# 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)** | | E |

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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.

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

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

This circadian rhythm occurs daily and is controlled by sunset occuring. This is controlled by the seasons as throughout the year the sun sets at different times due to different seasons. Days are longer in summer and so the sunsets later and rises earlier so the weta leaves its burrow later and returns earlier than in winter when the days are shorter so the sun sets earlier and rises later so the weta leaves its burrow earlier and returns later in summer. Thus it has more time to forage in winter

A

behaviour in relation to seasonal changes

M

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.

Assessor's use only


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**.)

Start = 8:48 Day 1 or 8.8 hours
Finish = 6:12 Day 7 or 6.2 hours
One increment = 5mm ∴ 1mm = 24 minutes
Duration = (24 − 8.8) + (5 × 24) + 6.2
= 15.2 + 120 + 6.2
= 141.4 hours

Period = Duration / N° of Days/periods = 141.4 hours / 6 periods = 23.5 hours A

incorrect calculation

correct answer

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

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The weta being nocturnal has the advantage of it avoiding predators who might attack, kill, and eat it thus it improve ~~the~~ its survival rate. As they find it difficult to see and could be asleep

advantage explained, plus survival

It also means there is little competition for food and space due to other animals and insects being asleep. It also means it does not overheat or become dehydrated as it is poikilothermic and so will heat up fast as it cant control its own body temperat

advantage explained

advantage described

Also the ground will be moist for water as the sun will not be evaporating it.

advantage

The disadvantages of being nocturnal as there is less prey to prey upon as insects ~~are~~ that it preys on could be asleep, it also requires special adaptations to sense in the dark as it cannot see. This results in the disadvantage that if it is exposed to light, say when a predator digs into its burrow during the day it could become disorientated and blinded by the light and so be vulnerable.

disadvantage explained (weak)

poor biology

Also at night it cannot forage far as it must ~~reduce~~ return to its burrow by dawn. It is also controlled by the seasons so does not have much time to forage in short summer nights.

weak disadvantage

E

## QUESTION TWO

Assessor's use only

*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.

Short day flowering due to photoperiodism **A**

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

**A**

Phytochrome (P) is a pigment that detects light in red light Pr is changed to Pfr and this occurs during the day. At night (or in far red light) Pfr is changed back to Pr slowly. Phytochrome controls flowering in Kalanchoe by only flowering when there

**M**

is a sufficient build up of Pr, if the day (over 11 hours) is too long there will not be enough time for all the Pfr to change back to Pr and so Kalanchoe would not flower.

wrong on its own, but in sentence context

**M**

(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 response to an environmental cue like temperature that is non directional unlike a troposim which is directional, towards or away from the environmental cue. The petal movement in Kalanchoe as it is a response to light ~~or temperature~~ that is non directional.

no growth indicated – for tropism

Nastic responses are also usually reversible and caused by turgor like the petals moving wheres tropisms normally are not reversible and caused by hormones like auxin.

**N**

*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.

This regular movement of opening of petals is caused by turgor pressure, this is the pressure of water in the petal cells. when at turgor the cells are full of water during the day so expand and so the petals open but when the pressure is released at night the petals contract and are closed. This saves energy at night. It helps with reproductive success as during the day when insects are active the petals attract them and insects pollonate the flowers, so seeds are formed when they pollonate the flowers and the plants reproduce. The petals attracting the insects increase the chance of this occuring and thus reproductive success

cellular level

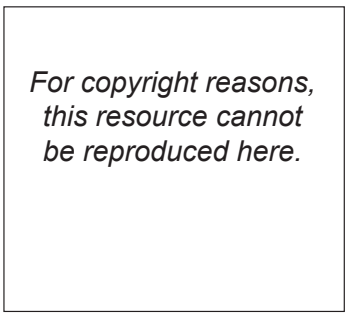
very good

E

## QUESTION THREE

Assessor's use only

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 exploitation

(ii) psyllids and ants: Mutualism

A

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

The pittosporum plants are not preyed upon by other insects as they are driven away by the ants.

A

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

(i) **commensalism** unaffected

Description: One party are the winners the other is so neither won or lost.

Example: Ramora fish and sharks

(ii) **parasitism**

Description: One organism benefits so is a winner the other loses and is harmed.

Example: • Tape worms in people.
• fleas on dogs

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.

poor example, but some good biological description

Interspecific competition acts to control population size as a population can only be as big as the enviroment supports. Interspecific competition is competition between two species that are different, such as the Hooker Sea lion and Yellow Eyed Penguin in the South Island of New Zealand. Both are aquatic animals that hunt for food which is mainly ~~fish~~ fish and yet live on land. Therefore both must compete for prime breeding space to raise young close to the ocean so that they can access food. This limits population sizes as the penguins can only have a population that is large if they can get enough food, if not some will starve. For this food they have to compete with the sealion which usually wins as they eat penguins as well as fish. They must also compete with the sealions on land, for space to breed unhindered. This determines who the animals can breed successfully as competition creates stress which means less energy can be put into raising young so less of both penguin and sealions do so successfully so limiting the population size.

! bad example

not really interspecific competitors

very rarely

good biology

A

The sealion population is also limited by the amount of food, and must compete for food. If there is not enough some will starve to death.

good biology