91603

916030

3

SUPERVISOR'S USE ONLY

NZQA

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

QUALIFY FOR THE FUTURE WORLD
KIA NOHO TAKATŪ KI TŌ ĀMUA AO!

Level 3 Biology, 2018

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

2.00 p.m. Monday 19 November 2018
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 room for any answer, use the extra space provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–16 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

ASSESSOR'S USE ONLY

QUESTION ONE

Figure 1: Tendrils of *Clematis forsteri*
https://goo.gl/9f9PWH

Figure 2: Tendrils of *Clematis forsteri*
https://goo.gl/GXTchY

Figure 3: Touch-me-not plant with open leaflets
https://goo.gl/5XZnyN

Figure 4: Touch-me-not plant with closed leaflets
https://goo.gl/N6S5Uy

Plants exhibit specific orientation responses that provide adaptive advantages to their survival in a given habitat. Many plant species are known to produce slender spring- or thread-like structures called tendrils, as shown in Figures 1 and 2 of *Clematis forsteri*, a New Zealand native woody perennial climber, in response to touching a support. Yet other plants exhibit different responses to the touch stimuli. The *Mimosa pudica*, or touch-me-not plant, is one such plant that closes its leaflets rapidly when suddenly touched or shaken. Figures 3 and 4 depict how the leaflets are open, and then close on being touched.

Discuss these two responses, the adaptive advantages gained for the plants that display them, and how each plant has such a specific response to the touch stimulus.

In your answer:

- identify and fully describe both biological responses to the touch stimulus
- explain how the processes occur in each response, and justify why these responses are considered adaptive advantages
- compare the adaptive advantages the plants gain in their habitat by displaying these responses.

ASSESSOR'S USE ONLY

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

ASSESSOR'S USE ONLY

ASSESSOR'S USE ONLY

QUESTION TWO

Aphidius ervi (*A. ervi*) are **wasps** that lay their eggs inside the body of **aphids**. A female *A. ervi* lays around 150–350 eggs in a lifetime. *A. ervi* are black and about 4–5 mm long. The adult wasps resemble small winged ants.

Aphids are tiny sap-sucking insects, commonly called greenflies. They are commonly found on roses, and on crop plants such as eggplants, capsicums, and potatoes. The average life-span of an aphid is one month.

The adult female *A. ervi* deposits an egg into the aphid in a matter of seconds. The aphid continues to move and feed after the egg has been deposited. The larva develops within the aphid body which at this stage is called a "mummy". The mummy looks like an over-inflated bronze aphid. *A. ervi* then chews a hole through the back of the mummy and emerges as an adult wasp, killing the aphid, and is now ready to deposit eggs in live aphids.

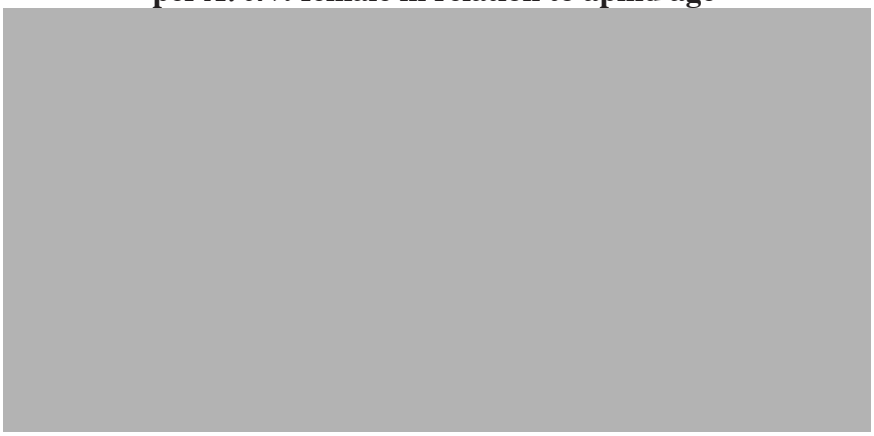
Ervi depositing eggs into aphid.

www.biocomes.eu/biological-control/biological-control-examples/

The graphs on the following page show the preference of *A. ervi* to (1) Age of the aphids and (2) Mean number of eggs laid per *A. ervi* female in relation to the age of the aphid.

ASSESSOR'S USE ONLY

Graph 1: Mean number of aphids used for egg laying per *A. ervi* female in relation to aphid age



Graph 2: Mean number of eggs laid in aphids per *A. ervi* female (estimated from dissection) in relation to aphid age

Adapted from Du, Y., Poppy, G.M., Powell, W. et al., *J Chem Ecol*, Vol 24 (1998), p. 1355.

Evaluate, using the information above, the costs and benefits of the relationships between the three organisms.

In your answer:

- identify the relationships between the *A. ervi* wasps and the aphids, and between the aphids and the rose / crop plants
- evaluate the costs and benefits in the above relationships between the aphids, *A. ervi* wasps, and rose or crop plants
- analyse the graphs above and draw conclusions on the lifecycles of the *A. ervi* wasps and aphids, and the impact on rose and crop plants.

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

ASSESSOR'S USE ONLY

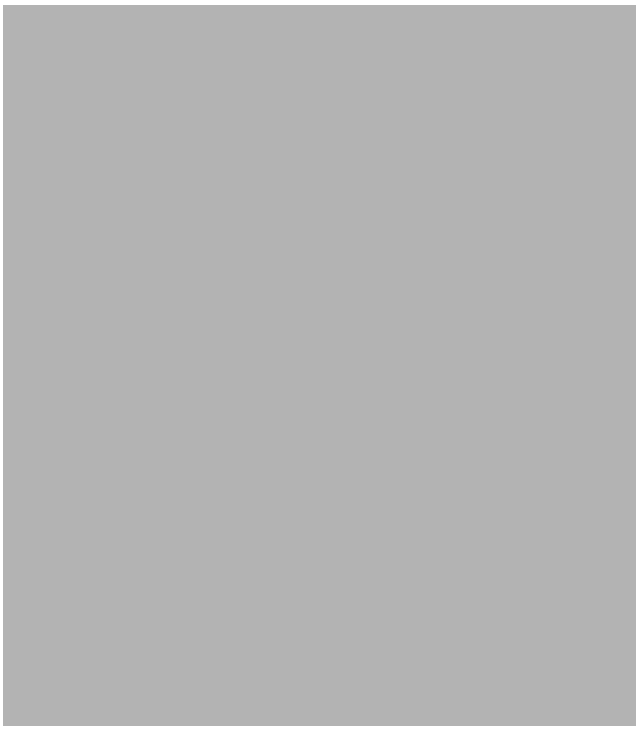
ASSESSOR'S USE ONLY

QUESTION THREE

Mus musculus, commonly known as the house mouse, is found abundantly in all bush areas of New Zealand. It feeds on berries, seeds, and insects, reducing the amount of these foods available to native birds and other ground-dwelling mammals. The mice are also known to eat the eggs of a species of native fish, the inanga, *Galaxias maculatus,* commonly called whitebait in New Zealand.

Every two or three years beech trees flourish to produce heavy seed crops, supplying the mice with a huge source of food. The mouse numbers therefore surge in response to this. As stoats feed on mice, the numbers of stoats increase along with the increased mouse numbers. In the following months, once the beech seeds have germinated and mouse numbers have dropped, the stoats turn their predatory attention to native birds.

Researchers monitored the activity of captured mice for 37 days. The activity shown below is an **actogram** of the mice in a 24-hour period in **normal environmental conditions** for the **first 17 days** indicated by Light and Dark (**LD**). Thereafter, the mice are subjected to 24 hours of **continuous darkness** indicated by **DD** for the next 20 days.



Adapted from Nicolas Cermakian, Lucia Monaco, Matthew P. Pando, Andrée Dierich, Paolo Sassone-Corsi, 'Altered behavioral rhythms and clock gene expression in mice with a targeted mutation in the *Period1* gene', *EMBO Journal*, 2001, Vol 20, No 15, pp. 3967–3974.

Analyse the findings from this actogram to explain how the responses shown above help the mice to adapt to their ecological niche AND how this may impact on the environment.

In your answer:

- describe the timing response and rhythm shown by the mice in relation to the actograms
- explain how this rhythm is controlled
- evaluate the adaptive advantages that the normal rhythm and control mechanism have for the mice, and the consequences to the environment.

ASSESSOR'S USE ONLY

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

ASSESSOR'S USE ONLY

ASSESSOR'S USE ONLY

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

QUESTION NUMBER

ASSESSOR'S USE ONLY

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

QUESTION NUMBER

ASSESSOR'S USE ONLY

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

QUESTION NUMBER

ASSESSOR'S USE ONLY

91603