Assessment Schedule – 2021

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

Evidence Statement

Question One

Evidence	Achievement	Merit	Excellence
The adaptive behaviours of the evening primrose ensure that the plant is successful in its two-year life cycle. The flowers open at night; the response this shows is photonasty / nyctinasty, as night is mentioned, so this is more likely than temperature. This nastic response is a reversible movement of part of a plant to a diffuse environmental stimulus. The plant's relationship is interspecific competition, and this may be an example of allelopathy / antibiosis. Nastic movements are a result of changing turgor pressure in cells, resulting in a reversible movement of a part of the plant. Water moves by osmosis into cells, as the permeability of the membrane has changed to allow more of it in – resulting in turgidity, and therefore the cells expand causing the petals to open By having small flowers that open at night, the plant occupies a niche different to many of the other species living in the area. They can take advantage of the nocturnal pollinators, e.g. moth, gecko, mouse. By having a strong scent, the animal pollinator can use position chemotaxis response to more readily find the flower, resulting in a higher level of pollination. By having the ability to reduce competition by weeds, the evening primrose gets the best light, nutrients, and pollination. Adaptive behaviours are that the plant puts its energy into secreting a strong scent to attract the night pollinators, so the pollinator will use less time getting to the flower and will be able to spend more time pollinating. This increases reproductive success.	• Photonastic / photonasty / nyctinasty / thermonasty defined. e.g. Photonastic: The non-directional movement of plants in response to light • Interspecific competition / allelopathy defined. e.g Competition between different species e.g. allelopathy a plant produces and releases a chemical that prevents or inhibits the growth of other plant species in the area around it • Movement described as due to water amount / turgor pressure. • Movement of water gives quick / reversible response. • Many small flowers result in higher level of pollination. • Strong smell will attract more pollinators / they will get there faster / chemotaxis. • Stopping weeds limits competition for light / pollinators / nutrients / area of anchoring roots. • Opening at night gives access to alternate (nocturnal) pollinators.	• Annotated diagram or other explained, showing photonasty – water movement of response. Water moves by osmosis into cells – explains changes in turgor pressure / reversability. • Opening at night means in an area of a lot of flower species, they may not have to compete for pollinators, so therefore a higher rate of reproduction / pollen is more likely to be taken to the same species of flower. • Explains how strong-smelling flowers are an adaptive advantage, as insects can be drawn from further afield due to the smell travelling further Colour is not as easily seen at night, so the strong smell will attract pollinator. • Explains how stopping weed growth is an adaptive advantage, as the plant will then have less competition and therefore more water and light for photosynthesis / nutrients for growth potential.	• Comprehensively discusses the relationship between the evening primrose and the weeds and explains **how** the reduced competition for water, light and nutrients lead to greater growth & reproduction of the species. e.g., reduced competition for light, water & nutrients → increased photosynthesis → more energy available for flower production → increased genetic diversity → population better able to survive changes in the environment. • Comprehensively discusses the **photonastic** response of the evening primrose at night and links this to cross-pollination & increased variation for the success of the species. e.g., many small flowers opening at night, nocturnal pollinators, strong scent → higher level of cross pollination → increased genetic diversity → population better able to survive changes in the environment.

Not Achieved			Achievement		Merit		Excellence	
NØ = no response or no relevant evidence.	1a	2a	3a	4a	2m	3m	1 bullet point.	Both bullet points.

Question Two

Evidence	Achievement	Merit	Excellence
The innate behaviours of the skua species have resulted in success of the skua. They have a territory, which is a place that is protected / defended by adults that are raising offspring, thus providing a safe place for the rearing of young. Territories contain the resources needed for success – food, mates, and space. Territorial behaviour includes the calls, the marking, and the fights needed to maintain their area. If an area is marked and defended as necessary, e.g. when another bird is flying within 3 m above, then the young can be raised with less stress / more resources, and therefore there will be more chance of the young making it to reproductive age. Territory behaviours can be aimed at a member of the same species to avoid competition for resources, or aimed at another species if the chick is in danger. Territories can shrink, due to a small brood requiring a smaller amount of food, so no need for the defence of a large area, or it can be that resources are plentiful one year in a smaller region, so less energy and time is needed to maintain a small patch. They may also enlarge, due to scarcity of resources or a large brood. The territory will be the size required for that year's brood. The behaviour that is genetically programmed leads to the success of the chicks. The chick is protected, primarily by the physically stronger parent, and the chick is fed, even if the parents have to steal food. By putting time and energy into the territory establishment and maintaining it, there is, as a result, more time for the chicks' parents to teach and protect them, so the species can increase and get their own territories.	• Territory defined. • Territorial behaviour defined or described. • Gives a reason for territories to get larger. • Gives a reason for territories to become smaller. • Gives a reason for change in territory size • Defines innate behaviour. e.g. has a genetic basis and is therefore inherited from the parents.	• Explains territorial behaviour. • Explains a reason for smaller territory, linked to knowledge of territories. • Explains a reason for larger territory, linked to knowledge of territories. • Explains how changing territory size from year to year by defending an area that is appropriate to the availability of resources & the demands of the skuas they can avoid unnecessary waste of energy which leads to the success of the skua and its chicks. *Doesn't link to increased genetic diversity or survival of the species.* • Explains females do not put as large an energy investment into hunting or defending, due to size difference of sexes / already spend a lot of energy on the egg. • Explains how the chicks benefit from this innate behaviour, e.g. protection / time for learning.	• Comprehensively discusses how the named innate territorial behaviours mentioned lead to the success of the skua and its chicks. e.g. - If an area is marked & defended then the young can be raised with less stress / more resources à more chance of young making it to reproductive age. - Territorial behaviour ensures greater reproductive success due to greater focus on parental care, resulting in greater fitness of the young. - Territoriality results in the fitter pairs producing genetically fitter offspring and survival of stronger genotypes and phenotypes → increased genetic diversity → population better able to survive changes in the environment. • Comprehensively discusses how changing territory size from year to year leads to the success of the skua and its chicks. E.g., by defending an area that is appropriate to the availability of resources and the demands of the skuas they can avoid unnecessary waste of energy resulting in survival of more and stronger individuals → increased variation → population better able to survive changes in the environment.

Not Achieved			Achievement		Merit		Excellence	
NØ = no response or no relevant evidence.	1a	2a	3a	4a	2m	3m	1 bullet point.	Both bullet points.

Question Three

Evidence	Achievement	Merit	Excellence
Palolo worms exhibit a circannual, circalunar, and circadian rhythms, that is rhythms that have a period of activity approximately of 1 year / 365 days, one month / 28 days, and 24 hrs. The palolo display positive phototaxis. The worm has an eyespot – this means it takes in light, and will move the segment to the light. The light is coming from the Moon. This means that all of the gametes go the same way, and dissolve and have a higher chance of fertilisation. The palolo have an epitoke and body, and by separating the gametes from the body in broadcast / mass spawning, the body is safe to reproduce again. The gametes are released en masse for sexual reproduction to be more successful. The Samoan population (and many fish species) know to gather at night, as: 1. They can use a lantern to get the gametes to go to them, and have a high success rate. 2. They need to gather whilst the gametes are still in the membrane, otherwise at daylight it breaks, and the tiny sperm and eggs will disperse. By having multiple endogenous rhythms that are synchronised with elements of the abiotic environment, the time of reproduction is much more focussed, and the species is more likely to all release gametes at the same time – good for success and genetic variation. The mass will also be more than the amount that the people / fish will catch. r-strategy: there are usually many offspring per brood, which require little parental care and have a high rate of mortality. Offspring are often self-sufficient at an early age. Since not much energy is invested in each offspring, they tend to be small and come into the world with low energy reserves. This makes the offspring vulnerable to predation, so many or most will not survive. Sheer numbers ensure the survival of the population.	• Circadian rhythm named and defined. e.g. a rhythm that follows approximately 24 hour cycle • Circalunar rhythm named and defined. E.g a rhythm that follows approximately the lunar cycle of 29.5 days • Circannual rhythm named and defined. e.g. a rhythm that follows approximately a yearly cycle of 365 days. *Note: If a student uses the terms daily, lunar or annual i.e omits circa- then use judgement to assess if they adequately recognise the pattern.* • The eyespot allows the epitoke to sense the direction of light. • Fish / locals need to get the palolo worms at night before the outside dissolves. • Advantage described e.g. no parental care needed. • Disadvantage described, e.g. waste of a lot of gametes / energy in reproduction. • Describes phototaxis. • Describes r strategy.	• Explains how a **named** rhythm leads to success. • Explains how a second **named** rhythm leads to success. • Explains how gathering at night works, due to the eyespot. OR Explains why the locals gather at night due to need to get to them before the membrane dissolves and the palolo can't be caught. • Explains advantage of mass spawning / r-strategy. • Explains disadvantage of mass spawning / r-strategy.	• Comprehensive knowledge of how the rhythms link to survival, alongside strategies for success in palolo. Need to link at least two rhythms together for timing of release, to ensure best conditions for mass release leading to success / survival of the species. • Discusses, in-depth, how in the spawning / r-strategy the **advantages outweigh the disadvantages** in terms of success / survival of the species.

Not Achieved			Achievement		Merit		Excellence	
NØ = no response or no relevant evidence.	1a	2a	3a	4a	2m	3m	1 bullet point.	Both bullet points.

Cut Scores

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