Diploma Programme
Programme du diplôme
Programa del Diploma

Biology
Standard level
Paper 2

29 October 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]**.

8825 – 6024

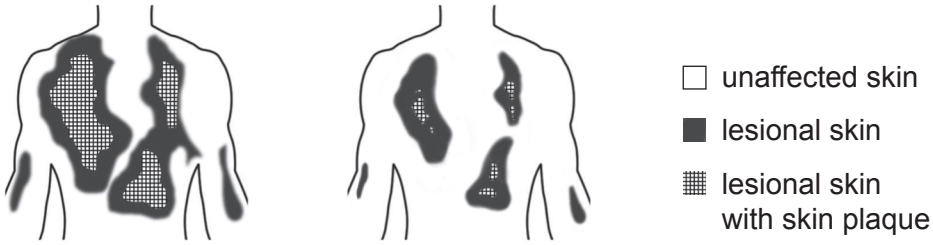
Section A

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

1. Psoriasis is a disorder characterized by inflammation of the skin. It causes the formation of red patches (lesional skin), which often have flaky, silver–white surfaces (skin plaques).

Some drugs are available to treat psoriasis. During treatment, the changes in psoriasis severity can be measured by taking daily photographs of the affected region(s) of the body.

In one study, five males of a similar age and with similar psoriasis severity were provided with the same dose of a medicinal drug for seven days. The skin maps show the change in psoriasis severity on the back of **one** of the males during this study.



Day 0 Day 7

(a) Distinguish between the appearance of the skin of this male on Day 0 and Day 7 of treatment. [2]

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(Question 1 continued)

(b) Explain how quantitative data could be obtained from all males to assess the success of the treatment. [2]

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(c) Comment on the reliability of this investigation. [1]

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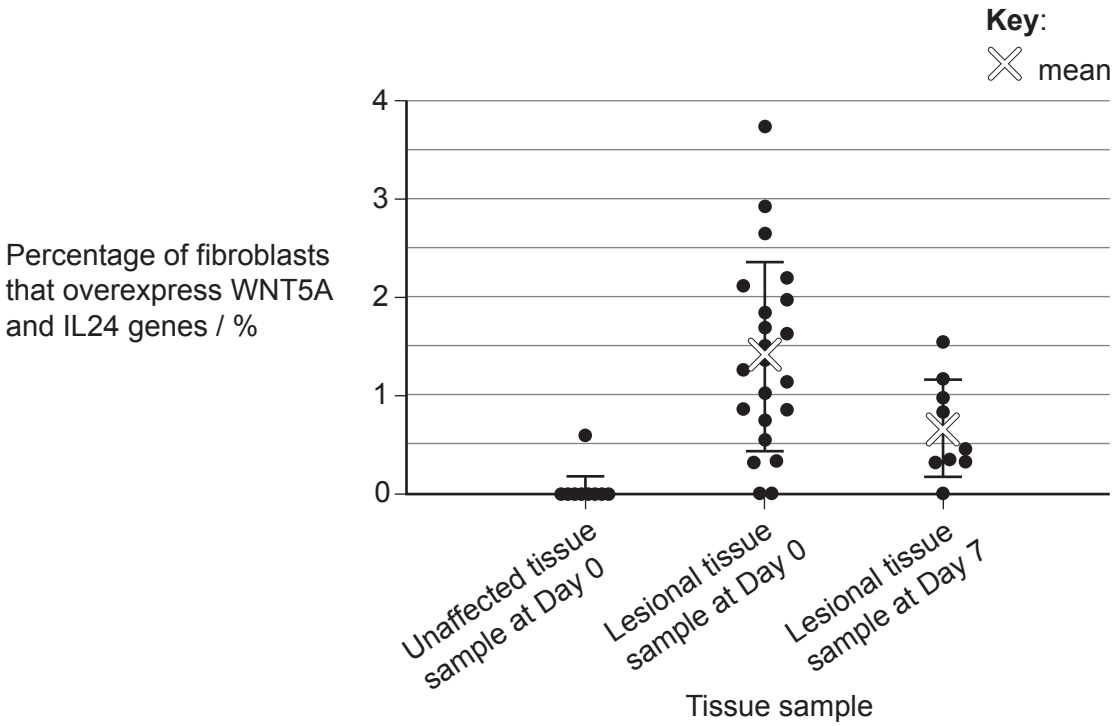
(Question 1 continued)

One drug commonly used to treat psoriasis is called guselkumab. It reduces inflammation in affected regions of skin.

Tissue samples of lesional skin were taken from people with psoriasis before treatment with guselkumab (Day 0) and after one week of treatment (Day 7). Tissue samples of unaffected skin were also taken from these people before treatment with guselkumab. The numbers of samples were different for the three groups.

Skin cells called fibroblasts were extracted from all tissue samples. The scientists measured the expression of two genes that are known to cause inflammation, WNT5A and IL24. They calculated the percentage of fibroblasts that overexpress (express more than normal) **both** the WNT5A and IL24 genes. The graph shows the data. The crosses on the graph represent mean percentages.



Statistical significance levels

Unaffected tissue sample at Day 0	Lesional tissue sample at Day 0
$p < 0.001$	

Lesional tissue sample at Day 0	Lesional tissue sample at Day 7
$p < 0.05$	

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(Question 1 continued)

(d) State the highest percentage of fibroblasts that overexpress WNT5A and IL24 in the lesional tissue sample at Day 0. [1]

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(e) Calculate the decrease in the mean percentage of fibroblasts in lesional tissue that overexpress WNT5A and IL24 after treatment with guselkumab. [1]

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(f) Suggest the reason for including unaffected tissue samples in this investigation. [1]

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(g) Explain the conclusions that can be drawn from the data in the graph. [2]

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2. The percentage of cytosine in the genome of the common octopus (*Octopus vulgaris*) is 17.6 %.

(a) Explain the reasons for expecting a thymine percentage of 32.4 %. [2]

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Scientists can amplify DNA molecules and separate mixtures of DNA molecules in the laboratory for analysis.

(b) State the laboratory method used to amplify DNA. [1]

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(c) Distinguish between the structure of the nucleotides in DNA and RNA. [2]

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3. Cell membranes have a fluid mosaic structure.

(a) Outline the reason the structure is described as a mosaic. [1]

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(b) Phospholipids are the most common molecules in cell membranes. Draw a diagram of the simplified structure of a phospholipid and label its amphipathic properties. [2]

(c) Explain how the rate of diffusion of oxygen into a cell is affected by the concentration of oxygen outside of the cell. [3]

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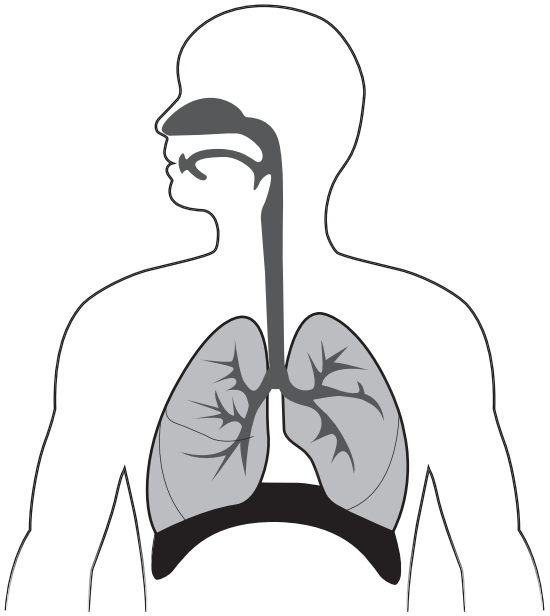
4. The image shows the location of the lungs and diaphragm in a human.



(a) Explain how contraction of the diaphragm causes air to enter the lungs. [2]

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(b) State another muscle group that causes inspiration when it contracts. [1]

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(c) Outline the role of surfactant in the mammalian lung. [2]

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5. Food chains combine to form food webs in an ecosystem.

(a) Define the term autotroph. [1]

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(b) Describe the role of decomposers in ecosystems. [2]

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(c) The efficiency of energy transfer along the various food chains in a food web varies. Suggest reasons for the differences. [3]

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(Question 5 continued)

There are estimated to be over 940 million cattle in the world.

(d) Suggest how increases in cattle farming are affecting climate patterns worldwide. [2]

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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. Insect pollinators are vital to maintaining the biodiversity of ecosystems, but they are threatened by some human actions. Some pollinators, such as honey bees (*Apis mellifera*), produce honey, which is rich in glucose.

(a) Outline how the properties of glucose are linked to their uses in organisms. [5]

(b) List human actions that could threaten populations of insect pollinators such as bees. [3]

(c) Explain how a plant species may evolve by natural selection over a long period to produce insect-pollinated flowers. [7]

7. Albert Szent-Gyorgi, the Nobel Prize winner for Physiology or Medicine in 1937, said, "There is no life without water."

(a) Draw a labelled diagram to show how two water molecules interact with each other. [4]

(b) Outline the effects of immersing animal and plant cells in pure water. [4]

(c) Explain the process of transpiration and how xylem vessels are adapted for the transport of water from roots to leaves. [7]

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References:

1.a Francis, L., McCluskey, D., Ganier, C. Jiang, T., Du-Harpur, X., Gabriel, J., Dhami, P., Kamra, Y., Visvanathan, S., Barker, J.N., Smith, C.H., Capon, F. and Mahil, S.K., 2024. *Nature Communications*, [e-journal] 15(913), [online] Available at: https://doi.org/10.1038/s41467-024-44994-w. Reference redacted. Source adapted.

1.d Francis, L., McCluskey, D., Ganier, C. Jiang, T., Du-Harpur, X., Gabriel, J., Dhami, P., Kamra, Y., Visvanathan, S., Barker, J.N., Smith, C.H., Capon, F. and Mahil, S.K., 2024. *Nature Communications*, [e-journal] 15(913), [online] Available at: https://doi.org/10.1038/s41467-024-44994-w. Reference redacted. Source adapted.

4. paveugra, 2015. *Respiratory system*. [image online] Available at: https://www.gettyimages.co.uk/detail/illustration/respiratory-system-royalty-free-illustration/489734346 [Accessed 29 October 2024]. Source adapted.

5. Bastian, C., 2022. *Three cows black and white group together in a field*. [image online] Available at: https://www.gettyimages.co.uk/detail/photo/three-cows-black-and-white-group-together-in-a-royalty-free-image/1440057213?phrase=cattle+in+field&adppopup=true [Accessed 4 December 2024]. Source adapted.

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