

Assessment Schedule – 2013

Biology: Demonstrate understanding of the responses of plants and animals to their external environment (91603)

Assessment Criteria

Q	Evidence	Achievement	Merit	Excellence
ONE	<p>Cowbirds are always on the move following cattle so have little time for mating and nesting. They lay eggs in host nests, so their chicks are hatched and raised by other birds. Chicks that hatch early and become bigger than their host's chicks will get most food, so have better survival chances than the host's chicks.</p> <p>One egg per host nest means the risk of survival for their chicks is spread, and their high reproductive and egg laying rate also means increased chances of passing on their genes.</p> <p>Parasitism gives cowbirds an advantage as it ensures they do not need to stop following cattle and food gathering, so they retain their own fitness and can reproduce and breed many times, spreading the risk for their chicks, by laying only one egg in each parasitised nest.</p> <p>But for the host songbirds it causes extra work and requires more energy, as they have to raise an additional chick. It means less food for their own chicks and may affect their survival as they are not as fast growing and may not get enough food or care for their own survival.</p> <p>This, combined with the high reproductive rate of the cowbirds (can lay up to 40 eggs per year), has probably led to the decline of songbird numbers.</p>	<p>Defines parasitism:</p> <ul style="list-style-type: none"> a (symbiotic) relationship where one animal / organism benefits and the other animal / organism is harmed. <p>Describes an adaptive advantage of cowbird behaviour:</p> <ul style="list-style-type: none"> high rates of reproduction no need to spend time on nest can lay eggs in several nests can keep on feeding. <p>Describes an aspect of the reproductive strategy without explaining it:</p> <ul style="list-style-type: none"> Songbird pays more attention to cowbird chick. Cowbird doesn't spend time raising its young. Cowbird can have many chicks at no cost to itself. 	<p>Definition Of Parasitism:</p> <ul style="list-style-type: none"> a (symbiotic) relationship where one animal / organism benefits and the other animal / organism is harmed. <p>Explains why the cowbird reproductive strategy works well:</p> <ul style="list-style-type: none"> By parasitising songbird nests, they can lay eggs and have them raised without expending energy or time. <p>Explains advantage / disadvantage in terms of survival to the cowbird or songbird:</p> <ul style="list-style-type: none"> Cowbirds are always moving to follow cattle for food, so do not need to stop in order to reproduce and raise young. Songbirds expend more energy raising young and are probably feeding the parasite chick more due to its size and faster growth rates. 	<p>Links the effectiveness of the cowbird's reproductive strategy to its way of life / ecological niche.</p> <ul style="list-style-type: none"> By being a brood parasite, it relies on other birds to hatch and raise its eggs, leaving it free to continue feeding, as it follows cattle, and not take time away for nesting. It has more energy to reproduce and can lay more eggs – up to 40 per season. They can reproduce often and spread the risk of raising their chicks across many nests. Its chicks hatch sooner and grow faster than their hosts, so attract more food, increasing their chances of survival. <p>Justifies how cowbirds affect songbird survival.</p> <ul style="list-style-type: none"> Where cowbirds retain fitness / high reproductive rates, songbirds are declining due to reduced fitness raising young that aren't theirs and neglecting their own, losing their own reproductive fitness and high mortality rates of their chicks / Increased genetic variability in cowbirds and death of song bird chicks causes loss of genetic variability / reproductive success. / Alleles passed on for the cowbirds increasing reproductive success and not for song birds.

Q	Not Achieved			Achievement		Merit		Excellence	
	NØ = no response or no relevant evidence	N1 = 1 point, from Achievement, but no definition.	N2 = 2 points from Achievement, but no definition.	A3 = Definition plus 1 other point from Achievement	A4 = Definition plus 2 other points from Achievement	M5 = Definition and 1 point from the reproductive strategy and Any 1 advantage OR 1 disadvantage Clearly explained	M6 = Definition and 1 point from the reproductive strategy and Any 1 advantage and 1 disadvantage Clearly explained	E7 = 1 point from Excellence	E8 = 2 points from Excellence

Q	Evidence	Achievement	Merit	Excellence
TWO	<p>The flying squirrel shows an endogenous rhythm which is reset when it senses a change in photoperiod. The squirrel is nocturnal and cannot see changes in light and dark from inside its nest. The endogenous rhythm ensures it becomes active when it becomes dark, and exposure to change in photoperiod resets the rhythm, acting as a zeitgeber.</p> <p>The two graphs show squirrel activity under two different light-dark regimes over 24 hours for 23 days.</p> <p>Graph (a) shows a regular pattern of activity from 1800 hrs to 2200 hrs because the change in light-dark regime is kept constant and the onset of light every 12 hrs resets the biological clock / rhythm daily.</p> <p>Graph (b) shows that when placed in constant darkness, the squirrels retain their rhythm for at least 15 days, but activity starts later each day by about 20-30 minutes. The free-running / natural rhythm is more than 24 hours (24.3 hrs).</p> <p>The endogenous rhythm has an adaptive advantage, ensuring the squirrel becomes active at nightfall without needing to go out during the day when visible to predators, or staying inside and missing nightfall and the chance to feed under reduced light when most food is available and it is safest from predators.</p> <p>Resetting of the free-running rhythm by exposure to light ensures the squirrels change their biological clocks to adjust for seasonal changes in night and day.</p>	<p>Describes the term endogenous rhythm:</p> <ul style="list-style-type: none"> Endogenous (biological clock) rhythm/Circadian rhythm that is built in / internally generated / not dependent on external cues. <p>Describes the term entrained:</p> <ul style="list-style-type: none"> Where the endogenous rhythm/Circadian rhythm is re-set by a zeitgeber / outside factors / light and dark. <p>Describes aspects of the graphs:</p> <ul style="list-style-type: none"> Squirrels' activity is reset by change in photoperiod / exposure to light. Squirrels' activity is not reset / becomes free-running when left in darkness/Squirrels' biological clock keeps running when left in darkness. Squirrels are active in the earlier part of the night / (1800-0100) when left in darkness. <p>Gives an advantage for behaviour:</p> <ul style="list-style-type: none"> Squirrels go out at the right time / night. Squirrels stay in tune with day and night. Squirrels rely on their biological clock to tell them when to be active. 	<p>Analyses the response and pattern with reasons:</p> <ul style="list-style-type: none"> The response is endogenous (biological clock) because the rhythm is regularly repeated and doesn't disappear when the light-dark regime changes to dark only/continues in the absence of external cues <p>Differences in the actograms are explained:</p> <ul style="list-style-type: none"> Graph (a) squirrels show a regular pattern of activity from 1800 to 0100 when exposed to a constant 12 hr light-12 hr dark regime. Their biological clock / rhythm is being reset by the change in light / dark. Graph (b) shows that the squirrels' rhythmic behaviour continues in the dark but that it is not re-set by exposure to light / there is no zeitgeber/environmental cue <p>An adaptive advantage is explained:</p> <ul style="list-style-type: none"> The squirrel nests deep in the tree where it cannot sense day and night. The biological clock triggers activity at the right time so feeding can happen in darkness / activity happens when there are fewer visual predators / when it is safer. 	<p>The pattern of the squirrel's behaviour is fully analysed through explanations and comparisons of the actograms.</p> <ul style="list-style-type: none"> Graph (a) shows the squirrels' activity in laboratory conditions under a constant 12 hr light – 12 hr dark regime, where the Endogenous biological clocks are entrained into a regular rhythm. There is no fluctuation in the activity. <p>Graph (b) removes the zeitgeber by placing the squirrels in a regime of constant / 24 hr darkness. With no zeitgeber / entrainment, the rhythm becomes free-running and shows the squirrel's natural endogenous rhythm is 24 hours and 20 / 30 mins. This can be seen where the squirrels' activity becomes later each day.</p> <p>The adaptive advantages are considered.</p> <p>In the absence of light, for short periods the biological clock will lead to activity at the right time – cover of dark. Activity will still happen even if the change in photoperiod changes. Energy is conserved, as squirrels are active only when they need to be.</p> <p>Inclusion of</p> <ul style="list-style-type: none"> Having the period of the endogenous rhythm greater than 24 hours ensures that the squirrel emerges only once it is dark (and thus safe) even at times (ie

				<p>springtime) when day length is increasing /change in season//</p> <p>From day 15, there are signs that the endogenous rhythm is beginning to break down slightly, as small bursts of activity are apparent across the 24 hours.</p>
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	NØ = no response or no relevant evidence	N1 = 1 point, from Achievement, but no definition.	N2 = 2 points from Achievement, but no definition.	A3 = 3 points from including 1 from endogenous rhythm or entrained, 1 from the graph and 1 from the advantage)	A4 = 4 points including 1 from endogenous rhythm 1 from entrained, 1 from the graph and 1 from the advantage)	M5 = Both graphs explained and 1 advantage	M6 = Both graphs <u>Clearly</u> explained and 2 advantages	E7 = 1 point from Excellence	E8 = 2 points from Excellence

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Q	Evidence	Achievement	Merit	Excellence
THREE	<p>The shoot shows –ve gravitropism as it grows upwards towards the surface and +ve phototropism once it breaks through the surface and has contact with light.</p> <p>Once the shoot (plumule) germinates, auxin produced in the apical meristem tissue settles on the lower side of the shoot tissue and causes elongation of the cells, whilst the top layer of cells elongate normally. The differential cell development as the shoot (plumule) grows causes it to bend upwards against gravity and towards the soil surface.</p> <p>Once the shoot breaks through the surface and encounters light, the shoot shows a +ve phototropic response. Auxin is produced in the apical meristem / shoot tip and accumulates on the shaded side of the shoot stem. Again it causes elongation of cells on the shaded side and differential growth, so that the shoot bends towards the light source.</p> <p>The adaptive advantage of the gravitropic growth response is that regardless of which way the seed is orientated, the plumule will always respond by growing upwards towards the soil surface against gravity, where it will eventually access light to begin chlorophyll production and photosynthesis, becoming independent in producing its own energy supply.</p> <p>The advantage of the phototropic growth response is that the shoot, as it develops leaves and chlorophyll, in order to photosynthesize, is able to gain maximum light exposure at the most effective angle to enable photosynthesis and therefore growth, development, and reproduction to occur. The plant has the energy and raw materials to develop specialised reproductive tissues such as flowers and seeds and seed receptacles. The plant is able to compete with other plants for adequate light for effective photosynthesis and starch production for continued growth and repair.</p>	<p>Describes growth response of shoot as it grows from germination.</p> <p>Describes roles of gravity, light, auxin.</p> <p>Describes advantages of shoot responses.</p> <ul style="list-style-type: none"> • Shoot shows –ve gravitropism as it grows upwards and away from gravity. <p>AND</p> <p>Shoot shows +ve phototropism when it reaches surface / has contact with and grows to light.</p> <ul style="list-style-type: none"> • Auxin is responsible for growth / elongation of shoot cells. • Auxin is produced in the shoot tips / apical meristem tissue • Auxin stimulates shoot cell growth on lower side of shoot in ground / darkness. • Auxin stimulates shoot cell growth on the shaded side when in light. • Shoot can reach surface to find light for photosynthesis/light used for making food. • Pollination and seed dispersal. 	<p>Explains roles of gravity and auxin OR light and auxin in shoot response.</p> <p>Explains adaptive advantages of shoot response.</p> <ul style="list-style-type: none"> • Once the shoot has germinated, auxin produced in the shoot tip settles on the lower side of the shoot and causes cells to elongate. This ensures the shoot grows up to the surface and shows a –ve gravitropic response. • When the shoot breaks through the soil surface, auxin produced in the shoot tip / apical meristem accumulates on the shaded side and causes cell elongation and differential growth so that the shoot bends as it grows towards the light showing +ve phototropism. <p>AND</p> <ul style="list-style-type: none"> • Adaptive advantages for the shoot are that the –ve geotropic response enables it to grow towards the surface in the absence of light. • Once it breaks the surface, it can orientate towards the light and gain maximum light exposure on developing leaf surfaces for photosynthesis. • Once shoot grows upwards it can produce flowers and have 	<p>Discusses the adaptive advantages of the shoot’s response, AND links it to gravity, light and auxin, in its ecological niche.</p> <ul style="list-style-type: none"> • Once the shoot has germinated, auxin produced in the shoot tip settles on the lower side of the shoot and causes cells to elongate, whilst cells on the upper side continue to grow normally. This causes the shoot to bend in an upwards direction and ensures the shoot grows up to the surface and shows a –ve gravitropic growth response. <p>When the shoot breaks through the soil surface, auxin produced in the shoot tip / apical meristem accumulates on the shaded side and causes cell elongation, whilst the non shaded cells grow normally and differential growth occurs so that the shoot bends towards the light and shows a +ve phototropic response.</p> <p>The advantage of the +ve phototropic response is that the shoot, as it develops leaves and (chlorophyll) in order to photosynthesize, is able to gain maximum light exposure at the most effective angle to enable photosynthesis and therefore energy for growth, development and reproduction to occur.</p> <p>Enables competition with other plants for light../Enables growth of specialized tissues for fertilisation and seed development/Enables</p>

			<p>pollination.</p> <ul style="list-style-type: none"> When shoot grows out of the soil into a mature plant, seed dispersal occurs. 	<p>development of leaf surface area to maintain adequate starch production for continued growth and differentiation / reproduction.</p> <ul style="list-style-type: none"> The adaptive advantage of the -ve gravitropic response is that regardless of which way the seed is orientated, the plumule will always respond by growing upwards towards the soil surface against gravity and should eventually find light to enable (chlorophyll) development and start photosynthesis.
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Judgement Statement

	Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
Score range	0 – 8	9 – 13	14 – 18	19 – 24