

Biology
Standard level
Paper 1B

Specimen Paper

Candidate session number

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

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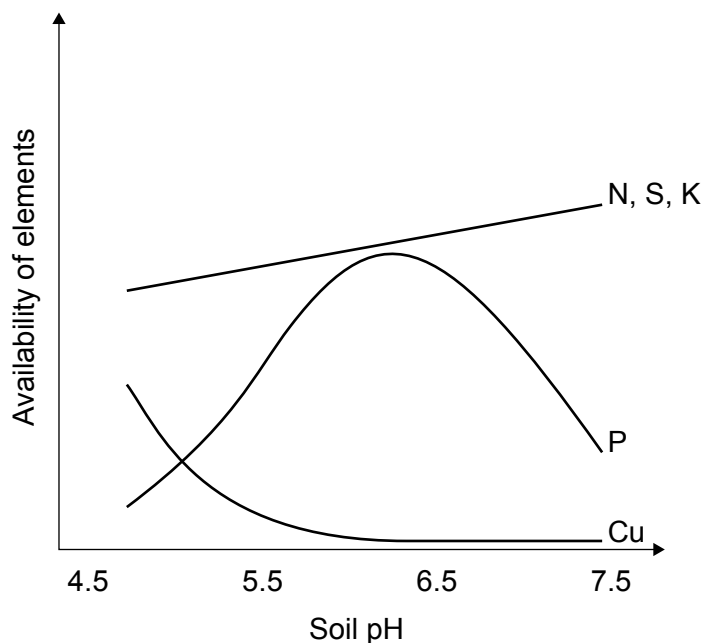
Instructions to candidates

- 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 addition of some forms of nitrogen fertilizer to soil can lead to acidification. As a strategy to combat this, farmers will often undertake ‘liming’ to combat acidification. This involves adding lime to return the pH to neutral.



Certain soil pH levels are associated with copper (Cu) deficiency in cattle.

- (a) Explain how a copper deficiency in soil could lead to a copper deficiency in a cow. [2]

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- (b) Deduce with a reason which action (fertilizing or liming) could lead to a copper deficiency in a cow. [2]

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(Question 1 continued)

- (c) Copper-deficient cows are more susceptible to infections and do not respond as well to vaccinations. Suggest a role for copper in cows.

[1]

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- (d) Phosphorous deficiency leads to poor growth of plants.

- (i) State an example of a soil pH where phosphorous deficiency might result.

[1]

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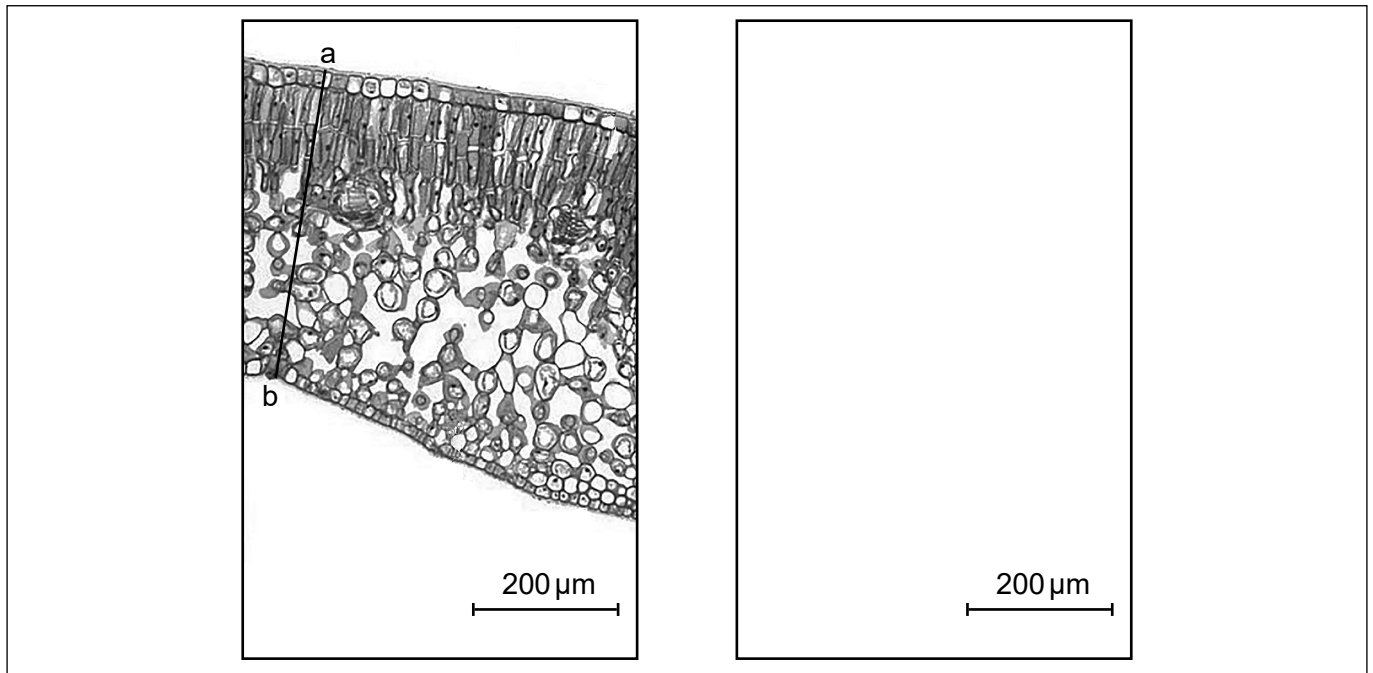
- (ii) List two biochemicals important to life that have phosphorous as a raw material.

[1]

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2. The micrograph shows a transverse section of a leaf from a flowering plant.



- (a) Draw a plan diagram in the right-hand box with labels to show the distribution of tissues in this transverse section of a leaf. [3]
- (b) Calculate the actual thickness of the leaf, from upper to lower surface along the line a–b, showing your working. [2]

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(Question 2 continued)

- (c) Suggest a reason for using a lower power objective lens when first focusing on a slide under the microscope.

[1]

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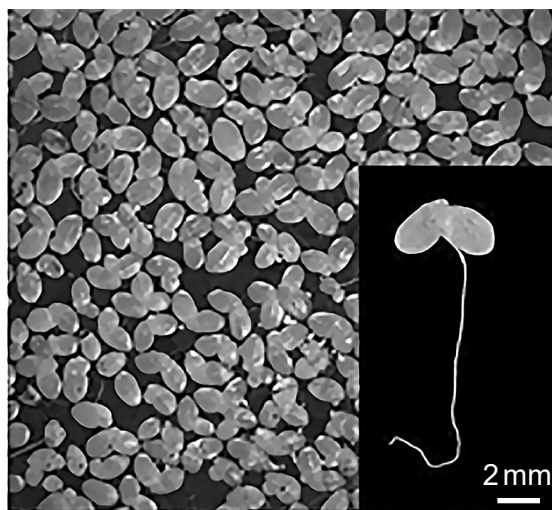
- (d) Identify **one** adaptation of the leaf for the absorption of light visible in this micrograph.

[1]

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3. Duckweed (*Lemna minor*) is a small flowering plant that floats on water. Duckweed can reproduce rapidly using asexual reproduction, giving rise to dense populations.



A group of students investigated the effect of temperature on the rate of population growth of duckweed. They set up three culture dishes using 500ml of filtered pond water with a pH of 7.0. The culture dishes were given a small starting population of plants and each dish was incubated at a fixed temperature (15, 20 or 25 °C).

The number of duckweed plants in each dish was counted over several weeks. The data are summarized in the table.

Time / weeks	Number of plants at a given temperature		
	15 °C ± 1 °C	20 °C ± 1 °C	25 °C ± 1 °C
0	5	5	5
1	10	14	15
2	31	37	50
3	38	76	80
4	24	115	117
5	23	168	177

- (a) Outline what indicates that temperature is the independent variable in this experiment. [1]

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(Question 3 continued)

- (b) Identify the temperature that gives the highest overall population growth rate over the experimental period.

[1]

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- (c) Explain how temperature can influence population growth in a species such as *Lemna minor*.

[2]

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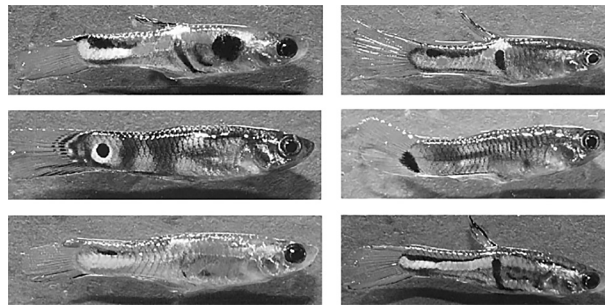
- (d) Suggest how the reliability of this investigation could be improved.

[1]

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4. The images show examples of adult male guppies (*Poecilia reticulata*).



- (a) State the name of the genus to which the guppy belongs.

[1]

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- (b) Outline Linnaeus's morphological concept of species.

[1]

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- (c) (i) Two alternative hypotheses were suggested:

- the guppies were from a single interbreeding population
- the guppies were not from a single interbreeding population.

Explain, with a reason, which hypothesis is stronger.

[1]

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- (ii) Suggest how additional evidence could be used to further test which hypothesis is supported.

[2]

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(Question 4 continued)

- (d) Suggest an adaptive advantage for these guppies of having striking colour patterns. [1]

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References:

1. Jamieson, J.D. and Palade, G.E., 1967. Intracellular transport of secretory proteins in the pancreatic exocrine cell. *Journal of Cell Biology*, 34, pp.597–615.
2. Houseman, J. and Ford, M., 2014. *Dicot leaf L*. [image online] Available at: <https://commons.wikimedia.org/wiki/File:Dicot_leaf_L.jpg> [Accessed 28 July 2020].
3. *Lemna minor*, 2015. [image online] Available at: <<https://www.semanticscholar.org/paper/Darwin-Wallace-Demons%3A-survival-of-the-fastest-in-Kutschera-Niklas/a2e3531fa8c1920d2bd4d04871bfeb19ed2143f0>> [Accessed 8 December 2020].
4. Jones, J.C., Gunter, H.M. and Meyer, A., 2008. Will he still look good with the lights on? Spectral tuning of visual pigments in fish. *Journal of Biology*, [e-journal] 7(26). Available at: <<https://jbiol.biomedcentral.com/articles/10.1186/jbiol86>> [Accessed 28 July 2020].



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