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3

91603



916030



NEW ZEALAND QUALIFICATIONS AUTHORITY
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Level 3 Biology, 2016

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

2.00 p.m. Thursday 10 November 2016
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 2–15 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.

Achievement

TOTAL

10

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QUESTION ONE: TUI

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Tui (*Prothemadera novaeseelandiae*) are notoriously aggressive, and will defend a flowering or fruiting tree, or a small part of a large tree, from all comers, whether another tui or another bird species. They vigorously chase other birds away from their feeding area with loud whirring wings. Tui have a display flight, in which they fly upwards above the canopy, and then make a noisy, near-vertical dive back into the canopy.

<http://www.nzbirdsonline.org.nz/species/tui>

http://www.biol.canterbury.ac.nz/mistletoes/photo_library.shtml

Tui feed on nectar from the red mistletoe (*Peraxellia tetrapetala*). The red mistletoe grows on the mountain beech (*Fuscopora cliffortioides*).

The flowers are pollinated by tui. To open flowers, tui grasp the top of the bud with their beaks and twist. This causes the flower petals to spring open (in less than $\frac{1}{4}$ of a second), and the birds can then insert their beaks to drink nectar, and thereby pollinate the flower.

Red mistletoe use specialised roots to get water and dissolved mineral ions from a host tree rather than from the soil, causing harm to its host tree mountain beech.

Identify and explain the behaviours and types of competition between the red mistletoe, tui, other birds, and the mountain beech, and evaluate the costs and benefits of maintaining these behaviours and relationships.

In your answer you should:

- describe territoriality
- explain the costs and benefits of the tui's territorial behaviour
- identify and describe the other types of relationships mentioned
- evaluate the costs and benefits to each species in the relationships identified.

Territoriality is the display of aggressive and ~~aggressive~~ behaviours to actively defend a territory with limited resources. Benefits of the Tui's behavior of displays of territorial behaviors

1) are that the Tui has more resources for it self. The Tui benefits the red mistletoe tree by ~~pollinating~~ pollinating the flowers and in return the Tui gets Nectar as a food source.

Here this behavior between the tree and Tui is Mutualism. This is because both benefit from each others interactions.

The Tui's niche requirements are fulfilled. Benefits to the Mistletoe tree are that by getting it water and dissolved minerals ions allow for the tree to increase growth and survival rate: the cost of this though is the other host tree loses these minerals and water causing it to become weak and causing that host tree to die. This behaviour is commensalism. This is where one species or organism benefits whereas the other doesn't.

This mistletoe tree ~~could~~ could be showing displays of taxis as this is a directional movement to a stimulus, either positive or negative.

The Tui's behaviour decrease chance of mate selection. This is because the Tui is actively defending his territory, even from other Tui's who ~~could~~ could be potential mates.

This ~~decrease~~ decrease the chance of offspring ~~which~~ which decreases the chance of a diverse or greater ~~gene~~ gene pool. A benefit to this is that the Tui attracts a lot of mates.

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QUESTION TWO: THE SPOTTED HYENA

The spotted hyena (*Crocuta crocuta*) is one of the most social of all carnivores. It lives in groups containing up to 90 individuals, and exhibits the most complex social behaviour. These animals live in social groups called clans that defend group territories.

Females are dominant over males, and even the lowest ranking female is dominant to the highest ranking male. Although males typically disperse from the clans they were born into, when they are between two and six years of age, females usually remain in their natal clan, so large clans may contain several different female lines of descent.

Females give birth at any time of year to litters containing one or two cubs. At the communal den, cubs are maintained for a period of 8 to 12 months; during this period the major source of food for cubs is milk provided solely by their mother. Although cubs of both sexes 'inherit' their mothers' social ranks, males voluntarily forsake those to assume much lower ranks in the neighbouring clans to which they disperse.

The following set of data shows the interactions of six female hyenas.

		Hyenas doing the biting					
		A	B	C	D	E	F
Hyenas being bitten	A	-	0	10	11	9	20
	B	7	-	18	8	6	8
	C	0	0	-	0	0	0
	D	0	0	17	-	12	11
	E	0	0	6	4	-	27
	F	0	0	18	0	0	-

Compare and contrast the advantages and disadvantages of belonging to the hierarchy of a clan, or living a solitary lifestyle.

In your answer you should:

- describe what a linear hierarchy is, and give the order of the linear hierarchy in the table above
- explain how a hierarchy is maintained, and identify which hyena is challenging for a higher position in the hierarchy
- explain factors that could influence an individual's position in the hierarchy
- discuss the advantages and disadvantages to individual male and female hyenas belonging to a social hierarchy in the clan, compared to living a solitary lifestyle.

C = Most Dominate female because she does most biting and receives no bites back.

F, E, D, B, A. A is the least dominant of the females because she received the most biting from the other

Hyenas. A linear hierarchy is a where there is one Alpha and the rest follow the Alpha. From the table ~~Hyena~~ Hyena F is challenging C Hyena for Alpha position. This is seen by the numbers. The Alpha Hyena, C, did most of the biting with a total of 69 bitings and has not been bitten by any of the other Hyenas whereas the Hyena F, did the second most biting with 66 bitings and receiving the second least amounts of biting with only 18 bites all from the Alpha Hyena. A hierarchy is a maintained rank by ~~the~~ the members of the Hyena. The Alpha Hyena actively defends the Alpha positions and she does this by aggressive behaviours such as biting to maintain the hierarchy. ~~A~~ A factor that could influence an individual's position on the hierarchy is by fighting the Alpha. If this individual beats the Alpha, then this individual becomes the new Alpha. If the Alpha Hyena ever gives birth, another Hyena could kill the Alpha Hyena because she would be weak and take up the position of Alpha. Benefits to the Hyenas that are ranked higher on the hierarchy is that they have access to more ~~supplies~~ supplies, resources, mates, offspring etc. This means that the gene-pool of the Hyenas would

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be strong because the Alpha gets to mate. Gene pool is strengthened because only strong individuals get to mate. This means the weak Hyenas die or are unable to mate making the gene pool strong. ~~There are also~~ Another benefit is that the Alpha gets to eat first and whatever is left the rest of the clan gets, going from the stronger members get more and the least only a little or scraps of whatever is left. Cost are that individuals become weak due to hierarchy, or are left to die. If the Hyenas were to live a solitary life then there would be a higher genetic diversity in the gene ~~pool~~ ^{pool} but this would allow the weak alleles to be present in the gene pool. ||

A3

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QUESTION THREE: WETA

The Auckland tree weta (*Hemideina thoracica*) tokoriro remains secluded in the daytime under bark or in holes in trees in dim light. It emerges from cover soon after sunset to forage for mainly plant material, to return before dawn.

In the experiment below, the environmental conditions were maintained at 20°C in constant darkness for an experiment to observe its biological timing. The results are shown in **Graph 1** below left. The dark bars show when the weta is active.

The weta was then placed in 12 hours of light followed by 12 hours of darkness until day 18 (when it was exposed to 8 hours of light during the dark period), after which it was left in constant darkness. The results are shown in **Graph 2** below right.



<http://auckland-west.co.nz/wordpress/wp-content/uploads/2010/03/PICT6794aw.jpg>

Graph 1: Constant Darkness



Single plotted actogram of weta activity in a 24-hour period in constant environmental conditions.

Graph 2: 12 hr Light + 12 hr Darkness



A double-plotted actogram of weta with 8 hrs light (arrowed) on day 18 during the hours of darkness.

www.tandfonline.com/doi/pdf/10.1080/03014223.1994.9517476

Analyse the findings from these actograms to explain how the responses shown above help the weta adapt to its ecological niche.

In your analysis you should:

- describe the activity and rhythm shown by the weta
- explain how this rhythm is controlled
- explain the effect of the additional 8 hours of light on day 18 on the weta
- evaluate the adaptive advantage that this rhythm and control mechanism have for the weta.

In graph 1 the rhythm that is displayed is Neutral day period. This is where the weta did not need the sun or light to maintain ~~the~~ biological clock. ~~There was a~~ was a innate mechanism that the weta used and relied upon. The weta are able to use ~~the~~ Entrainment to ~~the~~ rely on day length. This is because the clock resets everyday but because the wetas didn't have light they would reset there clocks a little late everyday. This is in contrast to the Graph 2. the day day lengths were able to be maintained to be constant for up to about ~~18~~ 18 days.

This is ~~because~~ because they Zeitgeber which is the biological clock in time with the external environmental clues - for example the sun (or light). After day 18, the wetas' sleeping and activity time started to begin later every day. This is because of the increase time of light for 8 hours ~~causing~~ causing the weta's to start activity later every day. A adaptive advantage to having a controlled mechanism for day length and night is it can prevent the weta from waking up the wrong time allowing predators getting them. Another advantage is that they will be in time with the external environment.

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A4

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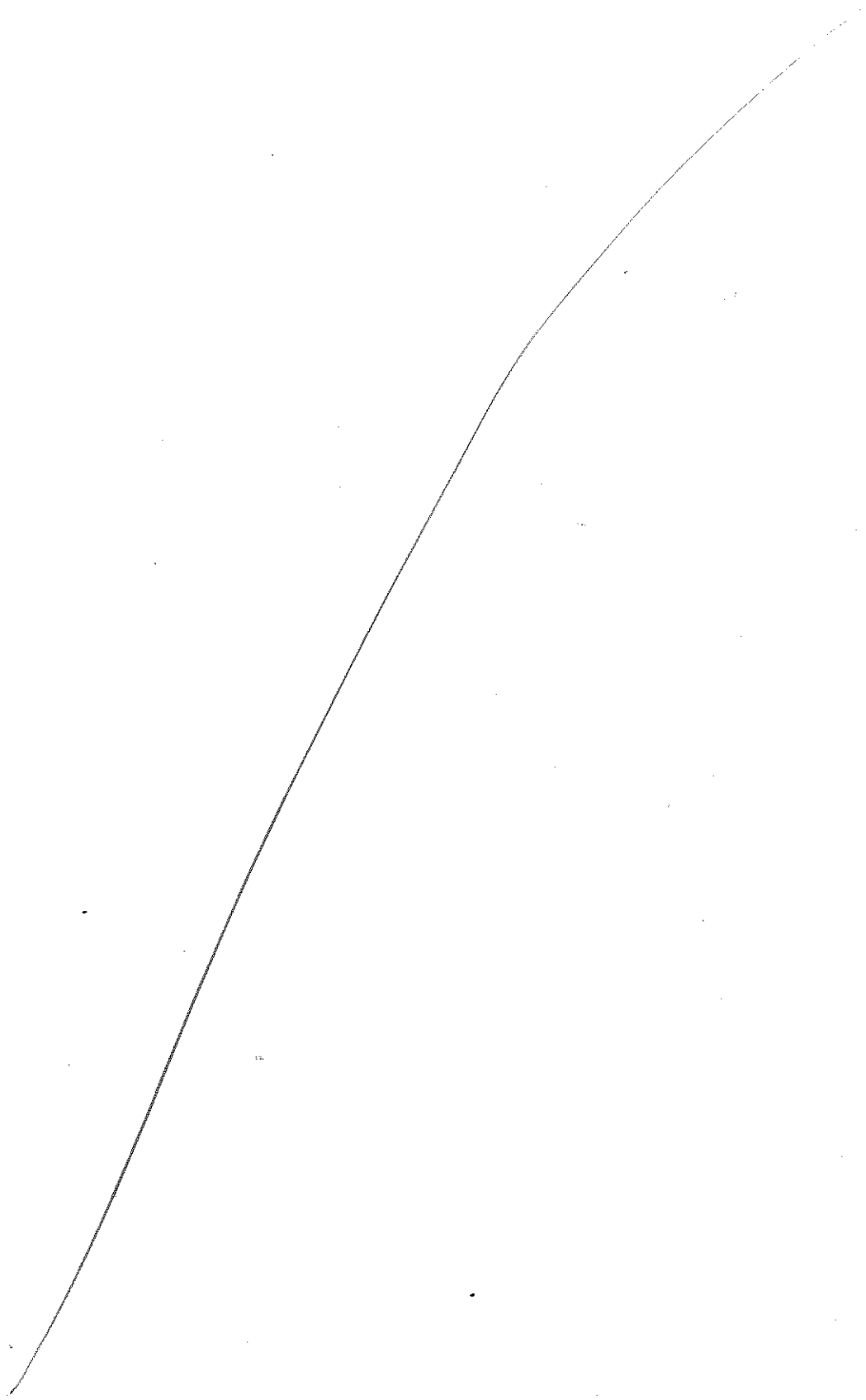
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Annotated Exemplar – A10 - 127846435

Excellence exemplar 2016

Subject:		Biology	Standard:	91603	Total score:	10
Q	Grade score	Annotation				
1	A3	This is a borderline Achieved answer, but the candidate correctly identifies territoriality, mutualism and agnostic behaviour. They don't identify parasitism, instead, incorrectly stating the relationship is commensalism. For Merit, costs and benefits are required for BOTH species in TWO of the relationships, and this student does not reach that point.				
2	A3	The candidate gets the order of the hierarchy slightly wrong. They also incorrectly identify the Hyena that is challenging. Despite this, the candidate shows an understanding of the term hierarchy, which although not clearly defined in a single statement, is obviously understood. The candidate is also credited for describing how hierarchy is maintained as well as factors affecting position in the hierarchy for a further point. The descriptions are too weak to transit to explanations and don't gain credit towards Merit. Although there is some explanation of the benefit to remaining in a hierarchy, a minimum of TWO clear explanations is not given and M5 was not awarded.				
3	A4	The candidate provides a definitions of Zeitgeber & Entrainment, which whilst not 'textbook' do convey understanding of the terms. In addition the candidate describes aspects of the graph and describes an advantage of the behaviour. These descriptions although starting to explain give insufficient detail to provide evidence towards M5 (any 2) or M6 (any 3)				