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NZQA

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

Level 3 Biology, 2014

91603 Demonstrate understanding of the responses of plants and animals to their external environment

9.30 am Thursday 13 November 2014
Credits: Five

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of the responses of plants and animals to their external environment.	Demonstrate in-depth understanding of the responses of plants and animals to their external environment.	Demonstrate comprehensive understanding of the responses of plants and animals to their external environment.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should attempt ALL the questions in this booklet.

If you need more space for any answer, use the page(s) provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–15 in the correct order and that none of these pages is blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

TOTAL

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QUESTION ONE: BEHAVIOUR IN AUSTRALASIAN GANNETS

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Australasian gannets, *Morus serrator,* are known as colonial breeders. During the summer, large colonies of birds can be found within gannet colonies, where breeding pairs fiercely defend their individual nesting territories. However, recent studies have shown that when foraging at sea, the same birds show no territorial behaviour across their chosen feeding areas, and yet they appear to maintain largely separate foraging areas at sea, specific to the particular colonies they belong to when nesting on land.

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Gannets display territorial behaviour when nesting on land, but not when foraging at sea.

Steffi Ismar, http://nzbirdsonline.org.nz/species/australasian-gannet

Discuss the reasons why Australasian gannets appear to behave as described above.

In your answer:

- describe territorial behaviour
- use biological ideas to explain why the territorial behaviour provides adaptive advantages for the gannets
- justify possible reasons why the Australasian gannets appear to maintain separate foraging areas when at sea.

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There is more space for your answer to this question on the following page.

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QUESTION TWO: COMPETITION BETWEEN WHEAT AND RYEGRASS

Wheat is an important cereal crop. Ryegrass is a weed in wheat fields. Wheat and ryegrass both belong to the grass family.

Australian scientists investigated one aspect of competition between wheat and ryegrass.

- Wheat plants were crushed up and mixed with distilled water.
- Water-soluble substances in the crushed plants dissolved in the water to make the full-strength extract.
- A series of dilutions of the full-strength extract were made.
- Ryegrass seeds were put into each dilution and the percentage that **germinated** (started growing) was recorded.
- If the seeds germinated, the **seedling root length** was also measured after 7 days.
- The results were presented as percentages of a control experiment.

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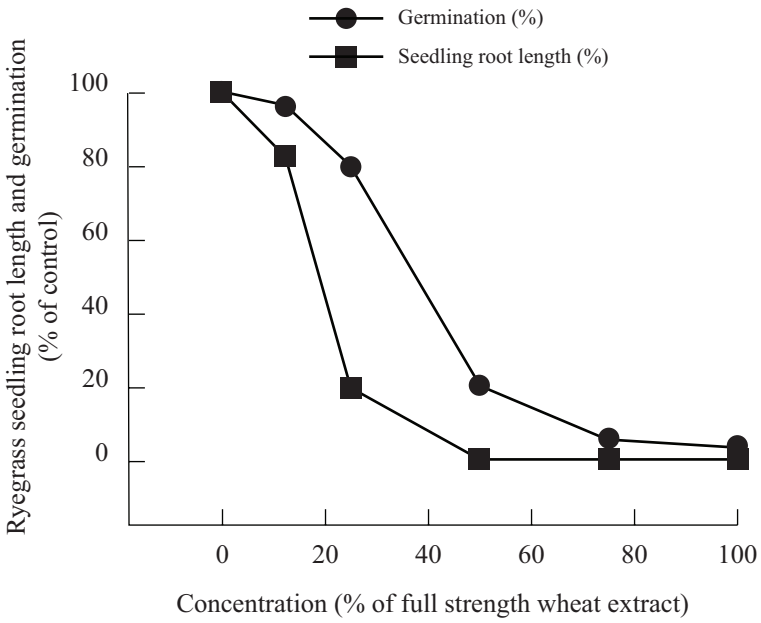
Ryegrass in a wheat field.

http://www.arc.agric.za/uploads/images/5724_Fig%201.%20%20Ryegrass%20in%20a%20wheat%20field.jpeg



Adapted from: www.regional.org.au/au/asa/1998/6/139wu-1.gif

The graph shows the effects of different concentrations of wheat extract on the germination of ryegrass seeds and on the length of the roots of the seedlings that grew from them.

Discuss the outcome of this experiment and what it suggests about wheat and its response to its environment.

In your answer you should refer to the graph and:

- describe the interaction between wheat and ryegrass and its importance to wheat farmers
- compare the ryegrass seedling root length and germination, with the concentration of wheat extract
- fully explain the response between wheat and ryegrass that the results of this experiment suggest
- analyse the results to suggest how this response could provide an adaptive advantage to growing wheat plants.

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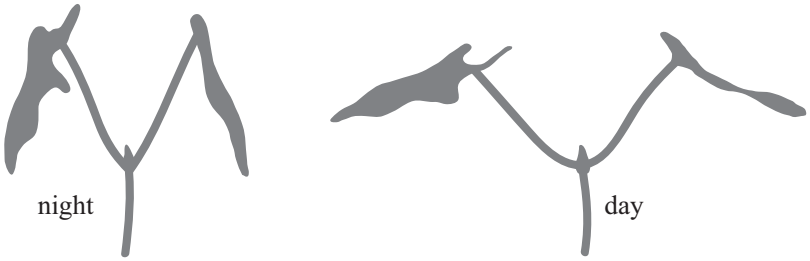
QUESTION THREE: 'SLEEP MOVEMENTS'

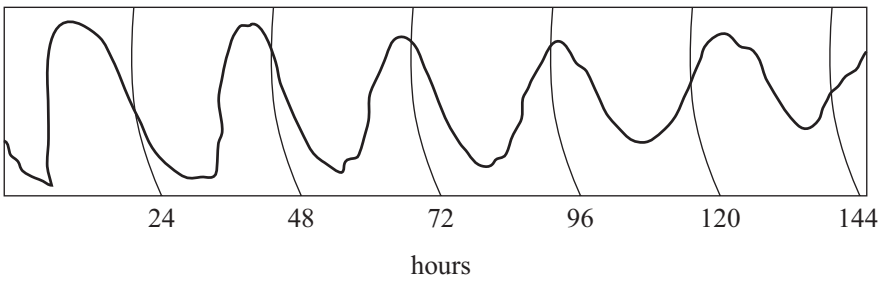
Some plants show regular changes in movement over time. 'Sleep movements' may involve the nightly folding of leaves, as in the case of many legumes, such as beans, or the nightly closing of flowers, such as tulips.

The diagrams below show the pattern of leaf folding in a runner bean (*Phaseolus coccineus)*.

A



B



Adapted from: www.plantcell.org/content/18/4/792/F2.medium.gif

In diagram **A**, the position of the primary leaves of a seedling at night is shown at the left, and during the day is shown at the right.

In diagram **B**, the peaks of the curve represent the night-time leaf position. The vertical lines indicate 24-hour intervals. The period for this trace is about 27 hours, and was recorded whilst the plant was kept in constant light conditions.

Discuss both the pattern of this behaviour and the underlying response that causes it, and evaluate the adaptive advantage this behaviour provides some plants and their flowers.

In your answer you should:

- describe the type of response shown by the runner bean and what causes it (detailed physiology and structure **not** required)
- explain why the rhythm or pattern shown by the runner bean would be endogenous and what is happening to the rhythm over time
- evaluate the adaptive advantages this pattern of behaviour provides some plants and their flowers with, such as the runner bean.

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Extra paper if required.
Write the question number(s) if applicable.

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