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Biology
Higher level
Paper 1B

12 May 2025

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

Candidate session number

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2 hours [Paper 1A and Paper 1B]

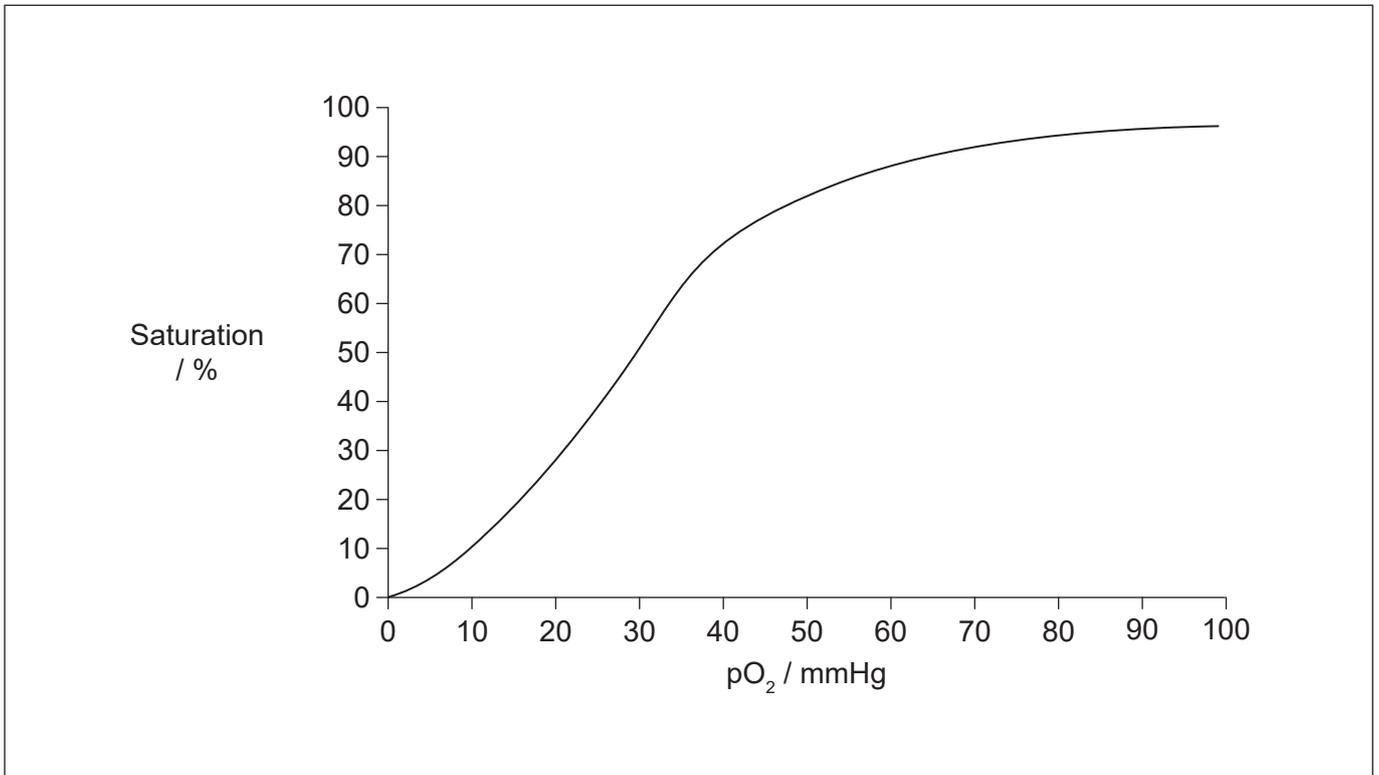
Instructions to candidates

- 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 **[35 marks]**.
- The maximum mark for paper 1A and paper 1B is **[75 marks]**.



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

1. Oxygen dissociation curves show the percentage of oxygen saturation of adult haemoglobin (Hb) at different oxygen concentrations, as measured in partial pressure of oxygen (pO_2).



- (a) Identify the percentage of oxygen saturation of haemoglobin at a partial pressure of 40 mmHg. [1]

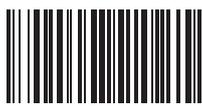
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- (b) Describe the relationship between partial pressure of oxygen (pO_2) and percent saturation of haemoglobin. [2]

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- (c) On the graph, sketch an oxygen dissociation curve for foetal haemoglobin. [1]

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(Question 1 continued)

(d) Describe an adaptation of haemoglobin for the transport of oxygen.

[1]

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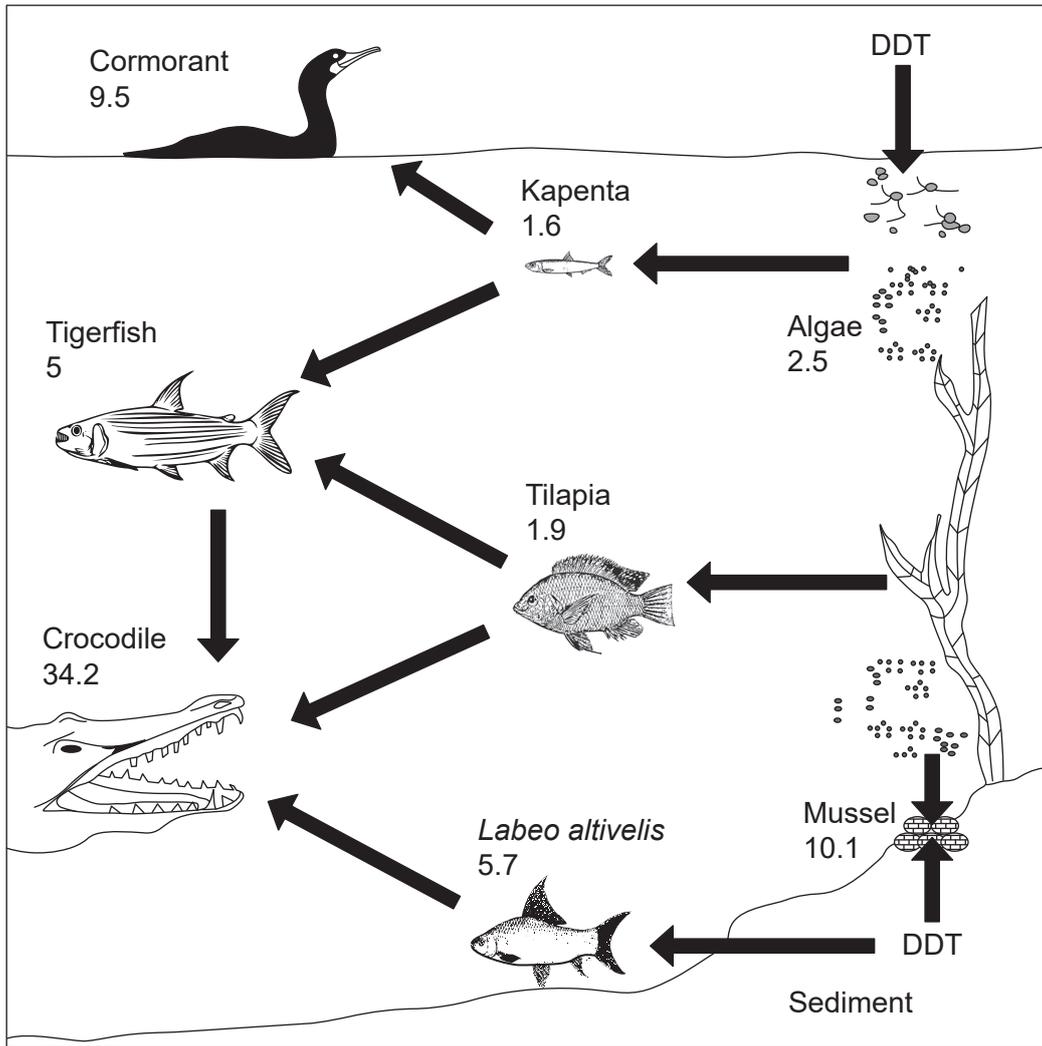
(e) Describe how tidal volume can be measured in a human.

[3]

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2. The diagram shows levels of DDT, a pesticide, in an aquatic food web in Lake Kariba, Africa. Numbers represent ppm (parts per million) of DDT in fat tissue.



- (a) Justify the observation that the crocodile has a higher mean DDT level than the cormorant or tigerfish.

[2]

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(This question continues on the following page)



(Question 2 continued)

(b) Identify, with a reason, which fish would be the safest to consume. [2]

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(c) Outline how the population size of tilapia could be estimated. [3]

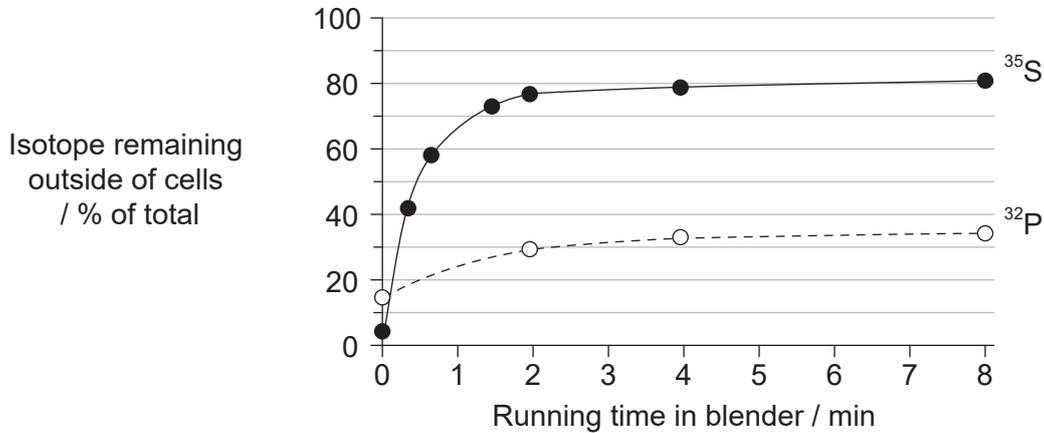
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(d) Discuss the impact of overfishing in Lake Kariba and how sustainable harvesting of resources can be assessed. [4]

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3. The graph shows results of an experiment by Hershey and Chase in 1952, in which bacteria were infected with a mixture of virus particles labelled with ^{32}P or ^{35}S isotopes. A suspension of the infected bacteria was agitated with a blender, and samples collected from the suspension were centrifuged to record the percentage of isotope remaining directly outside of the cells.



- (a) Calculate the difference between the percentages of ^{35}S and ^{32}P remaining outside bacterial cells at 2 minutes.

[1]

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- (b) Explain how this data provides evidence that DNA is the genetic material of cells.

[3]

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(Question 3 continued)

(c) (i) Draw a labelled diagram to show the structure of a DNA nucleotide. [3]

(ii) List the DNA nucleotides that are purines and pyrimidines. [1]

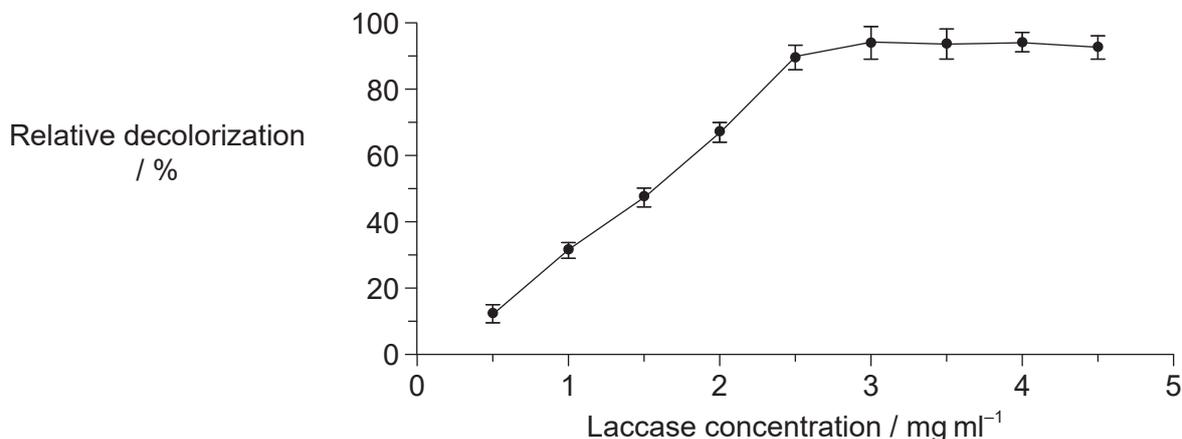
Purines:

Pyrimidines:



4. Laccase is an enzyme that has the ability to decompose synthetic dyes used in the production of clothing and thus could potentially help reduce synthetic dye pollution.

An experiment was performed in which laccase was immobilized in alginate beads to determine the effectiveness of laccase immobilization in decolorizing the dye crystal violet. The graph shows the effect of laccase concentration on relative decolorization activity of the immobilized laccase. Error bars represent \pm SD.



- (a) Predict the relative decolorization of crystal violet at an laccase concentration of 5 mg ml⁻¹. [1]

.....%

- (b) Deduce the significance of overlapping error bars in the data for laccase concentrations from 3 mg ml⁻¹ to 4 mg ml⁻¹. [1]

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(Question 4 continued)

(c) Discuss the variables that need to be controlled in this investigation. [2]

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(d) Suggest how the percentage of decolorization could be obtained experimentally. [3]

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(e) Distinguish between processes involved in cyclical and linear metabolic pathways. [1]

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References:

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3. Used with permission of Rockefeller University Press from *Journal of General Physiology*, Hershey AD and Chase M, vol 36, no 1, 1952; permission conveyed through Copyright Clearance Center, Inc.
4. Mogharabi, M., Nassiri, N., Bozorgi-Koushalshahi, M., Nafissi-Varcheh, N., Bagherzadeh, G. and Faramarzi, M., 2012. Immobilization of Laccase in Alginate-Gelatin Mixed Gel and Decolorization of Synthetic Dyes. *Bioinorganic Chemistry and Applications* vol 2012. <https://doi.org/10.1155/2012/823830>. Source adapted. Licensed under CC BY 3.0 Attribution Unported Deed (<https://creativecommons.org/licenses/by/3.0/deed.en>).

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12EP10

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12EP11

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12EP12