Diploma Programme
Programme du diplôme
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]**.

2225 – 6018

18 pages

Please **do not** write on this page.

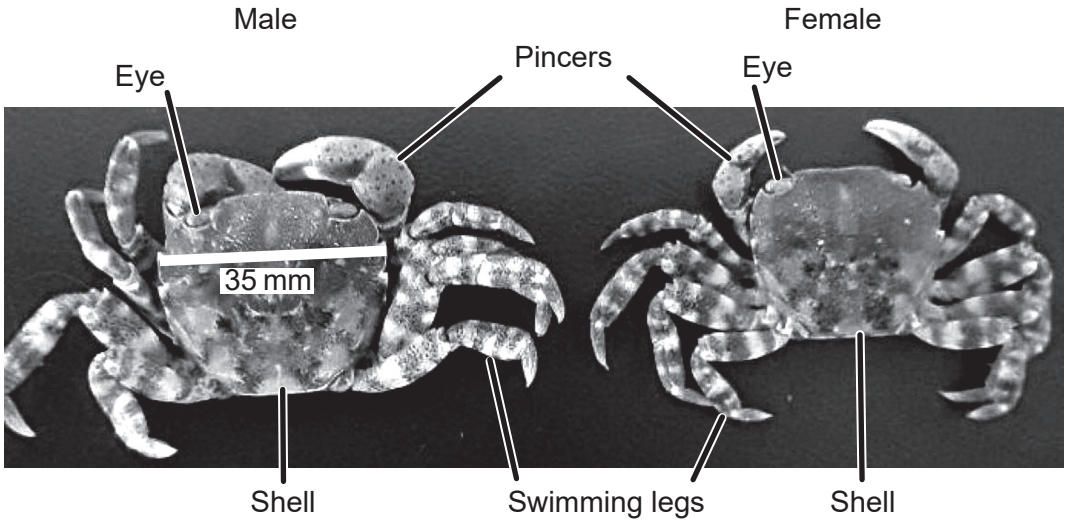
Answers written on this page
will not be marked.

Section A

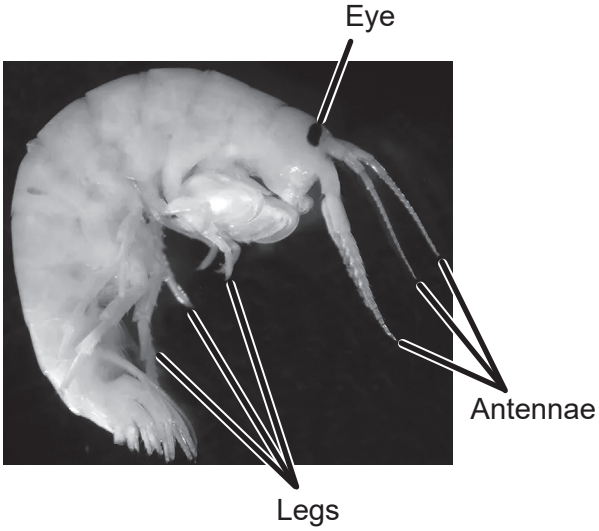
Answer **all** questions. Answers must be written within the answer boxes provided.

1. The Asian shore crab (*Hemigrapsus sanguineus*) is an invasive invertebrate species found along the French coast. It preys on another invasive species, the amphipod *Ptilohyale littoralis*, and also on the blue mussel (*Mytilus edulis*), a native species. Scientists studied the relationships between the species.

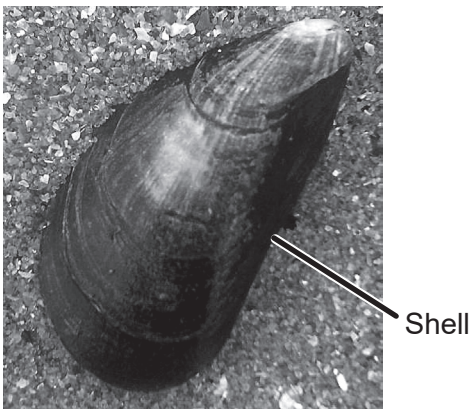
Asian shore crab



Amphipod (10–12 mm length)



Blue mussel (5–10 mm length)



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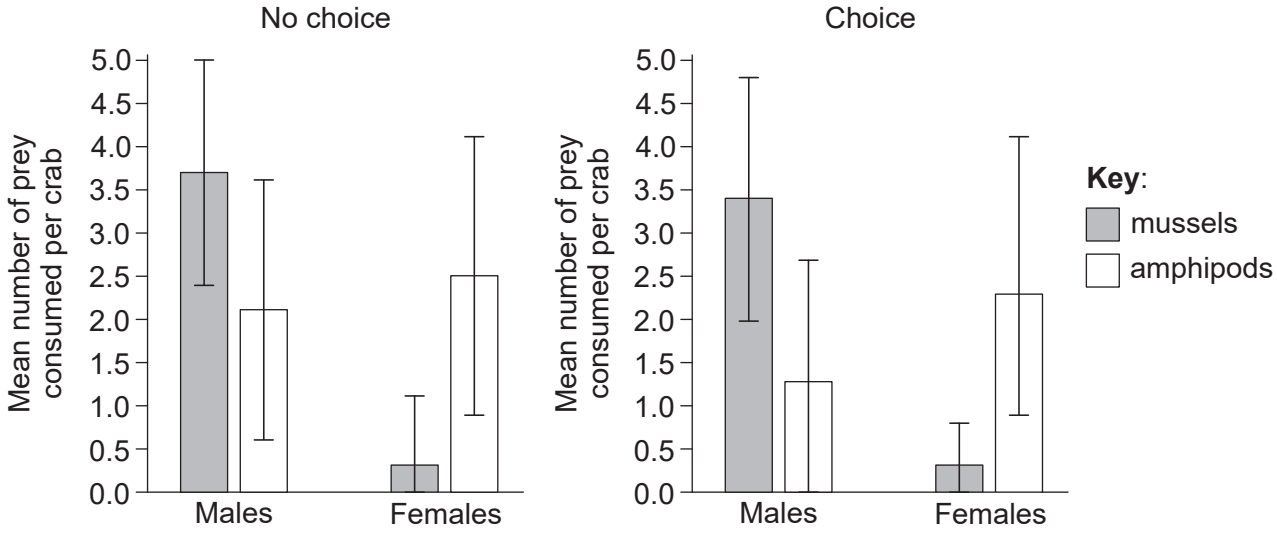
(Question 1 continued)

In order to study which prey is preferred by the crabs, each crab was put into a tank for 12 hours containing only one species of prey at a time (no choice) or containing both species at the same time (choice). 15 crabs of each sex were tested. The graphs show the mean number of prey consumed by male and female crabs.



(a) (i) Compare and contrast the mean number of prey consumed by males and females when they have no choice and when they have a choice. [4]

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(ii) Suggest a reason for the prey preference of the male compared to the female. [1]

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(Question 1 continued)

(iii) Suggest a characteristic of the prey that could affect the feeding choice for either sex of crab. [1]

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(Question 1 continued)

The table shows the calculated chi-squared values based on the data for the no choice and choice experiments for males and females.

	Observed data for no choice		Observed data for choice		Chi-squared values	
	Mussel	**Amphipod**	**Mussel**	**Amphipod**	χ^2	***p* value**
Males: Total numbers eaten	55	32	47	20	0.81	0.367
Females: Total numbers eaten	5	38	4	34	0.02	0.875

(b) (i) Calculate the percentage decrease in the number of amphipods consumed by males when given a choice compared to no choice. [1]

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(ii) Deduce with a reason whether the males or females are more flexible in their choice of prey. [1]

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(Question 1 continued)

(iii) Using all the data, justify the conclusion that the difference between no choice and choice is **not** significant for both males and females. [2]

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(c) Suggest **one** important limitation of this study. [1]

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2. There can be much variation within a single species, such as dogs (*Canis familiaris*).

(a) Define species. [1]

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(b) Describe how karyotyping can be used to decide if all these dogs are of the same species or not. [2]

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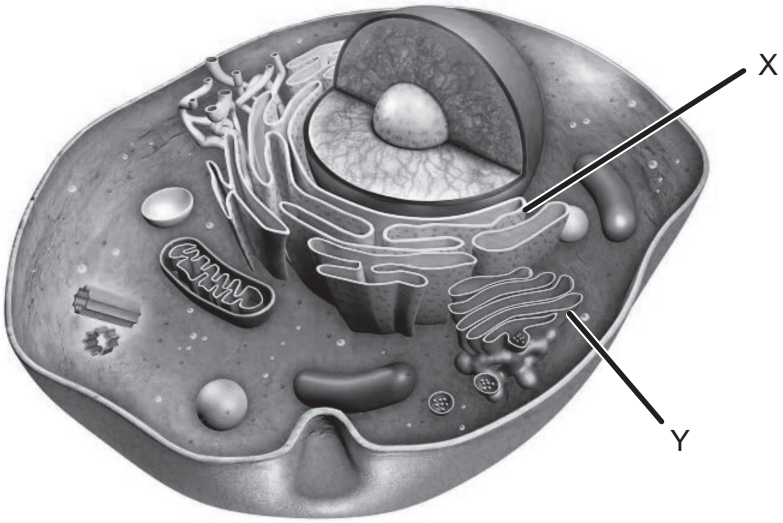
3. Eukaryotic cells have certain characteristics in common.



(a) State a function for structures X and Y labelled in the cell diagram. [2]

X: . . . . . .

Y: . . . . . .

(b) Describe **three** different processes that allow molecules to pass through the lipid bilayer of a cell. [3]

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(c) Outline **one** difference between the structure of prokaryotic and eukaryotic cells. [1]

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4. Beavers (*Castor fiber*) have been reintroduced into many European countries. They cut down trees and use them as a source of food as well as for building their homes and dams.

(a) Beavers are a keystone species. Outline the importance of keystone species. [2]

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(b) Studies show that species richness of large invertebrates increases in the presence of beavers. Suggest reasons why biodiversity is important in an ecosystem. [2]

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(c) Outline **two** methods of restoration of natural processes in ecosystems by rewilding, other than reintroducing a keystone species. [2]

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2. . . . . .
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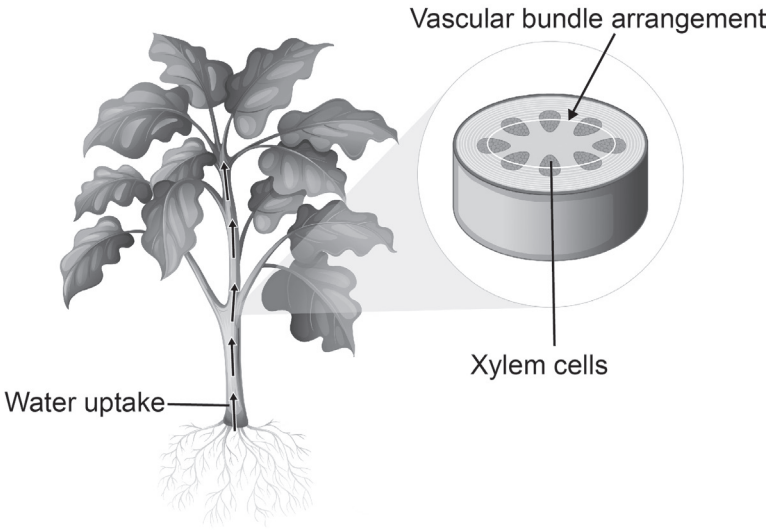
5. Plants require water that is carried through xylem vessels.



(a) Outline **two** adaptations of xylem vessels for water transport. [2]

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(b) Explain how transpiration causes the movement of water in plants. [3]

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6. The desert cottontail (*Sylvilagus auduboni*) is a rabbit that lives in North American deserts.

(a) State **two** abiotic factors that characterize a hot desert biome. [2]

1. . . . . .

2. . . . . .

(b) Suggest **one** adaptation of the cottontail that helps it to survive in desert conditions. [1]

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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.

7. All living organisms require energy to survive.

(a) Outline **three** characteristics of polysaccharides that make them efficient compounds to store energy in organisms. [3]

(b) Describe how energy passes through a food chain. [4]

(c) Explain the need for energy in cells and how energy is released through cell respiration. [8]

8. Hereditary information is stored in nucleic acids and passed on to offspring.

(a) Outline how mitosis allows for the same hereditary information to be passed on to new cells. [3]

(b) Describe the importance of DNA in speciation. [4]

(c) Explain the genetic basis of inheritance patterns in organisms that reproduce sexually. [8]

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References:

1. Image Asian shore crab: Silver, C., 2019. *Creature Feature – Asian Shore Crab*. [online] Available at: https://www.blueoceansociety.org/blog/creature-feature-asian-shore-crab/ [Accessed 13 March 2024]. Source adapted.

Image amphipod: Brutto SL, Iaciofano D. A taxonomic revision helps to clarify differences between the Atlantic invasive *Ptilohyale littoralis* and the Mediterranean endemic *Parhyale plumicornis* (*Crustacea*, *Amphipoda*). *Zookeys*. 2018 Apr 30; (754): 47–62. doi: 10.3897/zookeys.754.22884. PMID: 29740225; PMCID: PMC5938321.

Image blue mussel: Emőke Dénes. https://commons.wikimedia.org/wiki/File:Broadstairs_-_Mytilus_edulis_2.jpg. CC BY-SA 4.0 https://creativecommons.org/licenses/by-sa/4.0.

Graphs: Spilmont, N. and Seuront, L., 2023. Aliens eating aliens: an introduced amphipod as a potential prey of an invasive rocky shore crab in laboratory experiments. *Aquatic Invasions* 18(2), pp. 163–177. https:// doi.org/10.3391/ai.2023.18.2.106252. Source adapted.

2. Image by macrovector on Freepik. https://www.freepik.com/free-vector/colored-purebred-dogs-icon-set_4329617.htm#fromView=search&page=1&position=2&uuid=afab0859-2246-4637-abc5-a733503d42d3&query=%40macrovector+dogs.

3. Adobe Stock / Andrea Danti.

4. Nils Tirén/reproduced by Ola Myrin/Malmö museum.

5. Image by brgfx on Freepik. https://www.freepik.com/free-vector/diagram-showing-stem-root-cell_18973458.htm#fromView=search&page=1&position=16&uuid=26e1a0ae-56b5-4aab-ae64-64cf6e2b7928&query=plant+vascular+xylem. Source adapted.

6. Holly Cheng. https://commons.wikimedia.org/wiki/File:Sylvilagus_audubonii_2.jpg. Licensed under CC BY-SA 3.0 https://creativecommons.org/licenses/by-sa/3.0. Source adapted.

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