



88076002

**BIOLOGY
HIGHER LEVEL
PAPER 2**

Friday 2 November 2007 (afternoon)

2 hours 15 minutes

Candidate session number

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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.
- Section A: answer all of Section A in the spaces provided.
- Section B: answer two questions from Section B. Write your answers on answer sheets. Write your session number on each answer sheet, and attach them to this examination paper and your cover sheet using the tag provided.
- At the end of the examination, indicate the numbers of the questions answered in the candidate box on your cover sheet and indicate the number of sheets used in the appropriate box on your cover sheet.

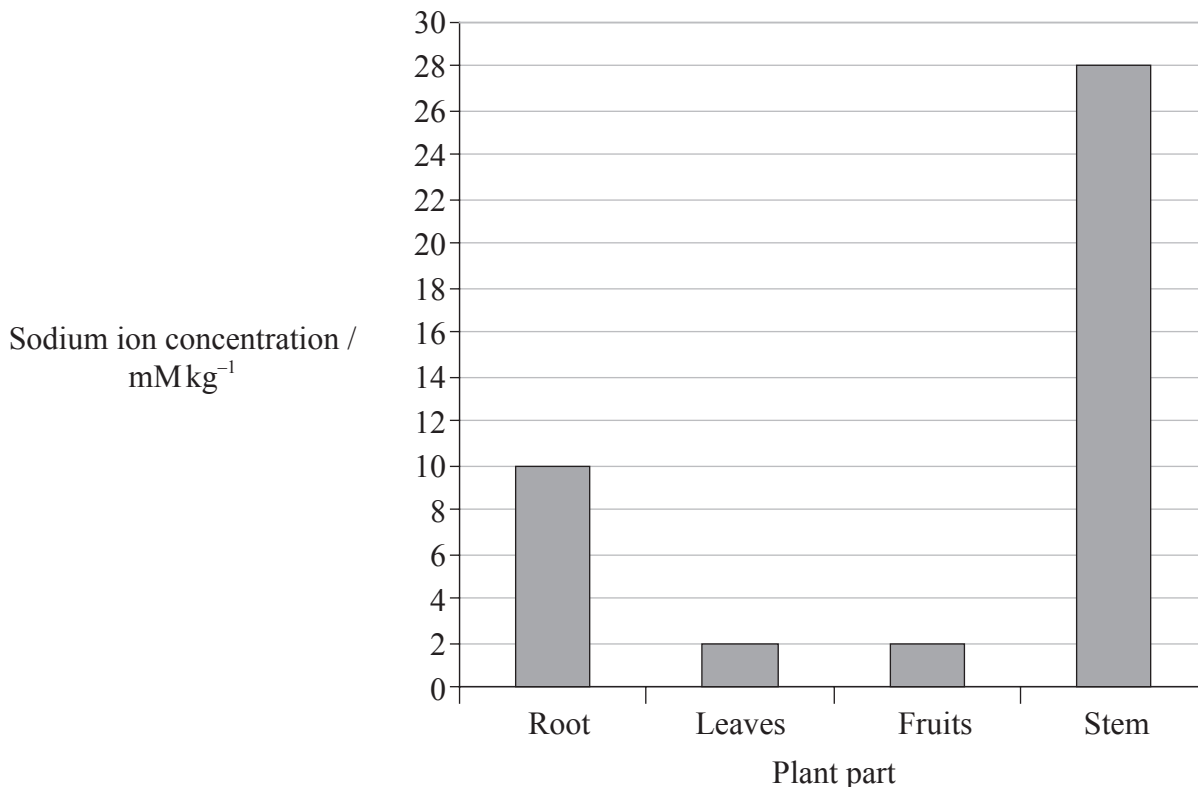


SECTION A

Answer **all** the questions in the spaces provided.

1. Sweet pepper (*Capsicum annuum*) is an important widespread agricultural crop. Scientists studied the transport and distribution of sodium in sweet pepper by growing plants in sodium chloride solutions.

The graph below shows the sodium ion concentration in plant parts of sweet pepper grown in 15 mM sodium chloride for three weeks.



[Source adapted from: M Bloom-Zandstra, *et al.*, Sodium fluxes in sweet pepper exposed to varying sodium concentrations, *Journal of Experimental Botany*, 1998, Vol. 49, No 328, pp. 1863-1868, by permission of Oxford University Press.]

- (a) (i) State the concentration of sodium ions in fruits. [1]

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- (ii) Calculate the percentage increase in sodium ion concentration between root and stem. [1]

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(Question 1 continued)

- (b) Suggest why a high sodium ion concentration in the cells of the stem is important in providing support to this type of plant. [1]

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- (c) State **one** possible use of sodium in plants. [1]

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- (d) Scientists also found that the concentrations of sodium ion in cells of the stem and in xylem sap were the same. Explain why this led the scientists to believe there was no active transport between xylem and stem. [2]

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- (e) Suggest **one** possible method of transport of sodium ions between xylem and stem. [1]

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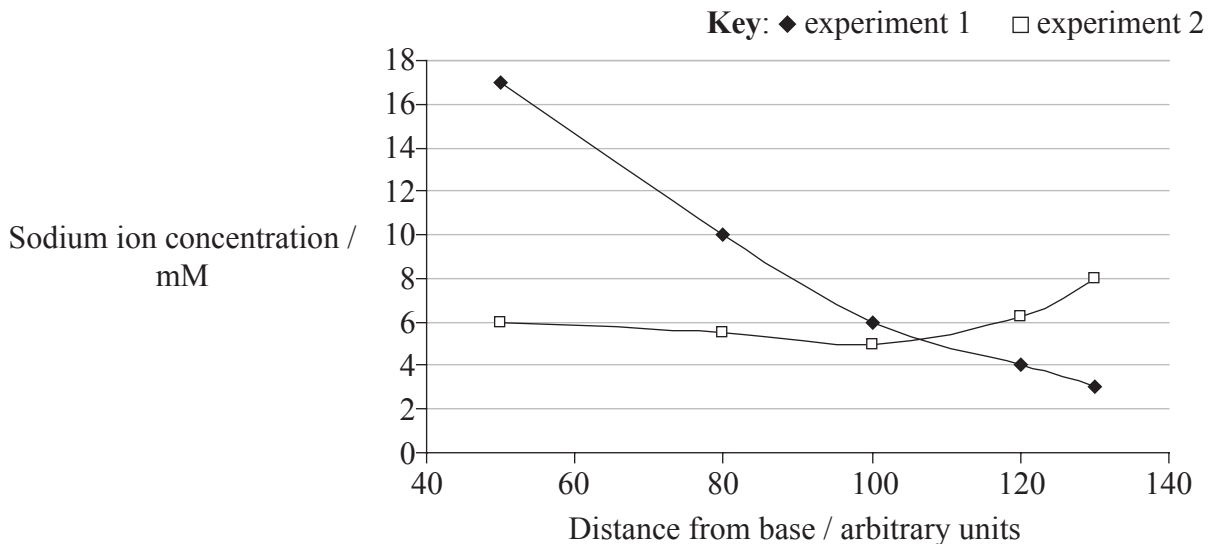


(Question 1 continued)

The graph below shows the sodium ion concentration of the xylem sap in relation to the distance from the base. Two experiments were performed.

Experiment 1: plants grown in 15 mM sodium chloride solution only

Experiment 2: plants grown in 15 mM sodium chloride solution and then transferred to a sodium-free solution for an extra week



[Source adapted from: M Bloom-Zandstra, *et al.*, Sodium fluxes in sweet pepper exposed to varying sodium concentrations, *Journal of Experimental Botany*, 1998, Vol. 49, No 328, pp. 1863–1868, by permission of Oxford University Press]

(f) State the relationship between sodium ion concentration and distance from the base of the stem in experiment 1. [1]

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(g) (i) State the sodium concentration when the stem is 50 arbitrary units from the base in plants for each of the following. [1]

Experiment 1:

Experiment 2:

(ii) Explain the difference in the sodium ion concentration in this part of the stem in plants of experiment 1 and experiment 2. [2]

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(Question 1 continued)

- (h) Compare the distribution of sodium ions in the stems of plants in both experiments. [3]

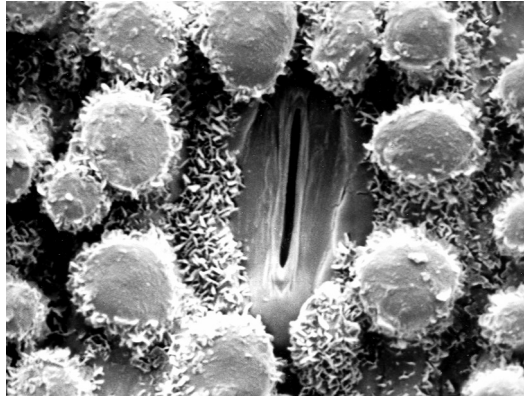
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(Question 1 continued)

Water transported in xylem is transpired through stomata in leaves. The electron micrograph shows one stoma of the lower epidermis of the leaf of a Simon bamboo (*Arundinaria simonii*). Its magnification is $\times 3000$.



[Source: Courtesy of Professor Zulma E Rúgolo, *Instituto Darwinion*, Buenos Aires, Argentina]

(i) (i) Draw a line showing the maximum length of the stomatal pore. [1]

(ii) Calculate the real size of the stomatal pore. Show your working. [1]

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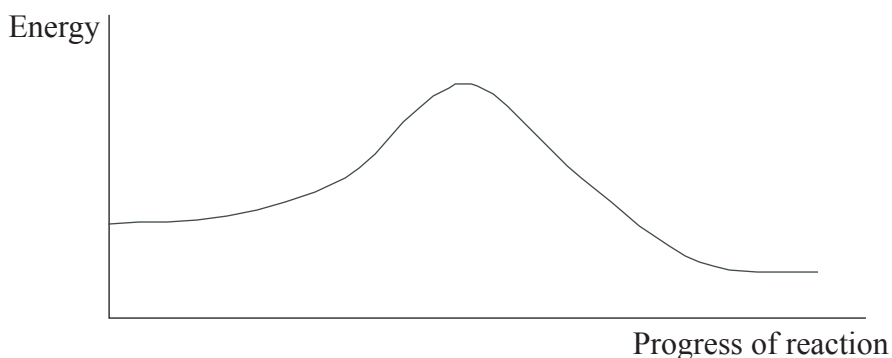
(j) Explain **two** abiotic factors that affect transpiration rate in this leaf. [2]

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2. (a) The table below compares prokaryotic and eukaryotic cells. Place a tick (✓) wherever the organelle is present. [2]

Organelle	Prokaryotic	Eukaryotic
Nucleus		
Mitochondrion		
Ribosomes		

- (b) (i) The graph below shows the energy changes in a reaction.



On the above graph draw the result you would obtain in this same reaction if an enzyme that catalyses this reaction were added. [1]

- (ii) Explain how the enzyme produces this effect. [3]

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(Question 2 continued)

(c) Outline the process of glycolysis. [3]

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3. (a) State **one** advantage and **one** disadvantage of genetic modification technology for crop plants. [2]

Advantage:
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Disadvantage:
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(b) Explain the effect of base substitution mutation in sickle cell anemia. [3]

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SECTION B

Answer **two** questions. Up to two additional marks are available for the construction of your answers. Write your answers on the answer sheets provided. Write your session number on each answer sheet, and attach them to this examination paper and your cover sheet using the tag provided.

4. (a) Outline how polar amino acids and non-polar amino acids control the position of proteins in plasma membranes. [6]
- (b) Draw and label the structure of a motor neuron. [4]
- (c) Explain how nerve impulses travel along a neuron. [8]
5. (a) Explain how the function of arteries, capillaries and veins is related to their structure. [8]
- (b) Blood carries hormones around the body. State **two** roles of:
- (i) HCG (Human Chorionic Gonadotrophin). [2]
- (ii) LH (Luteinizing hormone). [2]
- (c) Antibodies are also carried in blood. Describe the production of monoclonal antibodies and their use in diagnosis and treatment. [6]
6. (a) Explain how meiosis can result in genetic variety in gametes. [8]
- (b) Outline how the chi-square test can be used in analyzing monohybrid crosses. [6]
- (c) Describe the inheritance of human skin colour. [4]
7. (a) Draw and label the action spectrum of photosynthesis. [4]
- (b) Explain the relationship between the structure of the chloroplast and the light-dependent reactions of photosynthesis. [8]
- (c) Outline the potential harmful effects of increased carbon dioxide concentration on the ecosystem and state **one** measure that could be taken to reduce the amount of carbon dioxide in the atmosphere. [6]

