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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]

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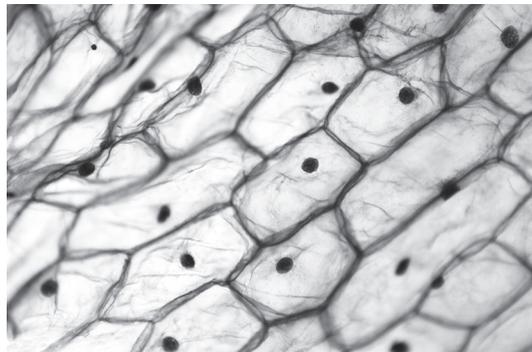
Instructions to candidates

- 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]**.



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

1. The image shows epidermis tissue from a bulb of the onion plant (*Allium cepa*) viewed using a light microscope.



50 μm

- (a) Calculate the magnification of the image.

[1]

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- (b) State the item of equipment that a student could use to accurately measure the length of an onion cell viewed using a light microscope.

[1]

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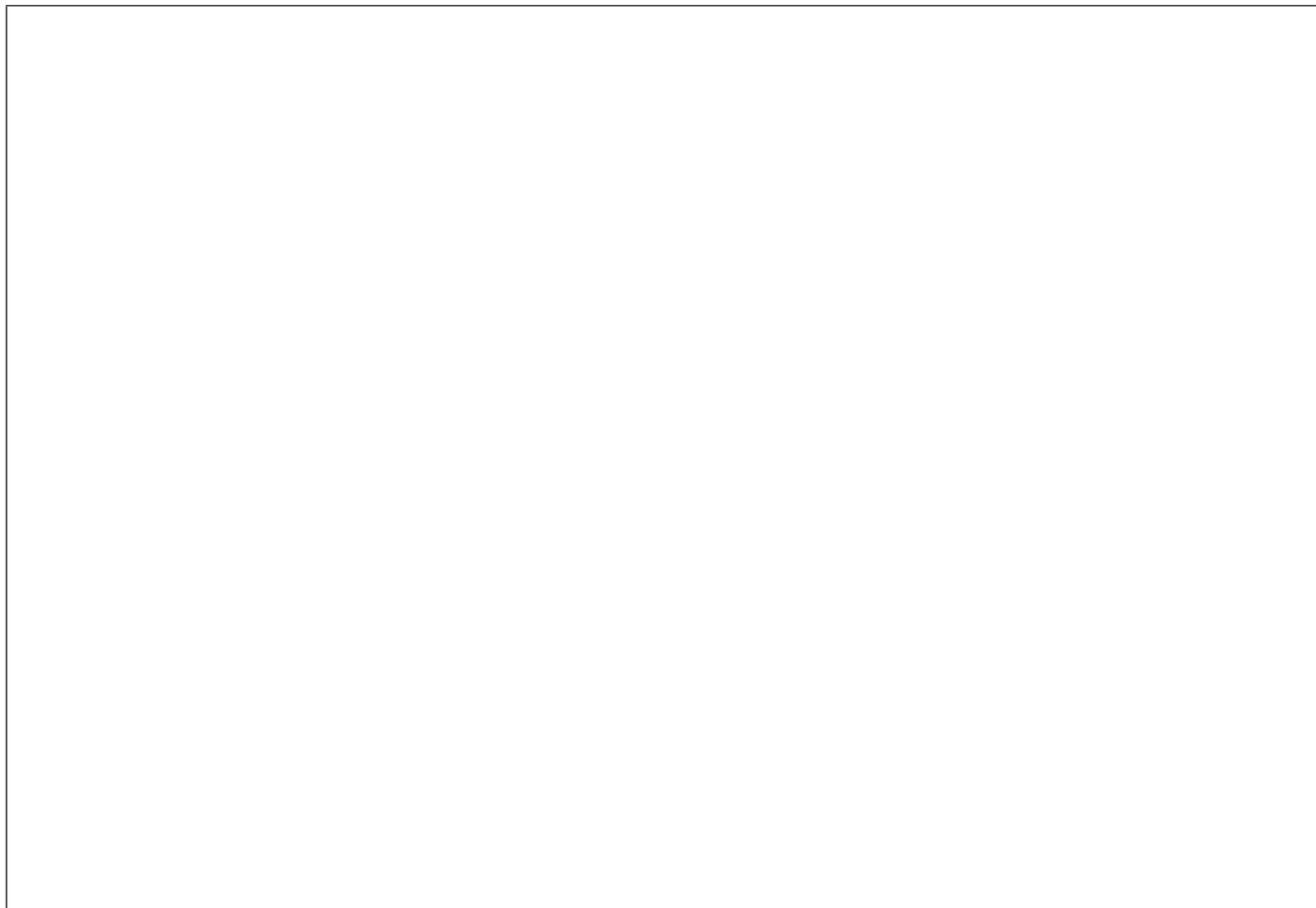
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(Question 1 continued)

- (c) Draw a labelled diagram of a nucleus from a eukaryotic cell, such as an onion epidermis cell, as seen using an **electron** microscope.

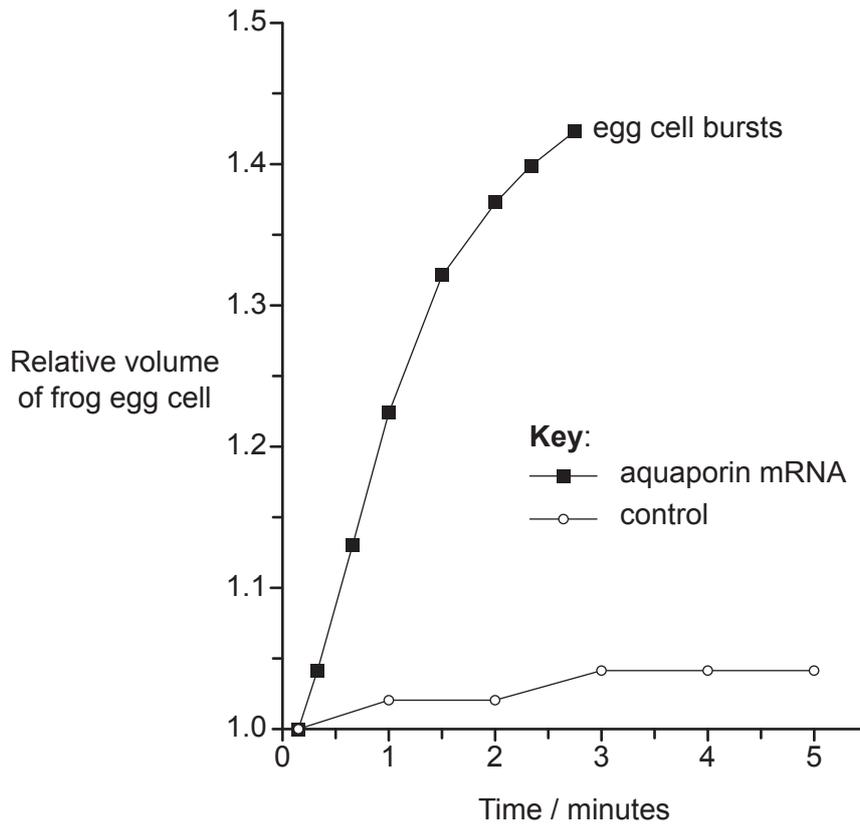
[3]



2. In the early 1990s, investigations involving egg cells from the African clawed frog (*Xenopus laevis*) led to the discovery of membrane channel proteins called aquaporins.

In one investigation, scientists injected 10 frog egg cells with a solution containing mRNA encoding for an aquaporin, and another 10 frog egg cells with distilled water (control cells). All the frog egg cells were then incubated in a hypotonic solution. The volume of the frog egg cells was then measured during a period of five minutes.

The graph shows the mean results of the investigation.



- (a) State the direction of net movement of water across the plasma membrane of all the frog egg cells between 0 and 3 minutes. [1]

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(This question continues on the following page)



(Question 2 continued)

- (b) (i) Distinguish between the results shown for the frog egg cells with aquaporin mRNA and the control egg cells. [2]

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- (ii) Explain the role of aquaporins in the movement of water across cell membranes. [2]

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- (c) Outline the reason that the results are displayed as mean relative volumes rather than mean volumes. [1]

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- (d) Comment on the reliability of the results of this investigation. [1]

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3. The image shows a castor bean tick (*Ixodes ricinus*) which is commonly found in woodlands or forest areas. This tick can carry bacteria that cause Lyme disease in humans.



- (a) Explain how the capture-mark-release-recapture method could be used to estimate the size of a tick population.

[3]

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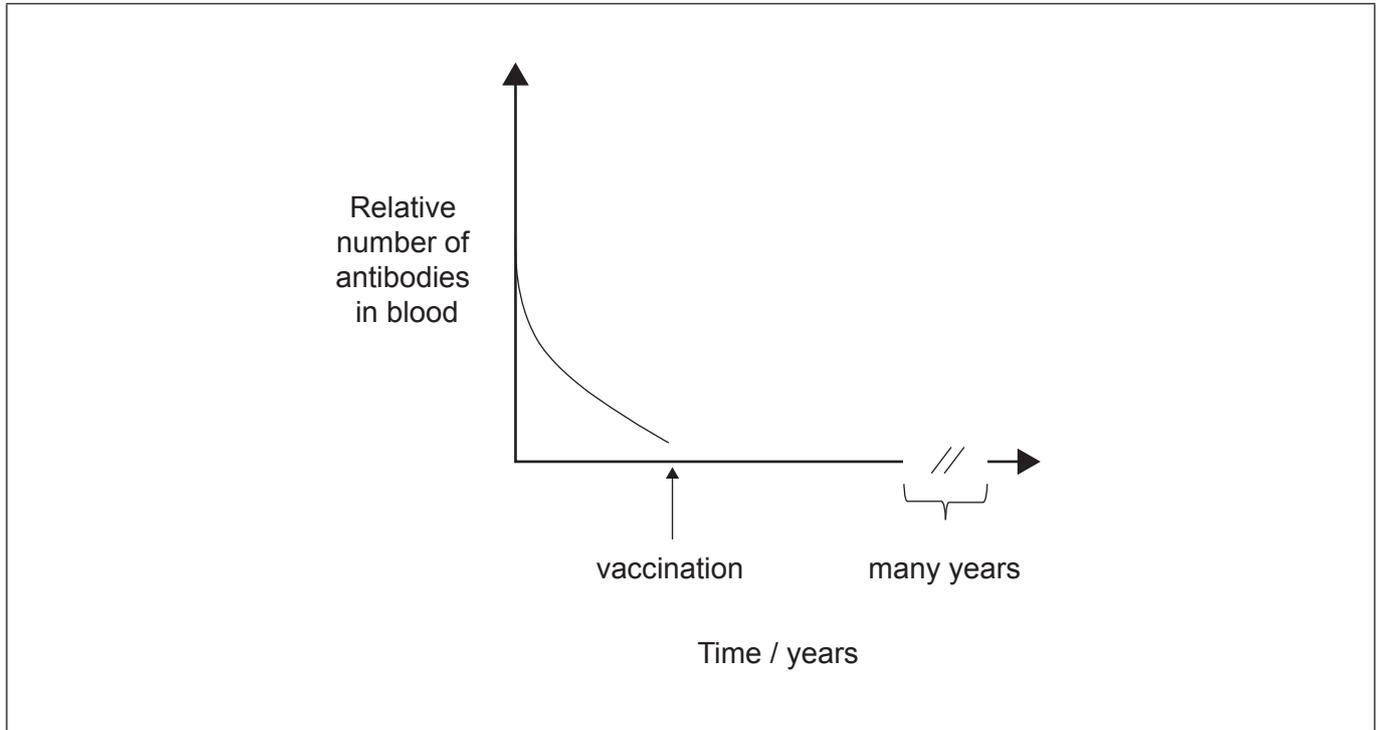
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(Question 3 continued)

A vaccine has been developed to protect people against the symptoms of Lyme disease.

The graph shows the relative number of antibodies specific to these bacteria in the blood of a person **before** vaccination.



(b) (i) Suggest what can be concluded from the graph about the person before they were vaccinated. [1]

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(ii) Sketch a line on the graph to show how the number of antibodies would change over time after vaccination. [1]

(c) Some symptoms of Lyme disease are caused by damage to the central nervous system (CNS). State **both** parts of the CNS. [1]

1.

2.

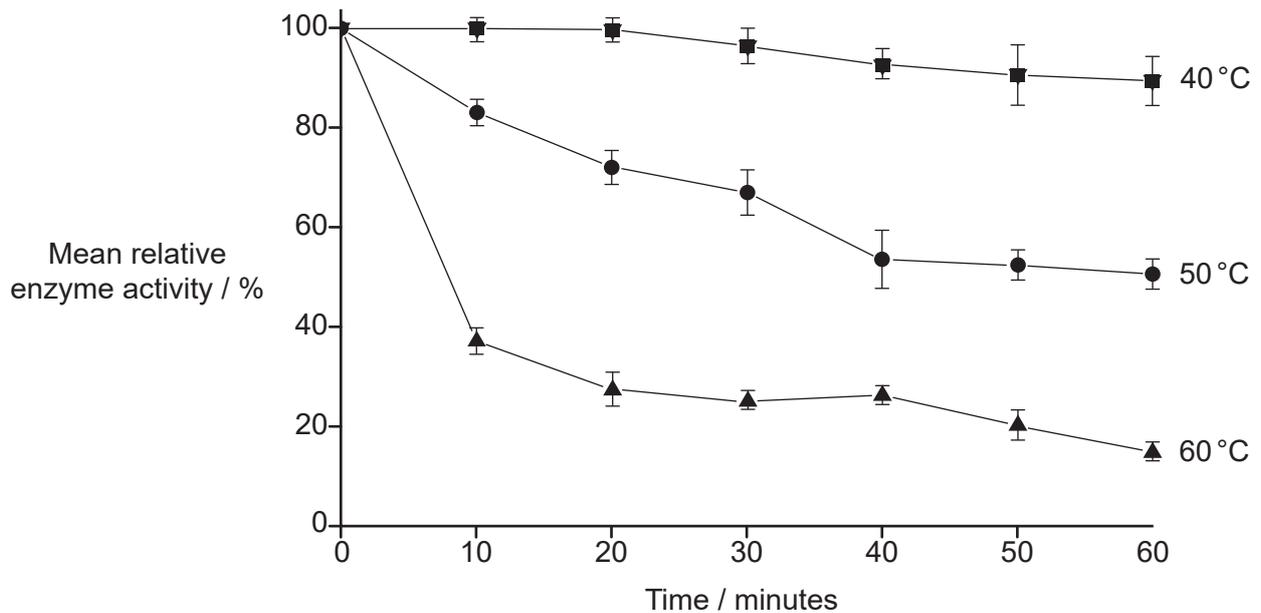


4. A scientist investigated the effect of storage temperature on the activity of an enzyme.

The scientist incubated three lipase solutions for one hour at three different storage temperatures (40 °C, 50 °C or 60 °C).

At every 10-minute interval, a sample of lipase solution was taken and immediately used to catalyse the digestion of a small volume of oil. The values were then compared to the results obtained at the optimum temperature for lipase (37 °C). Relative enzyme activity values were determined.

The graph shows the mean results of the investigation.



(a) Identify the independent variable in this investigation. [1]

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(b) Identify **one** factor that needs to be controlled in this investigation. [1]

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(This question continues on the following page)



(Question 4 continued)

(c) Explain the relationship shown between storage temperature and relative enzyme activity.

[2]

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(d) Describe how the reliability of the results obtained in this investigation is indicated on the graph.

[1]

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(e) When oils are digested, fatty acids are produced. These reduce the pH of the reaction mixture. Explain how the rate of reaction could be measured in this investigation.

[2]

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References:

1. PeterHermesFurian, 2017. *Onion epidermis with large cells under light microscope*. [image online] Available at: <https://www.gettyimages.co.uk/detail/photo/onion-epidermis-with-large-cells-under-light-royalty-free-image/655178448> [Accessed 29 April 2024]. Source adapted.
2. Reproduced from Gregory M. Preston et al., Appearance of Water Channels in *Xenopus* Oocytes Expressing Red Cell CHIP28 Protein, DOI: 10.1126/science.256.5055.385. 1992, AAAS.
3. Lezh, 2008. *Ixodid tick*. [image online] Available at: <https://www.gettyimages.co.uk/detail/photo/ixodid-tick-royalty-free-image/157332347> [Accessed 30 April 2024]. Source adapted.
4. Zheng, C., 2021. Study on enzymatic activity and lipase catalysis by lipase high-yield strain. Conf. Ser.: Earth Environ. Sci. 632 032016. <https://doi.org/10.1088/1755-1315/632/3/032016>. Source adapted.



12EP10

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12EP11

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12EP12