Diploma Programme
Programme du diplôme
Programa del Diploma

Biology
Standard level
Paper 1B

12 May 2025

Zone A afternoon | **Zone B** afternoon | **Zone C** afternoon

Candidate session number

1 hour 30 minutes [Paper 1A and Paper 1B]

Instructions to candidates

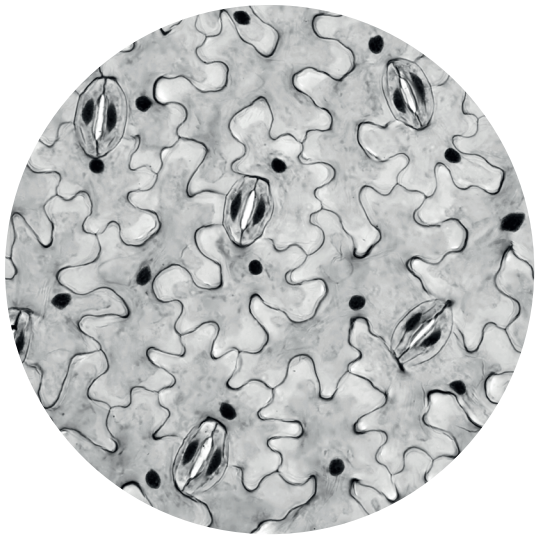
- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Answer all questions.
- Answers must be written within the answer boxes provided.
- A calculator is required for this paper.
- The maximum mark for paper 1B is **[25 marks]**.
- The maximum mark for paper 1A and paper 1B is **[55 marks]**.

2225 – 6011

9 pages

Answer **all** questions. Answers must be written within the answer boxes provided.

1. The image shows a cast of the lower surface of a leaf from a busy Lizzie (*Impatiens walleriana*) plant as seen under a light microscope with a magnification of 600×.



(a) On the image, label a guard cell. [1]

(b) State how the magnification of the microscope was calculated. [1]

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(Question 1 continued)

(c) (i) Outline how stomatal density in busy Lizzie leaves can be estimated within a known field of view. [1]

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(ii) Suggest how this estimate can be made more reliable. [1]

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(d) Explain **one** feature of tree roots that help trees to survive in mangrove swamps. [2]

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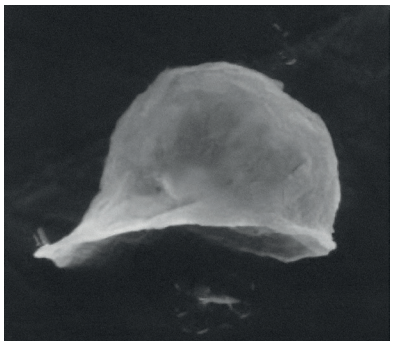
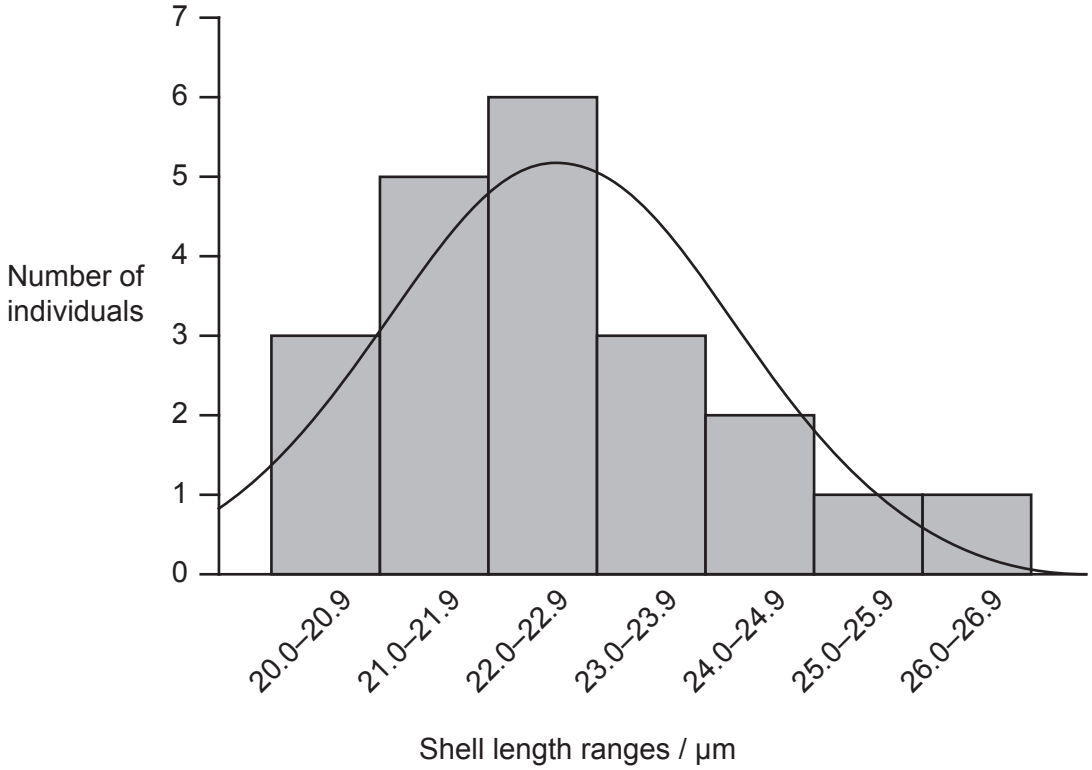
2. *Psammonobiotus balticus* belongs to a group of protists (unicellular eukaryotic organisms) that have a shell surrounding most of the cell, which provides shelter from predators. The graph shows the frequency of varying shell lengths in a population of *P. balticus*.

P. balticus



10 µm



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(Question 2 continued)

(a) From the diagram,

(i) identify the range of shell length that is the mode. [1]

. . . . . µm

(ii) identify the range that includes the individual with the median shell length. [1]

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(b) State, giving a reason, the type of variation shown by shell length. [2]

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(c) Mutations may increase variation within a species. Compare and contrast substitution and insertion mutations. [2]

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(d) Outline the reason that some species of protists are classified as mixotrophs. [1]

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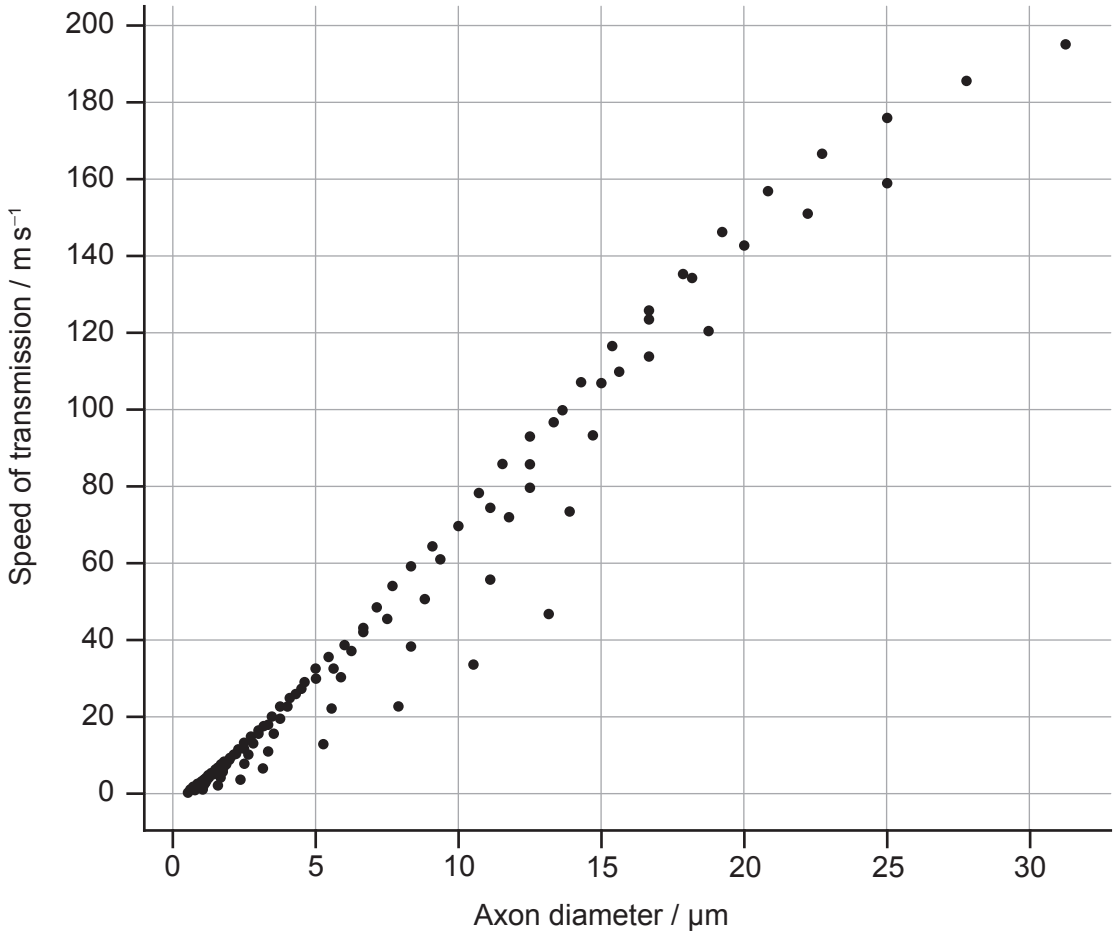
3. Scientists used MRI to calculate the speed of transmission of nerve impulses along axons of brain neurons.



(a) (i) Describe the relationship between speed of transmission and axon diameter. [1]

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(ii) In a similar experiment, scientists determined an R^2 value of 0.92.
Comment on this result. [2]

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(Question 3 continued)

(b) Distinguish between the functions of sensory and motor neurons. [1]

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(c) The transmission of nerve impulses along axons relies on a supply of energy. Explain how ATP is adapted to perform this function. [3]

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4. The table shows the nuclear DNA content of some plant and animal species.

Species scientific name	**Common name**	**Chromosome number**	**Genome size / DNA million base pairs**
Apis mellifera	honey bee	16	215
Homo sapiens	human	46	3080
Ailurus fulgens	red panda	36	2340
Pinus sylvestris	Scots pine	22	20 000
Paris japonica	canopy plant	40	150 000

(a) Suggest, giving a reason, whether gametes or somatic cells have been used to provide the information in the table. [1]

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(b) State **one** way in which chromosomes are classified to construct the karyotype of an individual. [1]

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(c) Outline the role of histones in plant and animal chromosomes. [1]

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(Question 4 continued)

(d) Using the data provided in the table, discuss whether genome size positively correlates to organism complexity. [2]

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References:

1. tonaquatic, 2021. [*Leaf epidermis under light microscope view*]. [image online] Available at: https://www.gettyimages.co.uk/detail/photo/the-leaf-epidermis-under-light-microscope-view-has-royalty-free-image/1323853398 [Accessed 14 June 2024]. Reference redacted. Source adapted.

2. Golemansky, V. and Todorov, M., 2006. New Data to the Shell Ultrastructure and the Biometry of the Marine Interstitial Testate Amoebae (Rhizopoda: Testaceafilosia). *Acta Protozoologica* 45(3), pp. 301–312. Source adapted.

3. Drakesmith, M., Harms, R., Rudrapatna, U., Parker, G. D., Evans, J. and Jones, D. K., 2019. Estimating axon conduction velocity in vivo from microstructural MRI. *NeuroImage* 203, 116186. https://doi.org/10.1016/j.neuroimage.2019.116186. Source adapted. Licensed under CC BY 4.0: https://creativecommons.org/licenses/by/4.0/.

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