</p> <p>b. many/three joints used;</p> <p>c. some variables were controlled;</p> <p>d. two methods of measurement;</p> <p><i>Limitation</i></p> <p>e. length of fingers/flexibility of joints not considered / OWTTE;</p> | <p><i>Award marking points for the design of the experiment but not for analyzing the results.</i></p> <p><i>a. Allow quoting the sample size (120).</i></p> <p><i>b. Results for all (MCP, PIP, DIP) are used.</i></p> <p><i>c. Accept named variables, e.g., left finger, healthy people.</i></p> <p><i>e. Accept other variables than left finger and healthy people.</i></p> | 2<br>max |

| Question |   |  | Answers                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Notes                                                                                                                                                                                                                            | Total    |
|----------|---|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 2.       | d |  | <p>a. when extended/straight no/very small angle<br/><b>OR</b><br/>if joint completely straight the angle would be 0(°)<br/><b>OR</b><br/>all angles are measured relative to the extended joint / OWTTE;</p> <p>b. angle increases when finger flexes/bends /vice versa<br/><b>OR</b><br/>flexion creates an angle (compared to extended);</p> <p>c. (finger joints) act as hinge (joints) when flexed / OWTTE;</p> <p>d. joint/measuring device (seen from above) opens when flexed, so larger angle/OWTTE;</p> <p>e. measuring device could be goniometer / (video and) computer/app analysis of images / protractor on image;</p> <p>f. different measuring devices produce similar results / OWTTE;</p> | <p>a. Allow 0°/180°.</p> <p>Allow answers using annotated diagrams.</p>  <p>Allow alternative terms, such as bent, flexed, straight, etc.</p> | 3<br>max |

| Question |   |    | Answers                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Notes                                                                                                                                            | Total    |
|----------|---|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 3.       | a |    | oscilloscope;                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                  | 1        |
| 3.       | b | i  | <p>a. SD is variability within a sample while the SE is the variability across samples of a population / OWTTE</p> <p><b>OR</b></p> <p>SD is for each sample/earthworm while SE for all the samples/earthworms;</p> <p>b. SD could be calculated from 5 repeats while for SE 30 replicates is (considered) acceptable;</p> <p>c. small SD shows data are clustered around the mean while small SE shows the sample mean is closer to the population mean / vice versa;</p> | <p><i>Answers must make clear differences between the two.</i></p> <p><i>Do not accept references to experimental / human errors for SE.</i></p> | 2<br>max |
| 3.       | b | ii | only one replicate/measurement / OWTTE;                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                  | 1        |
| 3.       | c | i  | <p>2.56 (faster)</p> <p><b>OR</b></p> <p>256 % (faster);</p>                                                                                                                                                                                                                                                                                                                                                                                                               | <p><i>Significant figures conventions not expected, so 2.5, 2.5555 etc. is acceptable.</i></p>                                                   | 1        |

| Question |   |    | Answers                                                                                                                                                                                                                                                                                                                                                                     | Notes                                                                                                                                                                                                                                                                                             | Total    |
|----------|---|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 3.       | c | ii | <p>a. MGF has larger <u>diameter</u> (of axon than LGF) / <i>vice versa</i><br/> <b>OR</b><br/> MGF is wider (than LGF) / <i>vice versa</i>;</p> <p>b. MGF has (thicker) myelin sheath / <i>vice versa</i>;</p>                                                                                                                                                             | <p><i>Mark only the first answer written</i></p> <p><i>Accept answers where MGF is implicit.</i></p> <p><i>a. Do not accept "longer".</i></p> <p><i>b. Accept "thicker myelin/more myelinated".</i></p>                                                                                           | 1<br>max |
| 3.       | d |    | <p>a. electric insulation of axon by myelin sheath;</p> <p>b. myelin sheath has nodes (of Ranvier);</p> <p>c. impulses jump/transmitted from node to node;</p> <p>d. ion pumps/channels are clustered at nodes (of Ranvier);</p> <p>e. faster (than in unmyelinated axon) / OWTTE;</p> <p>f. production of all-or-none action potentials by a single node (of Ranvier);</p> | <p><i>b. Should be for explaining what the nodes are, marking point c. for "jumping", so awarding c. doesn't give marking point b. automatically.</i></p> <p><i>Accept correctly annotated diagrams.</i></p>  | 3<br>max |

| Question |   |    | Answers                                                                                                                                                                                                                                                                                                                                                              | Notes                                                                                                                                                 | Total    |
|----------|---|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 4.       | a | i  | a. scale markers of the ruler are too far apart / OWTTE;<br>b. the mandible is too small to be precisely measured by a ruler / OWTTE;                                                                                                                                                                                                                                |                                                                                                                                                       | 1<br>max |
| 4.       | a | ii | a. Vernier/caliper/screw gauge (to measure directly on the beetle);<br>b. (measured) using microscope with (eyepiece) graticule;<br>c. beetle measured using app on mobile;<br>d. photograph taken (enlarged) and mandible measured (with ruler) / OWTTE;<br>e. digital software used to measure mandible;                                                           | <i>b. Microscope alone is not sufficient.</i>                                                                                                         | 1<br>max |
| 4.       | b |    | a. number/amount of flour beetles (at the start of each generation);<br>b. number/amount of predators/assassin bugs (at the start of each generation);<br>c. temperature;<br>d. humidity;<br>e. time;<br>f. food/nutrients/diet;<br>g. water;<br>h. space;<br>i. light;<br>j. variable relating to the organism (e.g. age, origin);<br>k. other reasonable variable; | <i>Mark the first two answers only.</i><br><br><i>Do not accept mandible size.</i><br><br><i>"Environment/habitat" is too vague unless specified.</i> | 2<br>max |

| Question |   |  | Answers                                                                                                                                                                                                                                                                                                                                                                                                                              | Notes                                                                                                                                                                                                                                                                                                                                                                 | Total |
|----------|---|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 4.       | c |  | <p>a. general trend is decreasing size/negative correlation;<br/> b. from generation 1 to 3/4 mandible size is constant/fluctuates;<br/> c. after generation 3/4 predation (starts) decreasing mandible size<br/> <b>OR</b><br/> lowest size in generation 6<br/> <b>OR</b><br/> steepest decrease between 5 and 6;<br/> d. towards the end of the experiment/generation 6 and 7, predation has (small/slight) increase / OWTTE;</p> | <p>Key:<br/> —●— control<br/> ---■--- predation</p> <p>0.44<br/>0.42<br/>0.40<br/>0.38<br/>0.36<br/>0.34<br/>0.32<br/>0.30<br/>0.28<br/>0.26<br/>0.24<br/>0.22<br/>0.20<br/>0.18<br/>0.16<br/>0.14<br/>0.12<br/>0.10<br/>0.08<br/>0.06<br/>0.04<br/>0.02<br/>0.00</p> <p>0 1 2 3 4 5 6 7 8<br/>Generation</p> <p>a. general trend decreasing<br/>b.<br/>c.<br/>d.</p> | 2 max |

| Question |   |  | Answers                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Notes                                                                                                                                                                                              | Total |
|----------|---|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 4.       | d |  | <p>a. variation of mandible size within the population;</p> <p>b. predation causes selection pressure</p> <p><b>OR</b></p> <p>as mandible size increases so does the likelihood of predation</p> <p><b>OR</b></p> <p>beetles with smaller mandibles have higher escape/survival rates</p> <p><b>OR</b></p> <p>smaller mandible is a competitive advantage / OWTTE;</p> <p>c. beetles with smaller mandibles have more chances of reproducing;</p> <p>d. overproduction of offspring with small mandible;</p> <p>e. competition for resources leads to survival of the fittest / small mandible beetles;</p> <p>f. <u>allele</u> for small mandible is inherited/passed on to offspring;</p> <p>g. increasing the <u>frequency</u> of allele/phenotype/beetles with smaller mandibles (in the population);</p> | <p><i>c. Must include idea of reproduction.</i></p> <p><i>e. Do not accept "survival of the fittest" out of context/as a sole answer.</i></p> <p><i>f. Do not accept "gene" or "genotype".</i></p> | 4 max |