Programa del Diploma

Biology
Standard level
Paper 2

13 May 2025

Zone A morning | **Zone B** morning | **Zone C** morning

Candidate session number

1 hour 30 minutes

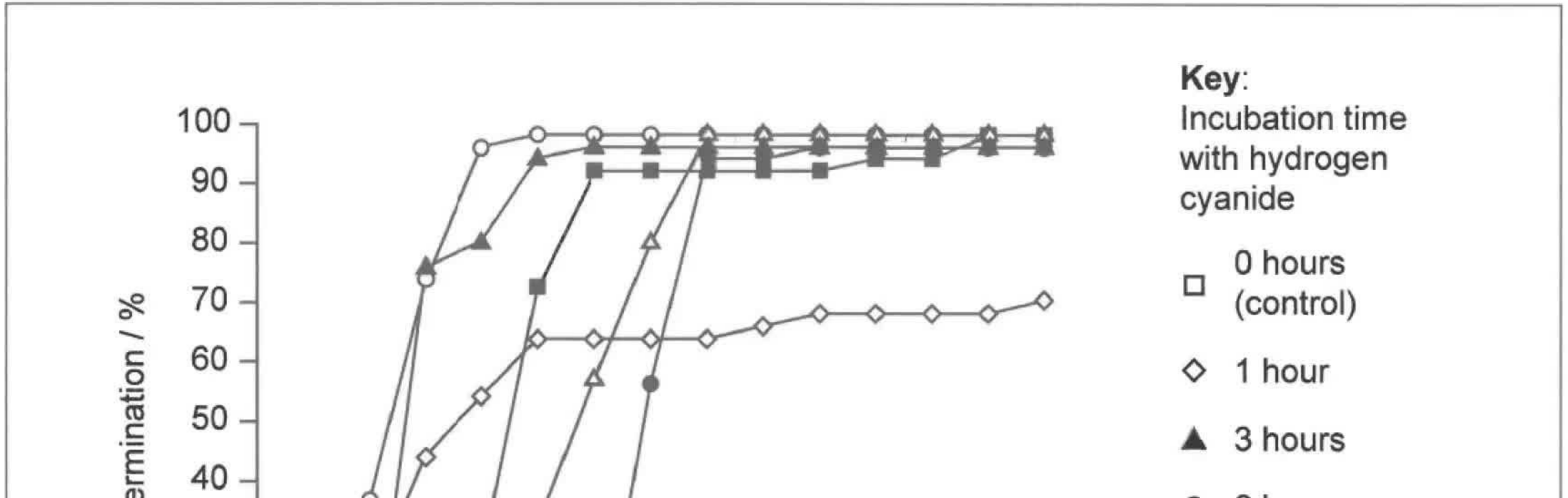
Instructions to candidates

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Section A: answer all questions.
- Section B: answer one question.
- Answers must be written within the answer boxes provided.
- A calculator is required for this paper.
- The maximum mark for this examination paper is **[50 marks]**.

Section A

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

1. Cyanide, a chemical found in all living organisms, is known to stimulate seed germination in many plant species. Cyanide is also known to be an inhibitor of cellular respiration. Freshly harvested sunflower (*Helianthus annuus*) seeds were incubated with hydrogen cyanide for different periods of time and then exposed to the conditions required for germination. The graph shows the percentage of seeds that had germinated over fourteen days.



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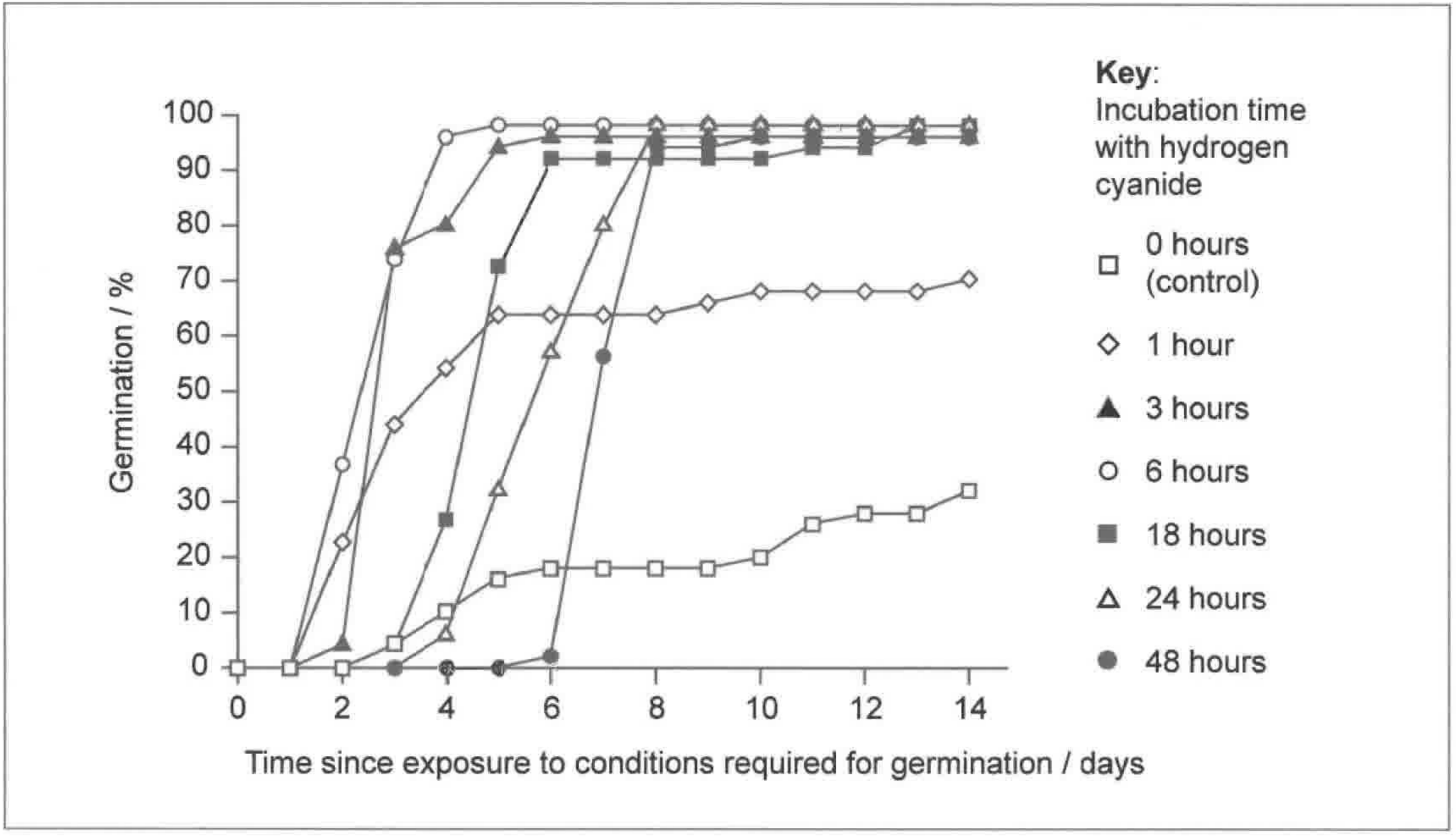

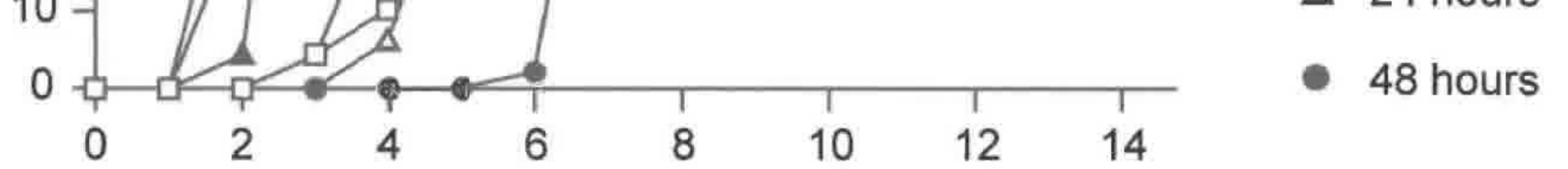

Time since exposure to conditions required for germination / days

(a) State the percentage of seeds that had germinated after 10 days with no hydrogen cyanide incubation time. [1]

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(b) Sketch a line on the graph to show what the results for seeds incubated for 60 hours in hydrogen cyanide might look like. [2]

(c) Compare and contrast the results for seeds incubated for 18 hours with those for the control seeds over the period of the experiment. [2]

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(d) Cyanide is also known to inhibit respiration. Suggest how this is shown in the graph. [1]

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(e) Evaluate the hypothesis that 6 hours incubation with hydrogen cyanide is the optimum time for seed germination. [2]

(Question 1 continued)

Ethylene is a chemical that promotes germination in sunflower seeds. Cyanide is known to activate ethylene production.

Four groups of sunflower seed embryos were treated as follows:

- D Control: dormant (not yet able to germinate) seed embryos not incubated with cyanide
- D Cyanide: dormant (not yet able to germinate) seed embryos incubated with cyanide for 3 hours
- ND Control: non-dormant (able to germinate) seed embryos not incubated with cyanide
- ND Cyanide: non-dormant (able to germinate) seed embryos incubated with cyanide for 3 hours

The graph shows the mean volume of ethylene emission by the four groups of seed embryos measured over a period of 5 hours at 20 °C.

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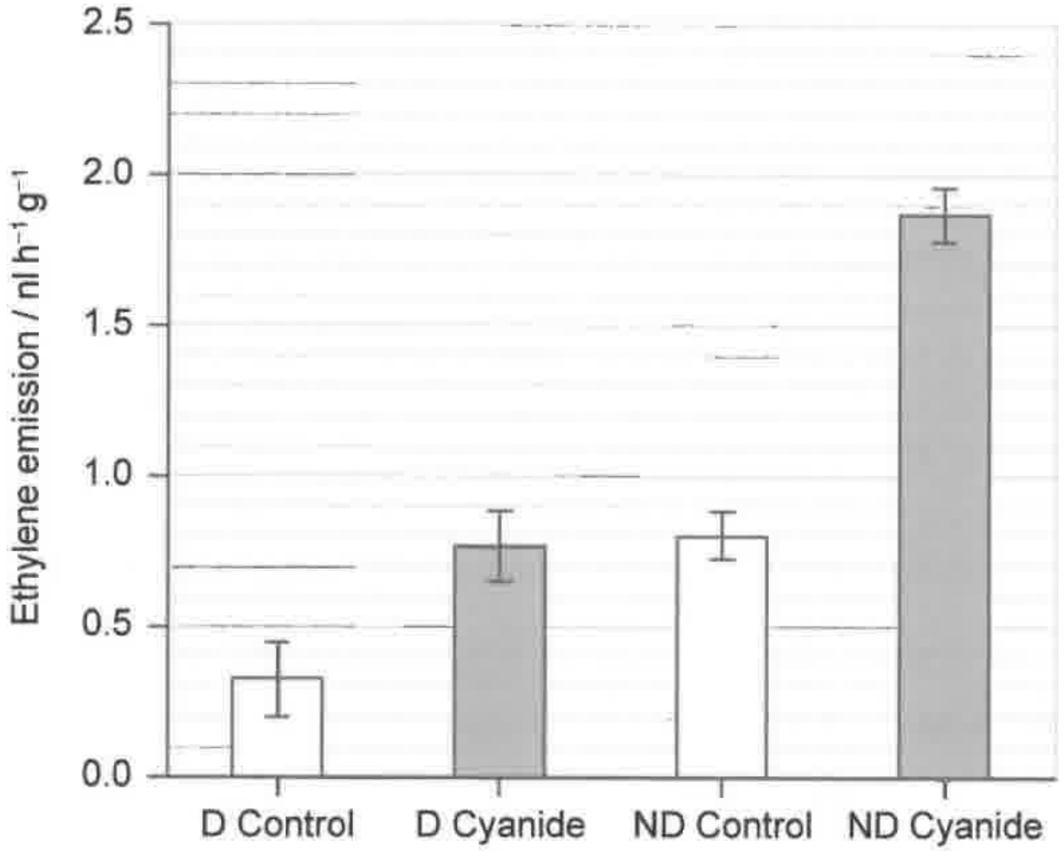

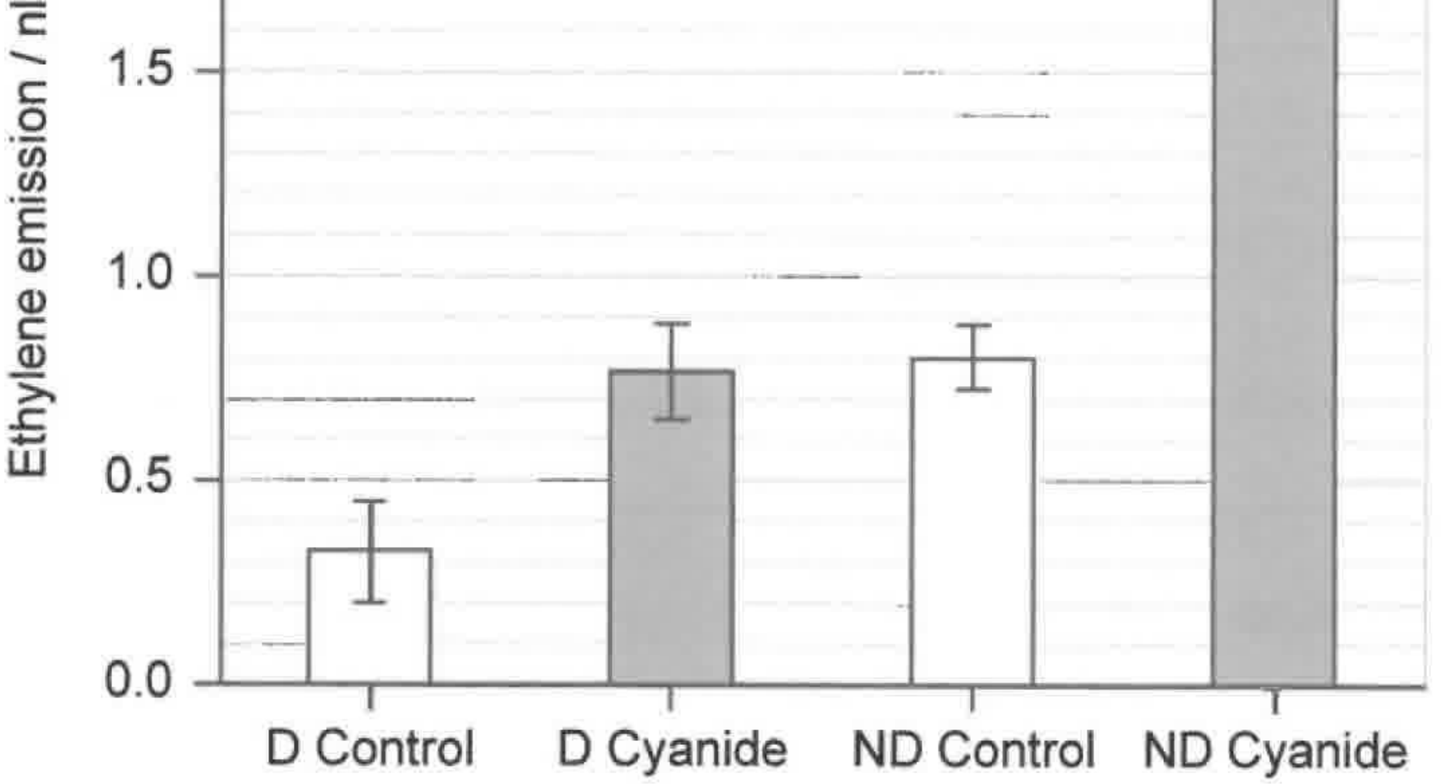

(f) State the mean increase in ethylene emission in the dormant sunflower seed embryos due to the presence of cyanide. [1]

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(Question 1 continued)

(g) Calculate the percentage change in the ethylene emission in the non-dormant sunflower seed embryos due to the presence of cyanide. [1]

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(h) Compare and contrast the effects of cyanide incubation on mean ethylene production for dormant (D) and non-dormant (ND) seed embryos. [2]

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2. Populations evolve by natural selection due to interactions with the environment and other species within the ecosystem.

(a) Identify **one** source of genetic variation in a population. [1]

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(b) Explain how natural selection is influenced by changes in the environment. [2]

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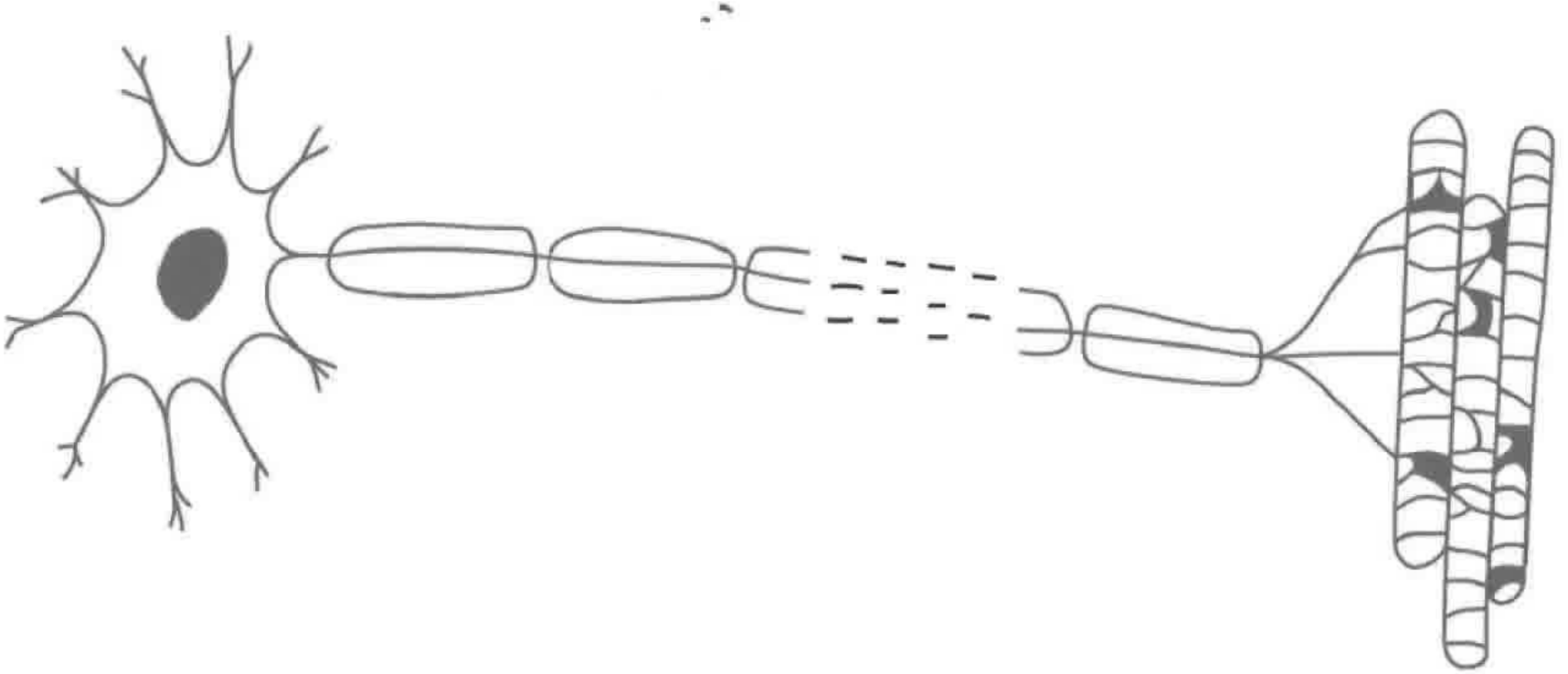
(c) Explain how the loss of a keystone species affects an ecosystem. [2]

3. The neuron is a specialized cell that exhibits a structure important to its function.
The diagram shows a neuron interacting with a muscle cell.



(a) Determine, with a reason, whether this neuron is insulated. [1]

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(b) List **two** structures that neurons have in common with prokaryotic cells. [2]

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(c) Describe how neurotransmitters are released from a presynaptic neuron membrane. [3]

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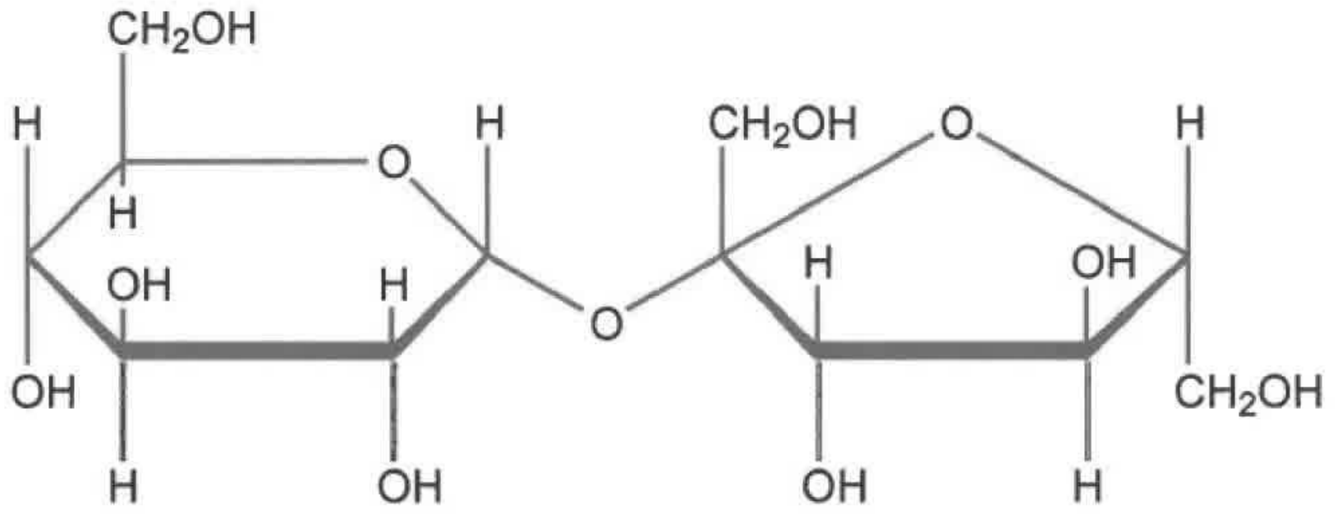
4. The image shows the molecular structure of sucrose, which the body digests in order to absorb the monosaccharides glucose and fructose.



Sucrose

(a) State the type of reaction that produces monosaccharides from disaccharides. [1]

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(b) Describe how capillaries are adapted for exchange of monosaccharides. [2]

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. . . . . .

(b) Describe how capillaries are adapted for exchange of monosaccharides. [2]

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(c) Outline how fructose could be transported by facilitated diffusion across cell membranes. [2]

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5. Watson and Crick's discovery of the double helical structure of DNA gave rise to our current understanding of genes.

(a) State the name of the monomers that make up DNA. [1]

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(b) Distinguish between the structure of DNA and RNA. [2]

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(c) From experiments, it was concluded that pea (*Pisum sativum*) plants have a recessive allele (t) for short stems. Explain the reason that recessive alleles are not always expressed in the phenotype. [3]

Section B

Answer **one** question. One additional mark is available for the construction of your answer.
Answers must be written within the answer boxes provided.

6. Water is one of the most abundant molecules on Earth. Living organisms must maintain homeostatic levels of water to survive.

(a) Outline how the cohesive properties of water benefit living organisms. [4]

(b) Outline how environmental factors affect the rate of transpiration in plants. [4]

(c) Explain the process of osmosis with reference to its effects on plant cells. [7]

7. Carbon is an essential element for life on Earth and must be distributed and recycled within ecosystems.

(a) Outline the chemical properties of carbon that allow it to form diverse compounds. [4]

(b) Describe the processes involved in the transfer of carbon in an ecosystem. [4]

(c) Explain the impact of anthropogenic activity on climate change. [7]