Biology
Higher level
Paper 1B

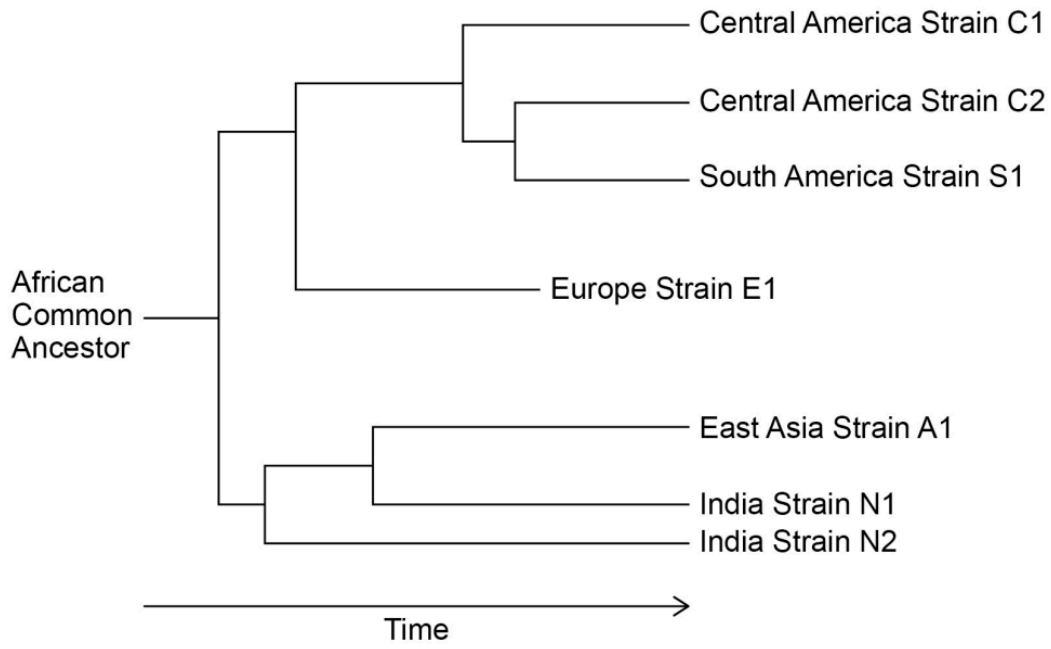
IB Biology HL prediction paper 1B

2 hours [Paper 1A and Paper 1B]

Instructions to candidates

- Do not open this examination paper until instructed to do so.
- Answer all the questions.
- Answers must be written within the answer boxes provided.
- A calculator is required for this paper.
- This product is an unofficial resource and is not affiliated with, endorsed by, or produced by the International Baccalaureate Organization (IBO).
- The maximum mark for paper 1B is **[35 marks].**
- The maximum park for paper 1A and paper 1B is **[75 marks].**

1. A phylogenetic diagram for multiple **Plasmodium vivax** strains from different world regions is shown below.



(a) Identify the pair of strains that share the most recent common ancestor. [1]

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(Question 1 continued)

(b) State what a node represents in a cladogram and define a clade. [2]

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(c) Deduce, with one piece of evidence from the branching pattern, whether Europe strain E1 is more closely related to Central America strain C2 or to East Asia strain A1. [2]

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(Question 1 continued)

(d) Explain how the molecular clock can be used to estimate the divergence time between Central America C1 and South America S1, and outline **one limitation** of this approach. [3]

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(e) Suggest one evolutionary reason why *P. vivax* is now rare in Africa despite an African common ancestor. [1]

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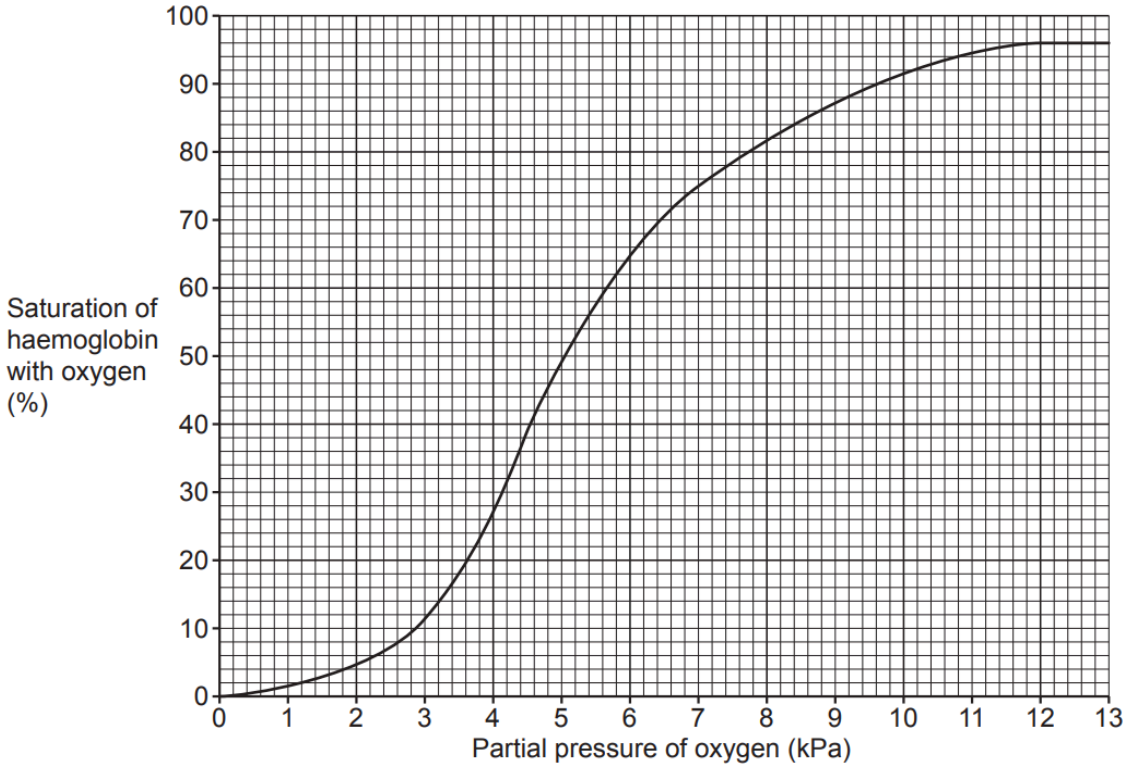
2. The image shows an oxygen dissociation curve for the mother's haemoglobin.



(a) At **5.0 kPa**, estimate the percentage saturation of maternal haemoglobin. [1]

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(**Question 2 continued)**

(b) Calculate the change in saturation between **4.0 kPa** and **8.0 kPa**. [2]

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(c) State the name of the iron-containing group that binds O_2 in haemoglobin. [2]

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(d) Describe how cooperative binding gives the dissociation curve its sigmoidal shape. [2]

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(**Question 2 continued)**

(e) Explain why the foetal haemoglobin (HbF) curve is expected to be left-shifted relative to the maternal curve and how this supports oxygen transfer at the placenta. . [3]

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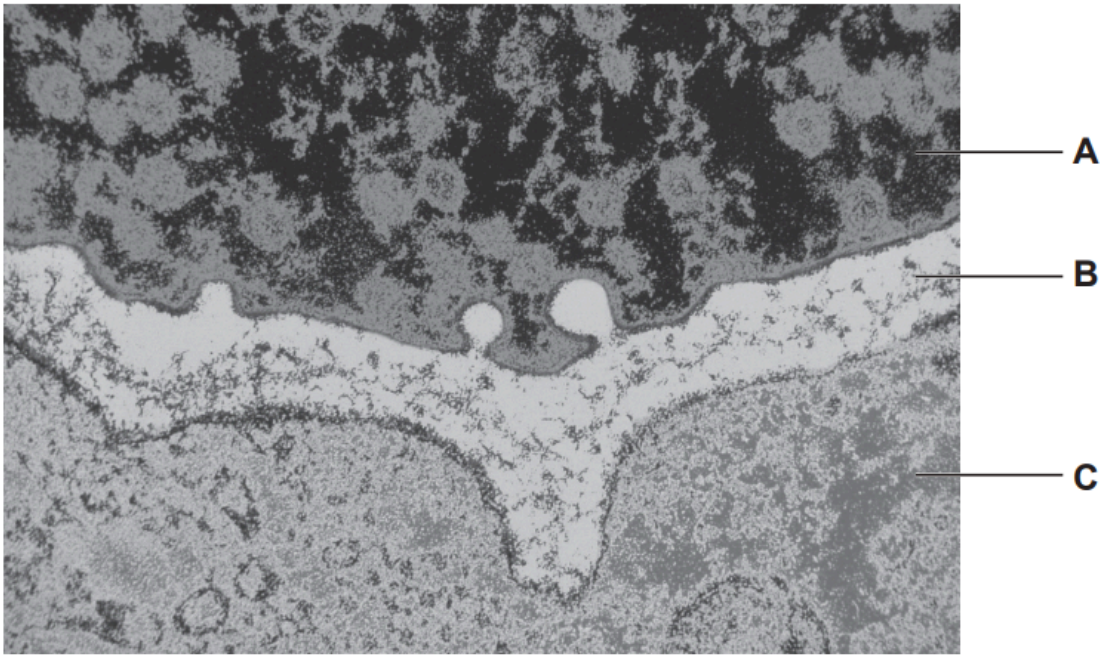
3. The electron micrograph below shows the junction between two neurons with labels A-C.



(a) **Label** the structures indicated: A, B and C. [1]

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(Question 3 continued)

(b) Describe how synaptic vesicles are formed, trafficked and prepared for release at the presynaptic active zone. [3]

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(Question 3 continued)

(c) A neurotoxin inhibits **acetylcholinesterase** at the synapse. Explain the effect on postsynaptic action potential generation and muscle control. [2]

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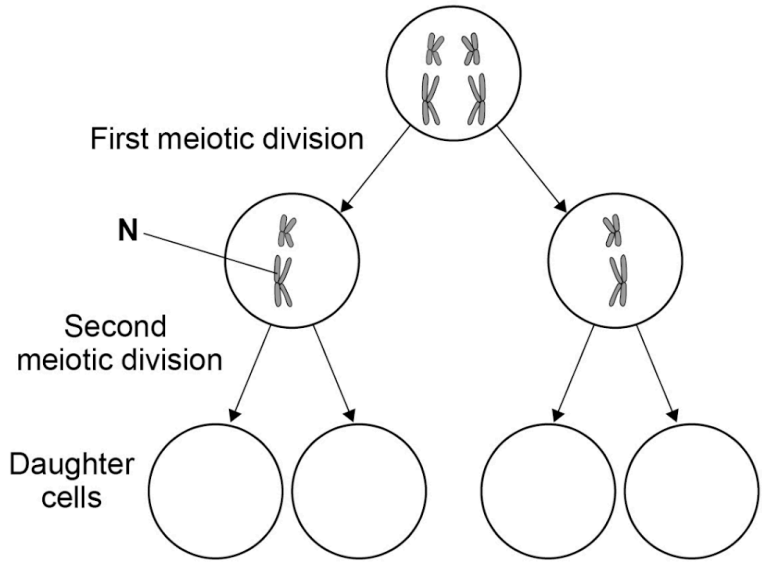
4. The image shows a cell after meiosis I; during meiosis II a non-disjunction event occurs in the chromosome labelled **N**.



(a) Identify in which division the non-disjunction occurred. [1]

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(b) Predict the chromosomal content of the four daughter cells for chromosome N after meiosis II. [2]

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(Question 4 continued)

(c) Explain one possible outcome for chromosome number in the zygote if an abnormal gamete from (b) fuses with a normal gamete. [2]

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(d) A test cross for a gene on chromosome N gives 58 dominant : 22 recessive offspring (**n = 80**). Assuming a 1:1 expectation, **use a chi-squared (χ^2) test** to determine if the deviation is significant at **p = 0.05**; **df = 1**, critical χ^2 = **3.84**. Show working and **state your conclusion**. [4]

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