

APOLLO

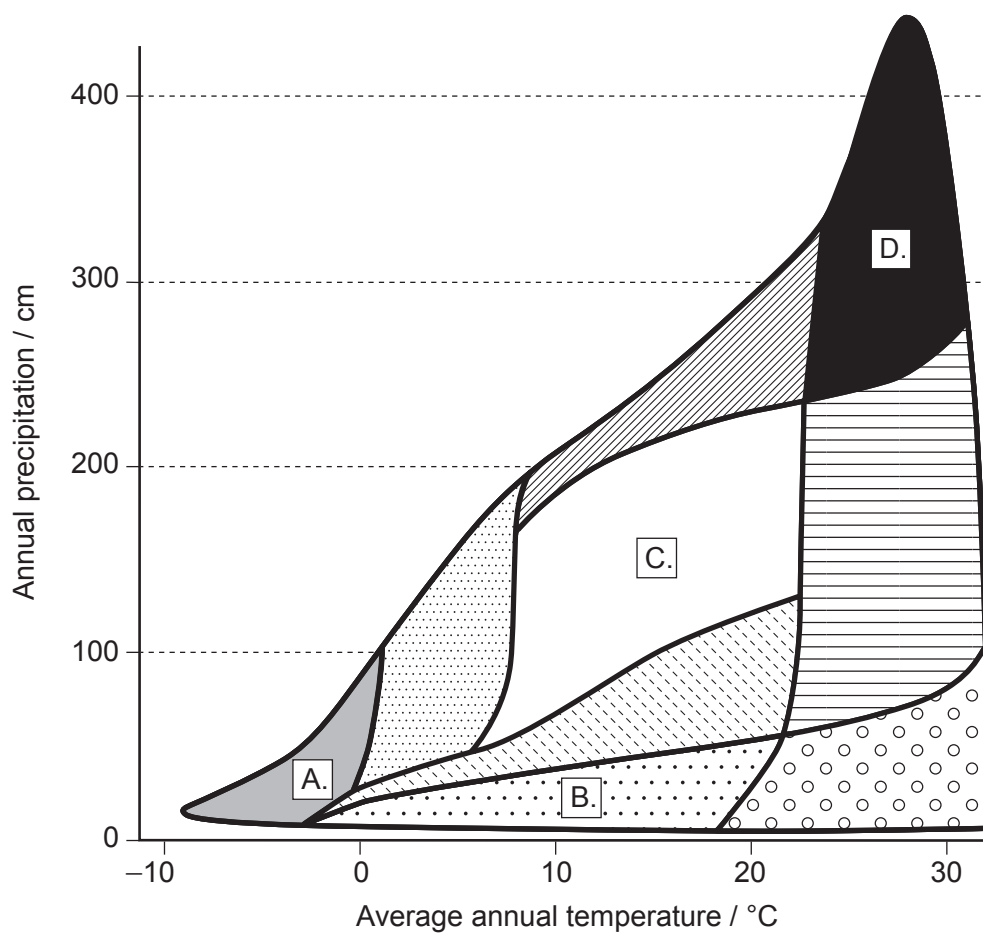
Adaptation to environment SL

Biology

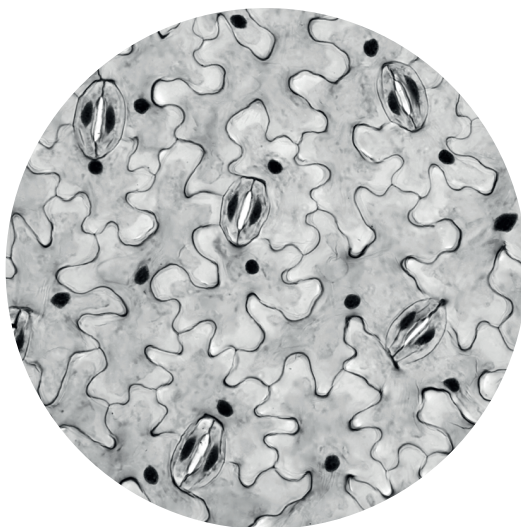
First assessment 2025

7 questions | questions

24. A graph of abiotic factors needed for biomes to develop is shown. Which label identifies temperate forest?



1. The image shows a cast of the lower surface of a leaf from a busy Lizzie (*Impatiens walleriana*) plant as seen under a light microscope with a magnification of $600\times$.



- (a) On the image, label a guard cell. [1]
- (b) State how the magnification of the microscope was calculated. [1]

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(Question 1 continued)

- (c) (i) Outline how stomatal density in busy Lizzie leaves can be estimated within a known field of view. [1]

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- (ii) Suggest how this estimate can be made more reliable. [1]

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- (d) Explain **one** feature of tree roots that help trees to survive in mangrove swamps. [2]

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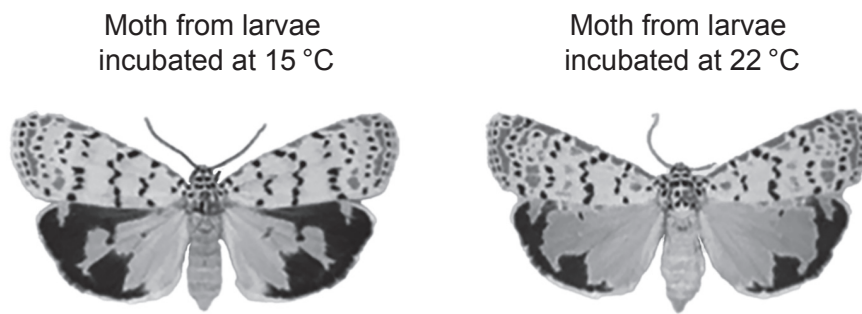
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1. Which characteristic of the ringed seal (*Pusa hispida*) is a consequence of the thermal conductivity of water?
- A. Streamlined body
 - B. Sharp teeth
 - C. Blubber (layer of fat)
 - D. Lungs

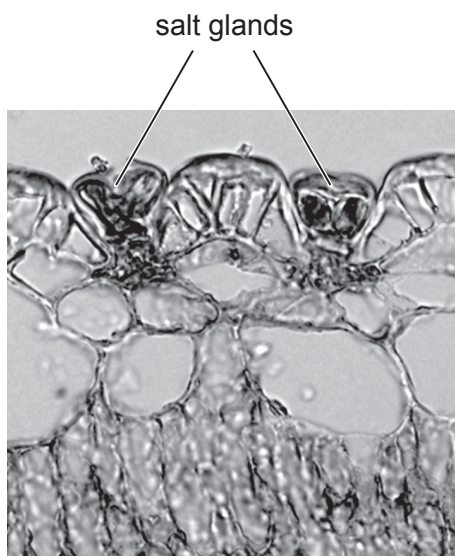
21. Scientists incubated larvae of the moth *Utetheisa ornatrix* at either 15 °C or 22 °C until they hatched. They found the hatched moths had different wing colour patterns due to phenotypic plasticity.



Which of the following explains the observed differences in wing colour?

- A. Colder temperatures induce mutations in genes for wing colour.
- B. The expression of genes for wing colour is affected by temperature.
- C. A mutation makes moths less visible to predators in cold climates.
- D. Wing colour is the result of polygenic inheritance.

24. *Avicennia officinalis* is a tree species that is adapted to live in mangrove swamps. Salt glands can be seen in the micrograph of a transverse section of an *A. officinalis* leaf.



How does *A. officinalis* benefit from this adaptation?

- A. The glands provide nitrates for amino acid synthesis as mangrove soils are nitrogen-deficient.
- B. The salt in the leaves attracts predators to eat the leaves.
- C. A high concentration of salt in the glands allows absorption of water into the leaf cells.
- D. The glands secrete salt to keep cytoplasmic concentration suitable for metabolic processes.

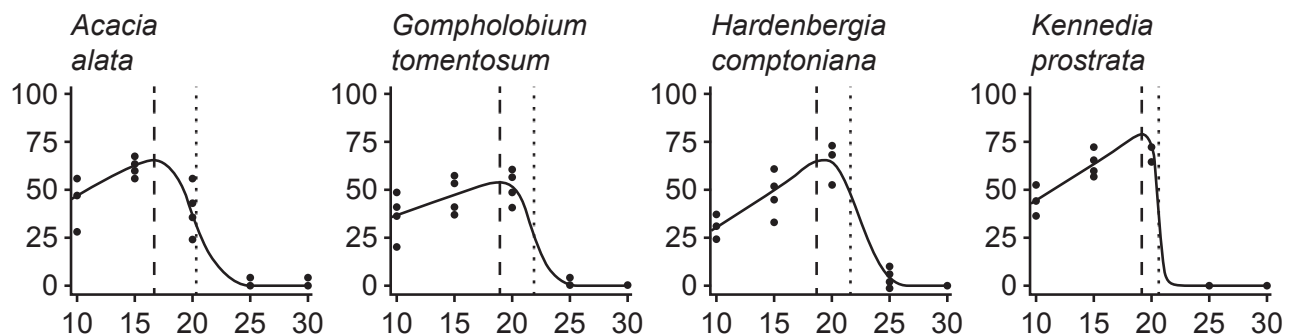
Section A

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

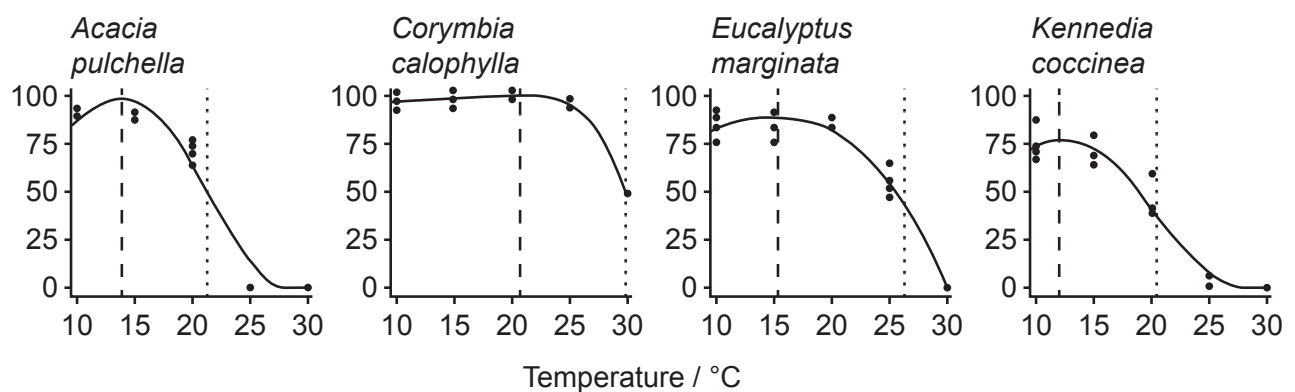
1. Fires are a natural phenomenon in some forest ecosystems, so plants evolve to become fire-adapted. The Northern Jarrah Forest in southwest Australia is an example. The seeds of many species germinate after forest fires, when there is less competition for resources from existing plants.

The effect of temperature on germination was measured in species that occur commonly in the Northern Jarrah Forest. The graphs show results for eight species across the range of soil temperatures expected in this ecosystem. Four replicates of 25 seeds were sown at each temperature. Statistical modelling was used to predict the overall relationship between temperature and germination, and to estimate the optimum temperature (T_{opt}) and maximum temperature (T_{max}) at which germination commonly occurs. The eight species were then divided into two groups according to the effects of temperature on germination.

Group 1



Group 2



Key: T_{opt} T_{max}

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(Question 1 continued)

(a) Identify the species in which T_{opt} is lowest. [1]

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(b) Calculate the range for T_{max} among the eight species. [1]

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(c) Analyse the graphs to find the key difference between species in Group 1 and Group 2. [1]

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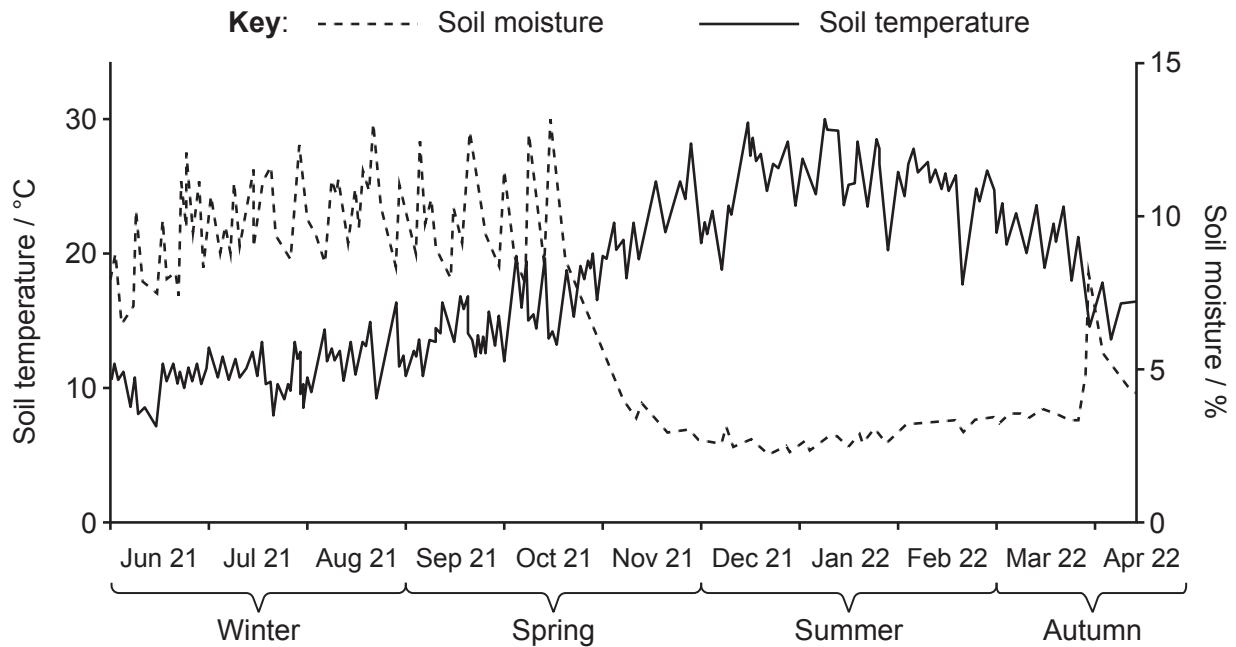
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(Question 1 continued)

To investigate the seasonality of germination, soil temperature and soil moisture were monitored at sites in Korung National Park, which is part of the Northern Jarrah Forest. The graph shows the results.



- (d) (i) Distinguish between soil moisture in winter and in summer.

[2]

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- (ii) Suggest reasons for the differences.

[2]

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(Question 1 continued)

- (e) Predict, giving reasons, when germination would start in *Kennedia prostrata*, following a forest fire at the start of summer. [3]

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- (f) Using the data in the graphs, discuss whether species in Group 1 or Group 2 are more likely to be adversely affected by increases in soil temperature due to global warming. [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.

7. Convergent evolution increases similarities, despite differences in origins.

- (a) Explain how analogous structures can evolve. [4]
- (b) Describe adaptations that are typical of plants growing in hot deserts throughout the world. [7]
- (c) Suggest examples of adaptations in herbivores for feeding on plants. [4]



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References:

- 1.a and d** Ryan, C., Callow, J.N., Lewandrowski, W. and Tangney, R., 2023. *Conserv Physiol* 11(1): coad093. <https://doi.org/10.1093/conphys/coad093>. Reference redacted. Source adapted.
- 2.** Christinelmiller. https://en.wikipedia.org/wiki/File:Multiple_Ribosomes_Translation_Protein_Synthesis.png. CC BY-SA 4.0. <https://creativecommons.org/licenses/by-sa/4.0>, image adapted.
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