

Assessment Schedule – 2024**Biology: Demonstrate understanding of the responses of plants and animals to their external environment (91603)****Assessment Criteria**

Achievement	Achievement with Merit	Achievement with Excellence
<p><i>Demonstrate understanding</i> involves:</p> <ul style="list-style-type: none"> describing the process(es) within each response and/or the selective advantage provided for the organism in relation to its ecological niche. 	<p><i>Demonstrate in-depth understanding</i> involves:</p> <ul style="list-style-type: none"> using biological ideas to explain how the responses occur explaining why the responses provide a selective advantage for the organism in relation to its ecological niche. 	<p><i>Demonstrate comprehensive understanding</i> involves:</p> <ul style="list-style-type: none"> linking biological ideas to explain why the responses provide a selective advantage for the organism in relation to its ecological niche; linking of ideas may involve justifying, relating, evaluating, comparing and contrasting, and analysing.

Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 7	8 – 13	14 – 18	19 – 24

Evidence**Question One**

Evidence	Achievement	Achievement with Merit	Achievement with Excellence
<p>While both species coexist, snail numbers have dropped due to introduced predators. The term is ‘predation’, with possums preying on the snails. They hunt and kill the snails for food, which, after respiration will give energy for movement and reproduction. The possum benefits and the snails (prey) are harmed, i.e. positive / negative relationship.</p> <p>Possums and hedgehogs are showing interspecific competition for the same food resource (kauri snails). This means the resource must be in limited quantities; the snail population is quite low. It is a negative / negative relationship as each species gets less than if there were to be no competitor species.</p> <p>Being nocturnal is an advantage to the snail as their food (earthworms) comes to the soil surface at night, and the snail avoids desiccation. This also means they are more vulnerable to nocturnal predators, such as possums and hedgehogs, which is a disadvantage. Being large and slow-moving, the snails avoid the predators that use vision as their main sense, e.g. most birds.</p> <p>Snails can still be active in the daytime, meaning they have an opportunity to gather food undisturbed by exclusively nocturnal predators.</p> <p>By laying three times a year, the snails increase the chances of successful reproduction, as they will lay eggs only when conditions are suitable. During those three times, there may be occasions when there are fewer predators and more favourable conditions for young to survive.</p> <p>Hedgehogs hibernate to avoid challenging conditions (e.g. winter) when there is less food available. This adaptation increases the hedgehog’s chances of survival. By hibernating, they conserve energy at a time of the year when resources and food are scarce. This is valuable in cold conditions where more energy would be needed to sustain a homeothermic (warm-blooded) organism.</p> <p>By being nocturnal / active at night, the possum reduces competition for food as there are fewer species to compete with for food (mainly the hedgehog).</p>	<p>Describes:</p> <ul style="list-style-type: none"> • relationship between possum and snail – predation • relationship between possum and hedgehog – inter-specific competition • advantage to the snail of being nocturnal • disadvantage to the snail of being nocturnal • hibernation • advantage of laying more than once • nocturnal behaviour defined • advantage to the possum of being nocturnal. 	<p>Explains:</p> <ul style="list-style-type: none"> • that by being active at night, the kauri snail has greater food availability or avoids desiccation linked to greater chances of survival • by being active at night, the kauri snail is vulnerable to nocturnal mammalian predators, such as the possum and hedgehog, which may lead to decreased reproductive success • hibernation increases an organism’s chances of surviving hostile conditions by living off stored reserves • how laying multiple times per year increases the chances of reproductive success • the nocturnal possum can synchronise its activity with the activity of its prey (the snail). 	<p>Discusses, demonstrating understanding of the relationships and behaviours of the three species that support survival and reproductive success:</p> <ul style="list-style-type: none"> • predation: the snail provides a food source for the possum, increasing the likelihood of possum survival, and so increases the chances of reproductive success • interspecific competition between possum and hedgehog for a limited resource: decreases during the hibernation of the hedgehog, and so increases reproductive success of the possum • kauri snail being nocturnal: greater food availability AND reduced desiccation, increasing the likelihood of snail survival, and so increases reproductive success • kauri snail laying three times a year: lays eggs only when conditions are suitable, increasing numbers of viable offspring, and so increases reproductive success • hibernation: increases the hedgehog’s chances of survival as energy is conserved when food is scarce and

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			<p>environmental conditions are harsh, and so increases the likelihood reproductive success</p> <ul style="list-style-type: none"> nocturnal behaviour of possum: reduces interspecific competition for food and, with possum activity synchronised with activity of prey, and so increases reproductive success.

Not Achieved		Achievement		Achievement with Merit		Achievement with Excellence	
N1	N2	A3	A4	M5	M6	E7	E8
Describes ONE evidence point at Achievement.	Describes TWO evidence points only at Achievement.	Describes THREE evidence points at Achievement.	Describes FOUR evidence points at Achievement.	Explains TWO evidence points at Merit.	Explains THREE evidence points at Merit.	Discusses TWO evidence points at Excellence.	Discusses at least THREE evidence points at Excellence.

N0 = No response; no relevant evidence.

Question Two

Evidence	Achievement	Achievement with Merit	Achievement with Excellence
<p>The kōwhai is a native. It is known as a ‘short-day’ plant (SDP), as it is induced to flowering after the lengthening nights reach a critical length (critical night length); these longer nights are in winter and, consequently, the kōwhai flowers in late winter to early spring. It produces nectar, which is sweet and a food source for a pollinator. In the case of the bumblebee, it exhibits positive chemotaxis OR positive trophotaxis (movement towards a stimulus that is a potential food source). Both are directed movement responses to a chemical gradient, the movement towards a chemical stimulus (towards volatile organic compounds) released by the kōwhai nectar; the bumblebee gets directly to the food source, using less energy and time, both of which can go towards keeping safe or moving to a new flower.</p> <p>The kōwhai shoots’ growth response is negative geotropism. This serves to allow fast growth out of the soil and up to gain light by photosynthesis when there are competing plants around. This allows for glucose formation to be used in respiration for energy, as making nectar and flowers takes energy.</p> <p>Auxin is a plant growth hormone. This is produced in meristematic regions of the plant and migrates to the lower side of the plumule, causing cell elongation (by changing the permeability of the cell wall). These cells elongate faster than the cells in the upper part of the plumule, causing it to bend upwards. This means the plant can grow out of the soil faster.</p> <p>The bumblebee gains nectar from the kōwhai. The nectar is sweet, and this sweet chemical can be picked up by the bumblebee. The bumblebee’s response is called positive chemotaxis and results in a more direct (i.e. faster with less energy) movement to the food source.</p> <p>Biological clocks are cells or groups of cells that are able to measure time. They enable rhythms of behaviour, such as the circadian rhythm, as seen in the bumblebees under constant light. When the environment is not constant, rhythms are observed as being entrained to zeitgebers or environmental factors, usually something like the onset of light or darkness; these factors serve to reset the clock.</p> <p>The actograms show clear evidence of foraging periods rather than the constant foraging that would be possible with 24 hours of daylight, with the bees exhibiting diurnal rhythms.</p>	<p>Describes:</p> <ul style="list-style-type: none"> • a short-day plant • evidence for SDP (short days and long nights induce flowering) • positive chemotaxis or positive trophotaxis • negative geotropism or gravitropism • the advantage to the kōwhai of chemotaxis OR geotropism • action of auxin • a named rhythm, with a definition, e.g. circadian or circannual • the idea of the bumblebee having an endogenous rhythm as it is maintained in constant conditions • biological clocks • entrainment • the named zeitgeber. 	<p>Explains:</p> <ul style="list-style-type: none"> • SDP with evidence (related accurately to critical day or night length) • negative geo- /gravitropism, with an advantage • positive chemotaxis, with an advantage • auxin mechanism • how entrainment relates to rhythm • evidence from the actogram for a named rhythm for the bumblebee • the biological clocks of both the bumblebee and the kōwhai mean that flowering coincides with when the bumblebee pollinators are active, ensuring pollination and, therefore, kōwhai reproductive success. 	<p>Discusses, demonstrating understanding of biological clocks in the two species:</p> <ul style="list-style-type: none"> • being able to flower at a specific time of year is important for the success of kōwhai, e.g. if they flower too early the blooms maybe damaged by frost or, if in the middle of summer, water is in short supply also, it results in flower losses, and so a loss of reproductive opportunity • their biological rhythm is circa-annual (flowering once a year) and is controlled by a biological clock to ensure the endogenous rhythm is entrained to synchronise with seasonal changes; the zeitgeber is the photoperiod / night length • flowering needs to coincide with when the bumblebee pollinators are active, ensuring cross-pollination, and so increasing genetic diversity in the population; the biological clock ensures flowers bloom at an optimal time for bee pollination • bumblebees also rely on a biological clock that is endogenously controlled (evidenced by the continued presence of the rhythm in constant light conditions in the Arctic) to optimise their

<p><i>For biological clocks:</i></p> <p>Kōwhai and bumblebees have biological clocks, and the processes have rhythms – circadian for the bumblebee foraging, circannual for the flowering kōwhai. They are entrained to the daylight and the seasons.</p> <p>For the bumblebee, possibly the intensity of UV [<i>may say temperature</i>] of the light that is around, i.e. not just light, such as that in the Arctic Circle with full light 24 hours per day in summer.</p>			<p>foraging and pollination behaviours</p> <ul style="list-style-type: none"> • being active during the cooler periods of the day suggests that the zeitgeber is increasing light intensity but is also entrained by a temperature zeitgeber • life processes controlled by biological clocks ensure that reproduction and other life processes occur at a time of year or day that optimises the chance of reproductive success.
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Question Three

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<p>A territory is an area with defined boundaries and is defended by its owner(s) against other members of that species. By defending a territory against other members of the same species, the chestnut-crowned babbler gains many advantages, including increased protection from the environment due to the larger nest, which also serves to protect against predators.</p> <p>Kin selection is altruism towards genetic relatives. This may be exhibited by individuals assisting with food gathering or rearing young for relatives. In the case of the babbler, kin selection appears to be operating as only genetic relatives assist with chick rearing.</p> <p>By living in a group, the babblers have greater access to potential mates, which reduces the energy needed for reproduction. Being in a defended territory gives the babblers within that territory exclusive access to the resources (e.g. food or mates) in the territory, which increases the chances of survival and reproduction.</p> <p>Advantages of social behaviour, for example:</p> <ul style="list-style-type: none"> • Finding food in a group means greater capacity to find food, i.e. more birds looking for food increases the likelihood of successfully gathering sufficient food to ensure survival of both adults and chicks. • Social preening is a valuable behaviour as it may increase bonds between individuals and / or establish or reinforce any social ranking system without the need for aggressive displays. It will also serve to remove parasites, e.g. ticks from the birds' plumage. <p>Having an increased number of helper-males to assist with chick-rearing increases the chances of the chicks' survival. For example, they can help build a nest. It increases the number of individuals gathering food for the chicks. These males may share alleles with the chicks due to being uncles. The helper-males may become the breeding males one day.</p> <p>The non-related females do not support reproduction because they do not share sufficient alleles with the chicks to make the altruistic trade-off viable. The more alleles an individual shares, the greater the altruism shown.</p>	<p>Defines:</p> <ul style="list-style-type: none"> • territory • kin selection • advantage of the territory to the babblers • males help raise chicks as they have alleles in common with the chicks • an advantage of social behaviour, e.g. improved food gathering • second advantage of social behaviour, e.g. preening to remove skin parasites • non-related females do not assist reproduction as they do not share alleles with the chicks. 	<p>Explains:</p> <ul style="list-style-type: none"> • a defended territory means increased access to resources, leading to increased chances of survival and reproduction • kin selection means individuals with common alleles will engage in altruistic behaviour to increase the chances of those alleles being passed on (through the chicks) • an example of how social behaviour will increase the chances of survival, e.g. cooperative food gathering • another example of how social behaviour will increase the chances of survival, e.g. preening removes skin parasites, reducing the chances of disease • helper-males make a genetic contribution to the next generation by ensuring the survival of their own alleles in the chicks, despite not fathering the chicks • non-related females do not assist with reproduction as they do not share alleles with the chicks produced by the breeding females, so the self-sacrifice is not worthwhile. 	<p>Discusses how the benefits of cooperative behaviour lead to the reproductive success of the babbler and its chicks.</p> <ul style="list-style-type: none"> • if an area is marked and defended, the young can be raised with less stress / more resources, increasing the chances of young making it to reproductive age • by living in a group, the babblers have greater access to potential mates, reducing the energy needed for reproduction • cooperative food gathering conserves energy, increasing the chances of survival, and so increases reproductive success • social preening increases the bond between individuals as well as serving to remove parasites, and so increases the chances of survival and reproductive success <p>Discusses the role of kin selection in the reproductive success of the babbler population.</p> <ul style="list-style-type: none"> • only genetic relatives (helper males) assist and engage in altruistic behaviour such as chick rearing, so increasing the chances of the chick's survival,

			<p>and contributing to the next generation by ensuring the survival of their own alleles, despite not fathering the chicks; AND discusses non-related females not assisting with reproduction as they do not share alleles with the chicks produced by the breeding females</p> <ul style="list-style-type: none"> • kin selection ensures greater reproductive success due to greater focus on parental care, resulting in greater survival of the chicks, and so ensures the continuation of the shared genes and the kin selection behaviour.
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