UNIVERSITY OF CAMBRIDGE

NATURAL SCIENCES TRIPOS Part 1A

PHO/1

Physiology of Organisms – Written paper (theory)

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4 June 2021 (1130-1430)

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*Answer **ALL 10** questions from Section A (SAQs), and **2 questions** from Section C (essays). Section A represents 25% of the total mark for the Physiology of Organisms exam. Section C represents 50% of the total mark for the exam. You are advised to divide your time accordingly. (Section B was the practical paper which was taken separately – it is not part of this paper).*

*You have **3 hours** (plus any pre-agreed individual adjustment) to answer this paper. You must complete this paper within this time-period. Uploading time should not be included in the allocated exam time.*

Word process your answers in one of the following formats: .doc, .docx, .rtf or .txt (or with permission, hand write), and strictly observe the word limits. There are no word limits for Section A, but there is a 1500 word limit for each essay in Section C.

You may hand-draw and submit scans or photographs of e.g. equations and figures. Please embed these images into your answer document if you can; if this is difficult you may upload them separately. Candidates should not copy and paste images from any other documents.

Please submit all your answers to Section A as one document.
Please submit each essay in Section C as a separate document.

You should therefore submit 3 documents in total (plus any image files if you are uploading them separately). Please name these as:

Candidate number_SectionA.docx (e.g. 7850X_SectionA.docx)

Candidate number_SectionC_essaynumber.docx (e.g. 7850X_SectionC_4.docx)

Please embed any images within the appropriate file if you can, but if you have to upload them separately please name them as per the following (using Section A or C as appropriate). You may upload them as .jpg or .tiff files.

Candidate number_SectionA_fig1.jpg (e.g. 7850X_SectionA_fig1.jpg)

Follow the guidance on the online exam site on how to upload your documents.

Candidates are permitted to use an approved calculator.

Section A. Theory short-answer questions (SAQs)

You must answer **ALL 10** questions below. Include all your answers in the same document (i.e. you upload one document covering all of this section). The first page of this question paper explains how this document should be named.

There is no word limit in Section A, but we strongly advise you spend no longer than 6 minutes on any one question. We are expecting a relatively brief answer to each question.

1. Briefly explain how myelination increases conduction velocity in a nerve fibre.

2. List the factors influencing flow through a cylindrical vessel. What would be the effect of halving vessel radius? Give one example from animals and one from plants of when flow-rate through such a vessel would be substantially reduced below normal.

3. Outline three similarities and three differences between mammalian and insect respiratory systems.

4. The night before running a marathon, an athlete consumes a large bowl of pasta. The carbohydrate eaten is interconverted (changed in type) in several steps between ingestion and the race itself. Describe these carbohydrate interconversions, stating how and where they take place.

5. How, when and from where is ADH released? What are the actions of ADH on the mammalian kidney?

6. List three effects of sympathetic nerve stimulation on the cardiovascular system, and a further three effects on thermoregulation.

7. Briefly explain how plants might signal and respond to salt stress.

8. Summarise the ways plants can increase their acquisition of nitrogen.

9. Write brief notes on the similarities and differences between the interactions of plants with fungal biotrophs and with mycorrhizal fungi.

10. How would you calculate the resilience of a biological material? Outline the experimental procedure you would use and how you would calculate resilience from the data obtained.

(Section C is overleaf. Section B was the practical paper, taken separately.)

Section C. Essays

Answer **TWO** of the following essay questions, with a maximum of **one** from question C1.

Save and upload each essay as a separate file. The first page of this question paper explains how these two documents should be named.

There is a strict word limit of 1500 words per essay. This does not include the title, but it does include any figure legends and text in tables. Assessors will stop reading once the word limit is reached.

C1. **Either** (a) Discuss three physiological implications of being aquatic, for animals.

Or (b) Why is auxin important for plants?

C2. What is the physiological significance of membrane potentials? Include examples from different organisms.

C3. Discuss how animals and plants would respond to increased CO_2 levels in their local environment.

C4. Compare and contrast how plants and animals sense and respond to light.

C5. Discuss the advantages and disadvantages of having a cell wall.

(End of paper)