Diploma Programme
Programme du diplôme
Programa del Diploma

Biology
Standard level
Paper 2

12 May 2026

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

Session number

1 hour 30 minutes

Instructions to students

- 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]**.

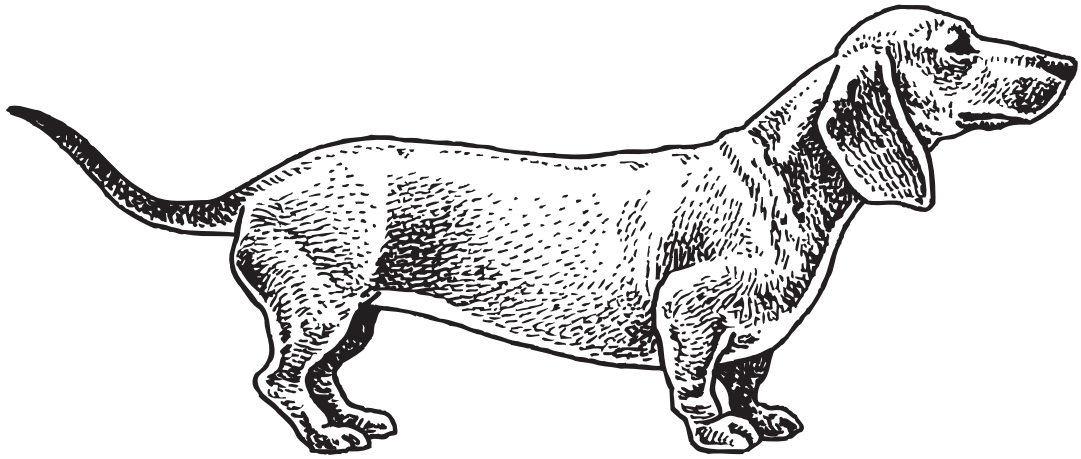
2226 – 4021

19 pages

Section A

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

1. Intervertebral disc disease (IVDD) is a common neurological disorder affecting many breeds of domestic dog (*Canis lupus familiaris*), such as the dachshund shown in the image. In dogs affected by IVDD, the diseased intervertebral discs compress the spinal cord, leading to pain, weakness and paralysis.



A study was undertaken to compare cases of IVDD in the six different sub-breeds of dachshunds.

Sub-breed of dachshund	Number of dogs examined	IVDD cases	Median age at IVDD onset / years	IVDD prevalence / %
Standard wire-haired	252	18	7.0	7.1
Miniature wire-haired	305	54	5.0	17.7
Standard smooth-haired	201	49	6.0	24.4
Miniature smooth-haired	744	127	5.0	17.1
Standard long-haired	127	16	6.0	12.6
Miniature long-haired	346	46	6.0	

(This question continues on the following page)

(Question 1 continued)

(a) Calculate the percentage of miniature long-haired dachshunds with IVDD. [1]

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(b) Distinguish between the IVDD prevalence and median age at onset in the standard smooth-haired and miniature smooth-haired dachshunds. [2]

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(c) Deduce with a reason whether standard dachshunds or miniature dachshunds are more likely to develop IVDD at a younger age. [1]

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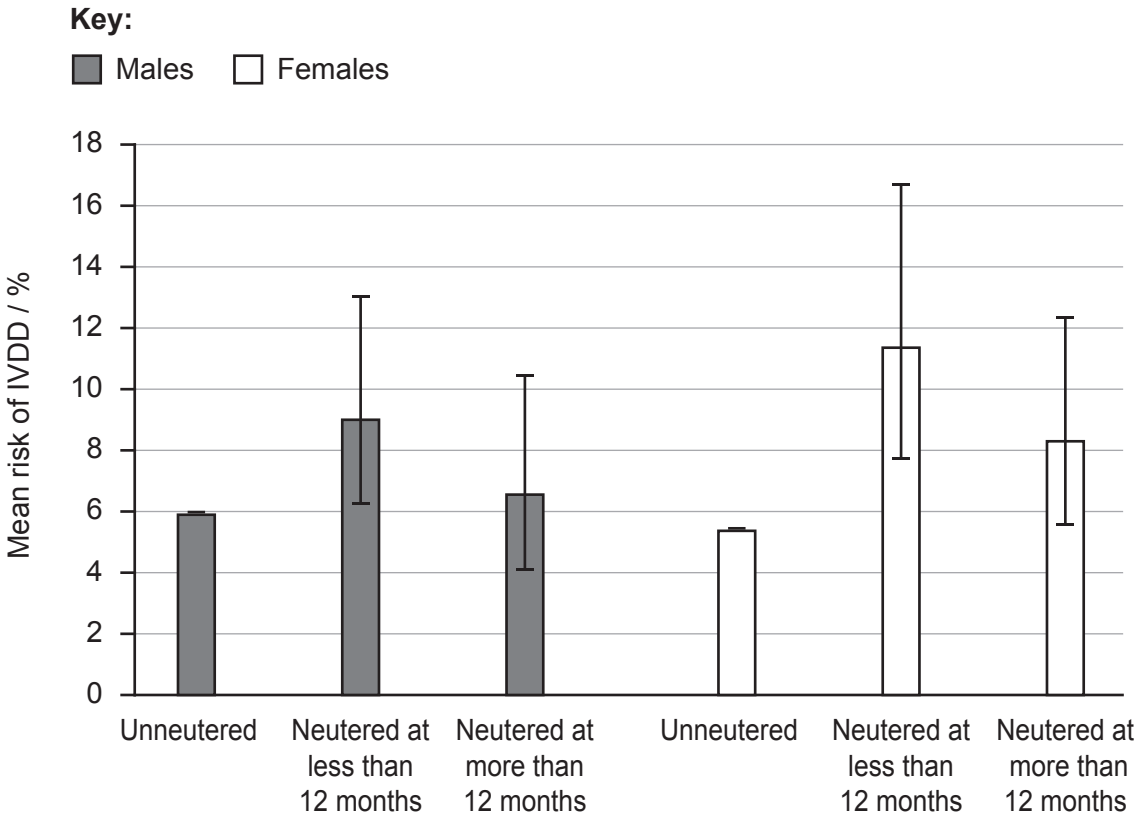
(Question 1 continued)

A second study investigated the impact of neutering (removal of ovaries or testes) on the risk of developing IVDD in male and female dachshunds. The study compared those animals neutered at less than 12 months of age and more than 12 months of age with unneutered animals.



(d) Identify which category of dachshunds has the highest mean risk of IVDD. [1]

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(e) Calculate the difference in mean risk of IVDD between unneutered females and females neutered at less than 12 months. [1]

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(Question 1 continued)

(f) Compare and contrast the mean risk of IVDD in male and female dachshunds. [3]

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(g) Using all the data, discuss which combination of sub-breed, sex and neutering decision would give the lowest risk of IVDD in a dachshund. [3]

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2. (a) Draw a labelled diagram to show the components of an RNA nucleotide. [3]

(b) Describe how an infinite variety of different polypeptide chains is possible. [2]

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(c) Outline the role of mRNA in translation. [3]

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3. (a) Define stem cells. [1]

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(b) Discuss the location and function of stem cells in adult humans. [3]

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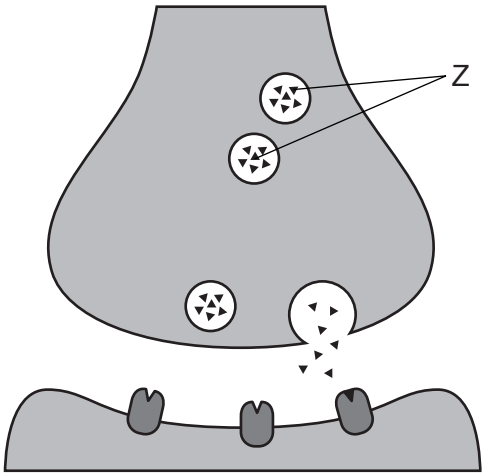
Answers written on this page
will not be marked.

4. Neurons communicate with other neurons across synapses. The diagram shows a junction between two neurons.



(a) Draw an arrow on the diagram to show the direction of travel of a nerve impulse. [1]

(b) Identify the molecule labelled Z. [1]

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(c) Explain the involvement of calcium in synaptic transmission. [2]

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5. The blue sea dragon (*Glaucus atlanticus*) is a type of sea slug found in tropical oceans that floats near the surface of the water.

(a) State the physical property of water that allows the blue sea dragon to float near the surface of the ocean. [1]

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(b) Non-biodegradable macroplastics have been found in tropical oceans.
Outline the consequences of macroplastic pollution on marine life. [2]

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(c) Explain the effect of increased water temperature on corals. [3]

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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.

6. Diversity is an important concept at all levels of organization in biology.

(a) Outline how the structure of starch and cellulose relate to their function. [4]

(b) Describe the adaptations that some forest plants have to maximize the amount of light they can harvest. [4]

(c) Explain the theory of natural selection as the mechanism for driving evolutionary change. [7]

7. Cystic fibrosis is an autosomal recessive condition caused by mutations in the CFTR gene. Cystic fibrosis affects mucus-producing cells, including those in the lungs, resulting in shortness of breath and frequent lung infection.

(a) Describe the inheritance of cystic fibrosis if neither parent has the disease. [4]

(b) Outline the role of mucous membranes in the defence against pathogens. [4]

(c) Explain how lung structure and inspiration (breathing in) contribute to the exchange of respiratory gases. [7]

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References:

1.(a) image: KeithBishop, 2013. *Dachshund - Dog, domestic pet*. [image online] Available at: https://www.gettyimages.com.au/detail/illustration/dachshund-dog-domestic-pet-royalty-free-illustration/166054743?adppopup=true [Accessed 8 April 2025]. Source adapted.

table: Packer, R.M.A., Seath, I.J., O'Neill, D.G., et al., 2016. DachsLife 2015: an investigation of lifestyle associations with the risk of intervertebral disc disease in Dachshunds. *Canine Genet Epidemiol*, 3(8). [e-journal] https://doi.org/10.1186/s40575-016-0039-8. Source adapted.

1.(d) Dorn, M., Seath, I.J., 2018. *Canine Genet Epidemiol*, 5(11). [e-journal] https://doi.org/10.1186/s40575-018-0067-7. Reference redacted. Source adapted.

4. Nrets. https://commons.wikimedia.org/wiki/File:Synapse_Illustration2_tweaked.svg. Licensed under CC BY-SA 3.0 http://creativecommons.org/licenses/by-sa/3.0/.

5. Oskar Suth. https://commons.wikimedia.org/wiki/File:Glaucus_atlanticus_australia.jpg. Licensed under CC BY-SA 4.0 https://creativecommons.org/licenses/by-sa/4.0.