Assessment Schedule – 2018

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

Evidence Statement

Question One

Evidence	Achievement	Merit	Excellence
The type of movement / response shown by the *Clematis* tendrils is **Positive Thigmotropism**. It is a directional growth movement that causes the plant to bend as a result of touching / coiling around a support in the **direction** of the support. It is caused by unequal elongation (growth) of cells due to the chemical Auxin (IAA). When the cells touch the support, the auxin is translocated from the contact (moves to the other side) and accumulates on non-touching side, causing cell elongation on that side and, therefore, coiling. (Accept auxin causes differential growth that results in coiling) **OR** the cells touching the contact do not grow as much (Accept that touching side has xylem lignification) on contact. Adaptive advantages include **providing support** to a weak stemmed plant to **orient itself in a particular direction** rather than staying at a lower level. It allows the plant to **climb up and gain more sunlight** for photosynthesis, rather than stay on the forest floor / down and get less light. It allows for **more seed dispersal** so that the plants can increase their numbers. The type of response shown by the *Mimosa* is an example of **a thigmonastic** response due to a **non-directional** stimulus, namely touch. The leaves fall down / droop when touched / tapped due to sudden changes in turgidity of cells at the base of the leaves (pluvini) due changes in osmotic pressure. This response is reversed after some time, so that the leaves are lifted horizontal again. Adaptive advantages include leaves do not get eaten by herbivores / browsers for these plants. When they reopen, they can continue with photosynthesis and produce the lost energy. They are different to each other in the way they respond to directional and non-directional stimuli. While one uses Auxins / IAA the other uses changes in turgor pressure to become turgid (leaves horizontal) and flaccid when leaves droop.	**Describes the response:** • *Clematis*: identifies positive thigmotropism due to a directional stimulus. • *Mimosa*: Identifies thigmonastic response *due* to a non-directional stimulus. **Describes how it occurs:** • Differential cell growth due to chemical / auxin. • Changes in turgidity (water movement / ion movement) of leaf bases. **Describes adaptive advantage:** • Gains height to get sunlight (C) • Less energy used in stem growth (C) • Prevents the leaves being eaten (M) • Leaves saved for photosynthesis. (M)	**Explains the process for either response in detail w.r.t to chemicals and changes in turgidity / water loss:** • The type of movement / response shown by the *Clematis*/ tendrils is explained. It is a **directional growth movement** that causes the plant to bend as a result of touching / coiling around a support in the **direction** of the support. It is caused by unequal elongation (growth) of cells due to chemicals / plant hormones / phytohormones. • The type of response shown by the *Mimosa* is explained as being due to a **non-directional** stimulus, namely **touch**. The leaves fall down / droop when touched / tapped due to sudden changes in turgidity of cells / due to loss of water from the cells at the base of the leaves. **Explains either of the adaptive advantages** • The weak stemmed *Clematis* grows towards light as the tendril coils around a support, allowing the plant to reach up. This allows it to carry out more photosynthesis. • The leaves drooping suddenly in the *Mimosa* prevents the leaves	**Comprehensively links ideas to explain how two processes occur, and the adaptive advantages of two responses.** • The type of movement / response shown by the *Clematis forsteri* / tendrils is **Positive Thigmotropism**. It is a directional growth movement that causes the plant to bend as a result of touching / coiling around a support in the **direction** of the support. It is caused by unequal elongation (growth) of cells due to the chemical Auxin (IAA). When the cells touch the support, the auxin is translocated from the contact (moves to the other side) and accumulates on non-touching side, causing cell elongation on that side and, therefore, coiling. **Compared to:** The type of response shown by the *Mimosa* is an example of **a thigmonastic** response due to a **non-directional** stimulus, namely touch. The leaves fall down / droop when touched / tapped due to sudden changes in turgidity of cells at the base of the leaves as the osmotic pressure suddenly decreases. This response is reversed after some time so that the leaves are lifted horizontal again. **Adaptive advantages:** • Adaptive advantages of tendrils include **providing support** to a weak stemmed

		from being eaten by browsers. This saves the loss of leaves that carry out photosynthesis.	plant to **orient itself in a particular direction** rather than staying at a lower level. It allows the plant to **climb up and gain more sunlight** for photosynthesis rather than stay on the forest floor / down and get less light Thus providing more energy and **increasing survival opportunity.** **AND** (Both needed) Adaptive advantages of closing the leaves include leaves do not get eaten by herbivores / browsers who feed on these plants / when the leaves reopen they can continue with photosynthesis and do not have any significant loss of energy production, thus **increasing survival opportunity**.

Not Achieved			**Achievement**		**Merit**		**Excellence**	
NØ = no response or no relevant evidence	N1 = 1 point, eg one definition / response	N2 = 2 points from Achievement	A3 = 3 points	A4 = 4 points	M5 =2 points from Merit	M6 = 3 points	E7 = 1 point from Excellence	E8 = 2 points

Question Two

Evidence	Achievement	Merit	Excellence
Exploitation **Parasitism** is behaviour where a parasite, such as the wasp, feeds off the aphids, the host, by laying eggs inside their bodies. The larvae benefit as they grow into adults while the aphids die, which is an **interspecific relationship where one organism is benefitted and the other is harmed**. This behaviour increases the wasp's survival as well as increases in population numbers as emerging adults can lay more eggs in new aphids. The aphids are disadvantaged as their numbers drop due to being eaten. The relationship between the aphids and the crop plants is **parasitism / herbivory, an interspecific relationship where one organism is benefitted and the other is harmed** as the aphids feed on sap of the rose or crop plant. The aphids benefit from the nutrition, and the crop loses either flowers or fruit due to infestation. From the graph, it can be seen that an adult Ervi would attack or lay eggs in over 80 aphids if they are 3 to 4 days old (graph 1). This corresponds to the larger number of eggs laid (25 or over) if the host is 3 to 4 days old, (graph 2) There will be increased reproductive success of the wasp if it is able to find 3-4 day old aphids.	**Identifies the relationship. Advantages and disadvantages** **Identified as parasitism** • The wasp is the parasite / parasitoid, and the aphid is the host. • The wasp is benefitted as larvae get nutrition and the aphid is disadvantaged since it dies. **Parasitism / herbivory:** • Identified as parasitism OR herbivory • The aphid is a pest / sap sucking insect / herbivore and the plant is the host. • The aphid gets nutrition and water, and the plant loses its food source. **Graph Analysis** • 3 to 4-day old aphids are more vulnerable to wasp attack. • Wasps will lay more eggs if the aphids are 3 to 4 days old. **Describes interspecific relationship** • An interaction between individuals of two different species.	**Explains the behaviours with an advantage and a disadvantage** **Parasitism between wasp and aphid** **Advantage and disadvantage**. E.g. • The wasp benefits because it does not have to feed its offspring. It has a guaranteed food source for larval development. This behaviour increases the wasp's survival chances. The aphids are disadvantaged as they are being killed or eaten, as they are hosts. (Accept a disadvantage to the wasp e.g. it depends on the aphid, so if the aphid dies prematurely the wasp dies.) **Parasitism/herbivory between aphid and crop plant** **Advantage and disadvantage** E.g. • Explains that this is an interspecific relationship where one organism is benefitted and the other is harmed. As the aphids feed on sap of the rose or crop plant, the aphids benefit from the nutrition they receive increasing their chances of survival. Meanwhile the crop loses nutrients and its chance of survival is reduced. **Graph Analysis (Either graph explained)** • Ervi females choose 3 to 4-day old aphids to release their eggs into. They avoid the very young 1- or 2-day-old aphids and the much older 5 – 7 days aged aphids. This is evident as lower numbers of host are used in the graph. OR • They prefer the 3 or 4-day old hosts as 25 are selected as seen in the graph. Also, each wasp lays as many as 25 eggs in each host that is	**Evaluates the costs AND benefits to each species in the relationships identified.** Links are made to show the impact of Parasitism between Wasp and aphid AND Parasitism/Herbivory between aphid and crop plant Both relationship, advantages and disadvantages are discussed clearly, with a clear link to **reproductive success** being increased or decreased Parasitism of the wasps increases their chance of survival and therefore their reproductive success. and in turn, decrease in the **reproductive success** / decrease in the numbers / of the aphids in the population. As the aphids feed on sap of the rose or crop plant, the aphids benefit from the nutrition they receive increasing their chances of survival. Meanwhile the crop loses nutrients and its chance of survival is reduced. So, if the wasps reduce the numbers of aphids, the plant species will benefit and their reproductive success is likely to increase. **Graph analysis (Must include data from both graphs)** The graphs provide a clear indication of the preference of the parasite to the age of the host. This is because the 3 to 4-day old host may be best suited for the egg development into larvae that can feed off the host tissue and emerge as healthy adults ready to infect more hosts so 3 to 4-day old larvae are used (over 80) in graph 1. Reproductive success comes from parasitising more hosts and more eggs laid in host aged 3 to 4 days old as shown in graph 2 where the

		between the 3 to 4 day age. This means that the population of wasps will increase the most.	number of eggs laid per host is 25 or more. **Accept reasonable arguments as to why these ages are chosen (or others are not).**

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Question Three

Evidence	Achievement	Merit	Excellence
The mice show a **circadian endogenous** rhythm that runs for a period of approximately 24 hours and is controlled by an external stimulus, namely the **photoperiod**. The biological clock is reset when it senses a change in photoperiod. The mice are nocturnal / active in the absence of light (in darkness) OR inactive in the day and come out in darkness. The endogenous rhythm is controlled by a biological clock. The mouse ensures it becomes active when it becomes dark, and hides during the day. Exposure to change in photoperiod resets the rhythm, acting as a **zeitgeber.** The graph/actogram clearly shows that the mice exhibit a 24-hour activity where they are active for 12 hours of darkness and show 12 hours of inactivity or rest in light conditions. The biological clock is made up of special cells (SCN) that allow the pineal gland to produce excess melatonin based on low light or less melatonin in bright light. This controls the biological clock and the precise nocturnal activity of the mice. From the graph/actogram it is evident that when there is a shift from the LD constant normal conditions in the first 17 days to the conditions of total DD, darkness in the next 20 days. The rhythm continues to occur at almost the same time in the first three days of constant darkness. The rhythm is clearly endogenous. Thereafter, the animals' biological clock becomes free running and there is a clear phase shift in its rhythm as it continues to occur earlier each day. The endogenous rhythm has an adaptive advantage, ensuring the mice becomes active at nightfall without needing to go out during the day when visible to predators like stoats, and looking for food, namely seeds and berries, as well as the eggs of the whitebait. They also find mates and breed in large numbers. Consequences on the environment are hugely negative and include decrease in whitebait population as the whitebait eggs are eaten by	**Describes the term endogenous rhythm**: • Endogenous (biological clock) rhythm / Circadian rhythm that Is built in / internally generated / not dependent on external cues. **Describes the term entrained:** • Where the endogenous rhythm / Circadian rhythm is re-set by a zeitgeber / outside factors / light and dark. **Describes aspects of the graphs:** • The mouse activity is reset by change in photoperiod / exposure to light. • Mouse's activity is not reset / becomes free-running when left in darkness / the mouse's biological clock keeps running when left in darkness. • The mice are active in the earlier part of the night / (DD) when left in darkness. • Establishes the free running period as less than 24 hours. **Gives an adaptive advantage for behaviour: E.g.** • Mice go out at the right time / night when stoats are less active / less predation. • Some prey species may be more active at night (Easier access to food). • Synchronise with other mice for mating.	**Analyses the response and pattern with reasons:** • The response is endogenous with 12 hours of activity (darkness) and 12 hours rest (in light) controlled by the biological clock. The rhythm is regularly repeated and doesn't disappear immediately when the light-dark regime changes to dark only after 15 days. It continues in the absence of external cues. It then becomes free running as there is no external stimulus / zeitgeber to entrain / reset the biological clock. **Aspects of biological clock explained:** • The biological clock is made up of special cells in the brain. They are activated by the light / absence of light / photoperiod. In turn, the clock stimulates another gland to produce chemicals / hormones. The amount of chemicals / melatonin controls the activity of the mouse. This directs the precise nocturnal activity of the mice. **An adaptive advantage is explained:** • The mice are safe because the biological clock triggers activity at the right time so feeding can happen in darkness / activity happens when there are fewer visual predators so they don't get predated / when it is safer to mate. **Effects to the environment:** • Any TWO are explained: E.g.:	**The pattern of the mice behaviour is fully analysed through explanations and comparisons of the actograms:** Graph/actogram shows the mice activity in laboratory conditions under a constant 12 hr light – 12 hr dark regime is a circadian nocturnal rhythm, where the **endogenous** biological clocks are **entrained** into a regular rhythm. There is **no** fluctuation in the activity. On day 16, the removal of the **zeitgeber** by placing the mice in a regime of constant / 24-hr darkness depicts that the cycle still continues at the same time for the next 3 days. With **no zeitgeber** / entrainment, the rhythm becomes **free-running** and shows the animal's natural endogenous rhythm is earlier each day for the next 19 days. This can be seen where the mice activity becomes earlier each day. **Aspects of biological clock explained:** The biological clock is made up of special cells **(SCN)** at the base of the brain. (Accept in the hypothalamus) When light intensity is low, the eye detects less light and sends messages to the SCN/hypothalamus. This, in turn, signals the **pineal gland**. More melatonin produced in less light and less **melatonin** produced in bright light. This controls the biological clock and the precise nocturnal activity of the mice. The **adaptive advantages are considered.** The mice synchronise their activity with a change in photoperiod such as the changes as in spring time or autumn. Energy is conserved, as mice are active only when they need to be. There is less danger as chances of being predated on are less, as there are fewer

mice. Increase in Mustelids that feed on (the eggs of) native birds and therefore result in a decrease in the native bird population and diversity. Native bird numbers drop drastically as stoats feed on them if there isn't enough food. The particular species of whitebait are reduced due to attack by mice.	**Effects on the environment:** • More whitebait eggs are eaten. • Deprive other ground feeding animals of their food. • Less native birds survive. • Any other reasonable point.	The whitebait population falls as mice feed on their eggs. As mouse numbers fluctuate, the stoats that fed on mice then feed on native birds and affect native bird population. Deprive other ground feeding animals of their food and this decreases the population of other insects and ground dwelling animals that feed on beech seeds.	predators found at night. Breeding opportunities are increased as there are more mates to be found at such times. **Effects on the environment:** If mice multiply in numbers due to their behaviour, this. reduces the availability of berries, seed sand insects to other native species. It also results in the decrease in whitebait population as the whitebait eggs are eaten by the mice. When mice numbers decrease, the stoats that fed on mice start feeding on the eggs of native birds and, therefore, there is a decrease in the native bird population and diversity. Other logical arguments that are FULLY justified.

Not Achieved			Achievement		Merit		Excellence	
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Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 7	8 – 12	13 – 18	19 – 24