# EXEMPLAR

90716

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NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

# Level 3 Biology, 2007

## 90716 Describe animal behaviour and plant responses in relation to environmental factors

Credits: Four
9.30 am Tuesday 27 November 2007

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 answer 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 2–10 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.**

| *For Assessor's use only* | **Achievement Criteria** | |
|---|---|---|
| **Achievement** | **Achievement with Merit** | **Achievement with Excellence** |
| Describe animal behaviour and plant responses in relation to environmental factors. ✓ | Describe animal behaviour and plant responses in relation to environmental factors. ✓ | Describe animal behaviour and plant responses in relation to environmental factors. ✓ |
| | Explain animal behaviour or plant responses in relation to environmental factors. – | Discuss animal behaviour or plant responses in relation to environmental factors. – |
| **Overall Level of Performance (all criteria within a column are met)** | | **A** |

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You are advised to spend 40 minutes answering the questions in this booklet.

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## QUESTION ONE

Weta are nocturnal insects that emerge from holes in trees or from under bark soon after sunset, to forage for several hours on plant and animal material. They return to their resting places before dawn.


http://weta.boarsnest.net/coverpic.jpg

(a) Explain how this rhythmic behaviour is **controlled** in relation to seasonal changes throughout the year.

The wetas will have an indogenous time keeper, i.e. an internal clock. It predicts the amount of day light so knows when to be active and this is reset by environmental cues as the seasons change.

internal clock

zeitgeber

seasons not explained

A

In a study of their rhythmic behaviour, weta were placed in **constant** conditions, and their activity was recorded for seven days. The data were then plotted on an actogram.

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Double-plotted actogram of weta activity

R. D. Lewis (1999), 'Control models for the circadian clock of the NZ weta, *Hemideina thoracica*', *J. Biol. Rhythms* no 14, pp 480–485.

(b) Calculate the **period** for this rhythm. (Use the diagram in your calculation, and **show your working**.)

12hrs

N

(c) Discuss the advantages **and** disadvantages of the weta's normal nocturnal behaviour, with respect to the weta's survival.

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Some advantages of the wetas being nocturnal are that they keep away from predators, One of their main predators would be birds which are most active during the day so by only coming out at night they will avoid them and also be less visible to other predators. They will also avoid dessication by the sun. By hiding in dark places the weta will avoid the suns rays which will prevent it from drying out. There is also adequit food supply during the night so the weta will have a higher chance of survival as it will be able to feed and avoid predators and the sunlight.

A disadvatage for the weta's nocturnal behaviour is that it will have a limited time to be active during summer as dark hours are much more limited. There are much longer days and shorter nights in summer so the weta may find it more difficult to survive as it has less time feeding so may not gain enough food for energy to stay active. It may also find it difficult to find mates during the night as its dark so will have less chance of producing offspring which are needed to continue the survival of the species.

advantage explained – linked to survival

advantage not explained

advantage explained – with survival

accepted – disadvantage explained

not valid

E

## QUESTION TWO

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*Kalanchoe* is a popular house plant with brightly coloured flowers. Flowering in *Kalanchoe* is controlled by the pigment phytochrome in response to photoperiod. To induce flowering, growers must ensure the plants are exposed to less than 11 hours of daylight each day.

(a) Describe this pattern of flowering.

photoperiodism

evidence can come from TWO (b).

A

(b) Explain how phytochrome controls flowering in *Kalanchoe*.

phytochrome responds to sunlight. It respons to photoperiod which is the period of sunlight. It is able to detect red light which it absorbs so it will flower when daylight is shorter than its critcal day length.

has described (just) how phytochrome controls flowering.

A

(just)

(c) Petal movement in *Kalanchoe* is a nastic response.

Explain the **difference** between a nastic response and a tropism, using responses in *Kalanchoe* as an example.

A nastic response is a non-directional response to a non-directional stimulus. Such as in Kalanchoe, the petals would move in response to temperature or light intensity. A tropism is a directional response to a stimulus, e.g. phototropism where a plant would grow towards (positive) or away (negative) from the light.

example

example

M

*Kalanchoe* has small flowers with petals that open and close in response to changes in turgor pressure within the petals (below).

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| | |
|---|---|
| *For copyright reasons, this resource cannot be reproduced here.*<br><br>Night (closed) Day (open)<br><br>*Kalanchoe* flowers. | *For copyright reasons, this resource cannot be reproduced here.*<br><br>Diurnal changes of *Kalanchoe* petal movement (grey) and turgor pressure (black) in the upper epidermis cells of the flowers. |

www.uni-tuebingen.de/plantphys/bioclox/books/engl/ren150205.pdf

(d) Discuss how this regular movement of the petals is produced by changes in turgor pressure, **and** how this movement enhances the plant's reproductive success.

Turgor pressure is produce by the movement of water in the plant. During the day the plant is absorbing most water and nutrients from the soil which will increase the turgor pressure, thus making the flowers open. During the night the flower wont be absorbing as much minerals from the soil therefore the pressure decreases and the flower closes. This movement enhances the plants reproductive success because it ensures the flowers are open during the day when conditions are most favourables. Ie. when pollinators are around which will ensure their pollin is dispersed so they can reproduce. Its also most ideal to be open during the day so photosynthesis can take place and being closed at night conserves energy.

poor biology

explains reproductive success

poor biology

M

poor biology does not drop **M→A**, as irrelevant to question

## QUESTION THREE

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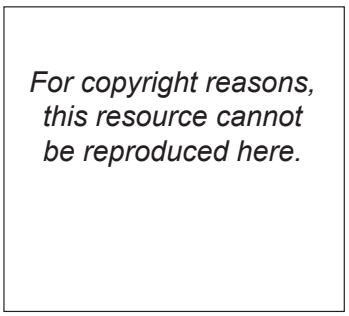
Psyllids are small insects (3–4 mm long) that feed by sucking plant sap. In New Zealand one species of psyllid lives on *Pittosporum* trees. Ants take honeydew from the psyllids and drive away other insects.




A juvenile psyllid.
http://ccpp.ucr.edu/news/Asian%20psyllid.html

(a) Describe the **relationship** between (i) psyllids and *Pittosporum*, **and** (ii) between psyllids and ants.

(i) psyllids and *Pittosporum*: parasitism

(ii) psyllids and ants: mutualism

A

(b) Describe ONE way in which *Pittosporum* plants could **benefit** from the relationship with ants and psyllids.

Ants take honeydew from psyllids which take sap from the pittosporum plant but in turn the ants drive away other insects which would stop them from eating the plant

A

(c) Describe the following interspecific relationships in terms of winners and losers, and give an example of each:

(i) **commensalism**

Description: one organism (wins) gains while one is not affected

Example: tree creeper climbing up a tree. (plant)

all correct

(ii) **parasitism**

Description: one organism (wins) gains while the host (loses) is negatively affected

Example: lice on an animal.

A

(d) Interspecific competition is common in both plants and animals.

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Discuss how **interspecific competition** acts to control the population size of both species involved, in either plants or animals.
In your answer, consider:

- access to / availability of resources
- reproductive success
- maximum population size

and include New Zealand examples.

Interspecific competition is the competition between species. In every environment there is a limitation of resources such as space, food, etc. fact

When a species enters a new habitat there will be a huge expansion of numbers but when it reaches the maximum capacity its habitat can take and competition of neighbouring species kicks in it will reach its maximum population size and level off. irrelevant to question meaning unknown

N