EXEMPLAR

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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)					**M**

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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.

This circadean rhythm is controlled by a biological clock. This clock creates a rhythm that is natural for the weta. However as seasons change night time and day time change. This change in rhythm is controlled by a zeitgeber which resets the biological clock. In this case the zeitgeber is daylight (or dark), which resets the wetas biological clock so it in sync with the environment. This allows the weta to emerge from holes at times best for it's survival.

A

M

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.

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**.)

Day 1 - start - 8:30pm Day 7 - start - 6:30pm
7 days 2 hour entrainment. $\frac{120}{5} = 17.1$ working
Rhythm starts approx 17 mins earlier every day
period = 23.75 hours
correct

Assessor's use only

M

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

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An advantage of the Wetas nocturnal behaviour is that it is active at a time when less predators such as birds are active. This benifits is survival as less weta are eaten. ~~It may also benifit wetas as they are less~~. However a disadvantage of the wetas nocturnal behaviour is it may have predators which are also nocturnal which can then eat wetas which decreases the wetas survival.

advantage explained

disadvantage described

M

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

A

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

wrong way round

During daylight the pigment P725 is converted to P665 so P665 predominates during day time. However at night time P665 is converted back to P725. By somehow 'measuring' the amount of each pigment present a plant can 'determine' relative day and night length so it 'knows' when to flower.

fine explanation – good biological knowledge, but mistake made, so **M→A**

A

(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.

tropism

A tropism is a growth response to or away from external stimuli. For example Kalanchoe will grow towards sunlight which as know as positive phototropism. A nastic response is not ~~in the~~ directional to external stimuli. For example when Kalanchoe is touched it will curl up. This is known as thigmonasty.

tropism example

nastic

nastic example – accepted as a nastic response as candidates may not know whether *Kalanchoe* curls up

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. Night (closed) Day (open) *Kalanchoe* flowers.	*For copyright reasons, this resource cannot be reproduced here.* 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.

When there is a decrease in turgor pressure in the cells of a Kalanchoe, the cells lose moisture so shrink, this causes the petals to close. Gain ~~loss~~ in turgor is caused by rapid production of potassium which causes water to come into the cell by osmoregulation and the petals will open again.

This process enhances plant reproductive success because when it is touched by something that could harm the pollen in the flower, the petals close. Only when nothing is around to touch the flower and therefore harm it will it open it's petals and release pollen. This causes Kalanchoe to have a enhanced reproductive success

cellular level

explains how movement of petals is produced – very good

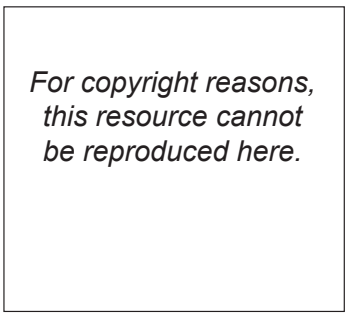
irrelevant to **M** for how movement is produced

M

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*: Parasitic. Psyllids benifit while Pittosporum is harmed.

(ii) psyllids and ants: Mutualism- Both species benifit.

A

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

By psyllids being present on the tree so will ants be present. Ants can drive away insects harmful to the tree such as wood lice.

A

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

(i) **commensalis**

Description: One species benifits (wins), other species unharmed

Example: Fish that swim behind shark flippers.

all correct, plus examples

(ii) **parasitism**

Description: One species benifits (wins), other species harmed (loses)

Example: Worms in humans

A

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

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.

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When two species have interspecific competition for resources, the populations can only get so big. If both species are competing for space i.e Kauri trees and other trees, there is only so much of the resource. So how ever much the more dominant species has the less dominant can only have whats left so population can only grow so big.

resource plus population size idea

Also with so much energy spent of competing for resources, less energy is spent of reproducing for example in animals less energy is spent on producing gametes and bringing up young to less offspring survive which is a factor that controls population size.

reproduction success idea

M

no real example – kauri plus other trees, plus no NZ animals named