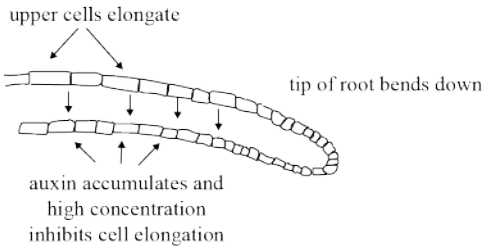
Assessment Schedule – 2017 Final

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

Evidence

Q1	Evidence	Achievement	Merit	Excellence
	The mānuka seed is planted below the soil surface. Its radicle starts to grow downwards as it starts to germinate, which is a positive geotropic / gravitropic response, meaning because auxin **inhibits** root cell growth, this means that at higher concentrations of auxin at the bottom side of the root slows the cell growth in this region of the radical / root. While on the side above the root, the cells are growing at a normal rate and this causes the root to bend downwards towards gravity.  Auxin moves toward gravity, causing it to sink to the lower part of the radicle / root, which results in cell growth being inhibited and normal cell growth on the top of the radicle / root causing growth downwards with gravity. The coleoptile / plumule bends and grows against gravity because the auxin concentration is high in the lower side of the coleoptile / plumule, and auxin causes cell elongation or cell growth as this causes the cells on the bottom half of the coleoptile to elongate faster than in the top cells, causing it to bend upwards. Once the coleoptile / plumule breaks the soil surface and is exposed to light, the leaves can start to photosynthesise. This causes the accumulation of auxin / IAA in the cells on the darker side of the shoot; this causes the cells on the	**Identifies & describes positive geotropism of the root / radicle,** which is **growth** towards the pull of gravity. **Identifies & describes negative geotropism of the plumule / coleoptile,** which is **growth** away from the pull of gravity. **Identifies & describes positive phototropism of the plumule coleoptile above ground** Once the plumule / first shoot breaks the soil surface, then the response will be a **growth** towards the light. **Accept a description of positive hydrotopism in the radicle** as the **growth** of the root towards a water source. **Describes an adaptive advantage of each tropism:** **+ve geotropism** E.g. the mānuka plant is able to access more water from the radicle growing downwards. OR The mānuka plant is able to support the above ground growth by growing downwards. **–ve geotropism** E.g. the mānuka is able to get its leaves above the ground and	**Explains each named tropism response and how they occur** E.g. The mānuka seed is planted below the soil surface, its radicle starts to grow downwards as it starts to germinate, which is a positive geotropic / gravitropic response. This happens because auxin **inhibits** root cell growth; this means that higher concentrations of auxin at the bottom side of the root slow the cell growth in this region of the radical / root. While on the upper side of the root, the cells are growing at a normal rate and this causes the root to bend downwards towards gravity. **Explains adaptive advantages of named tropisms OR allelopathy.** E.g. Because the root bends downwards displaying positive geotropism, it gets access to more water, which the young seedling requires for photosynthesis, and minerals for growth. This also provides the stability for the upward growth of the stem / coleoptile / plumule. E.g. Growth towards the light because of positive phototropism provides opportunities for producing more photosynthesis required for producing more energy needed for cell division and further growth by reducing	**Comprehensively explains and discusses the adaptive advantage of the named tropisms in germination and early growth of mānuka**. E.g. The mānuka seed is planted below the soil surface; its radicle starts to grow downwards as it starts to germinate, which is a positive geotropic / gravitropic response. Auxin moves toward gravity, causing it to sink to the lower part of the radicle / root, Because auxin **inhibits** root cell growth; this means that higher concentrations of auxin at the bottom side of the root slow the cell growth in this region of the radical / root. While on the side above the root, the cells are growing at a normal rate and this causes the root to bend downwards towards gravity. *E.g. This means that the mānuka plant is able to get its roots growing down to reach more water & nitrients required for faster and greater growth…..* **Makes comparisons between both tropisms and with phototropism** +ve geotropism occurs in the radicle as gravity causes auxin to be transported to the lower side of the root. This causes the cells' growth to be inhibited, which causes it to bend downward toward gravity.

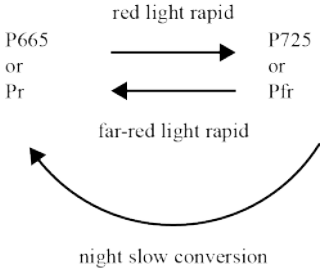
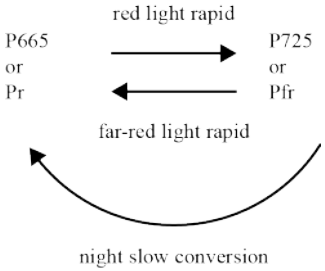
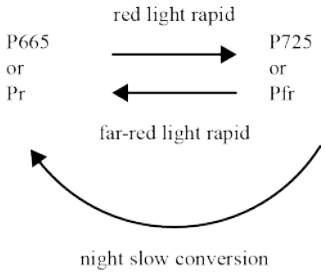
	darker side to elongate and bend away from the darker side towards the light. Because the root bends downwards displaying positive geotropism, it gets access to more water, which the young seedling requires for photosynthesis and minerals for growth; this also provides the stability for the upward growth of the stem / coleoptile / plumule. In comparison, the negative geotropism / gravitropism orientation ensures the stem will reach the light so the limited energy stored in the seed does not run out before its leaves reach the soil surface. Once reaching the light, the growth towards the light provides opportunities for producing more photosynthesis required for producing more energy needed for cell division and early growth.	exposed to the light / sun. **+ve hydrotropism** E.g. the mānuka is able to access more water from the radicle growing towards the water source **+ve phototropism** mānuka plant is able to get its leaves exposed to more sunlight for greater photosynthesis. Identifies **allelopathy / antibiosis / amensalism / exploitation** occurring as it releases leptospermone, a chemical that prevents other plants from growing near it. (OR An explanation of this process without naming it) E.g. reduces competition so mānuka will have more access to light, water and minerals required	competition. E.g Because the root / radicle releases the chemical leptospermone, it prevents other plants from growing nearby, which reduces interspecific competition and is called antibiosis, amensalism or allelopathy (accept exploitation) This ensures that mānuka will have more access to light, water and minerals required. (Accept alternative explanations if reasonable, such as support for above ground growth / grows towards the light for greater photosynthesis.)	In comparison, the –ve geotropic response in the coleoptile / plumule occurs when gravity causes auxin to move to the bottom of the cells in the coleoptile / plumule / this causes cell elongation and the coleoptile / plumule grows up away from gravity. Once the coleoptile / plumule breaks the soil surface and is exposed to light, the leaves can start to photosynthesise. The direction of growth is now stimulated by the light and not by gravity. Auxin/IAA accumulates in the cells on the darker side of the shoot; this causes the cells on the darker side to elongate and bend away from the darker side towards the light. Once above the surface, the growth towards the light provides opportunities for producing more photosynthesis required for producing more energy needed for cell division and further growth. All three processes use the hormone auxin but the response is different in the different tissues. Etc.

Not Achieved			Achievement		Merit		Excellence	
NØ = no reponse; no relevant evidence.	N1 = 1 point, e.g. one definition.	N2 = 2 points from Achievement.	A3 = 3 points.	A4 = 4 points.	M5 = 2 tropisms explained OR 2 adaptive advantages explained	M6 = 2 tropisms explained OR 2 adaptive advantages explained AND allelopathy explained.	E7 = ANY 2 tropisms explained AND their adaptive advantages discussed.	E8 = 2 gravitropisms explained and compared with phototropism AND adaptive advantages discussed.

Q2	Evidence	Achievement	Merit	Excellence
	Migration is the annual or seasonal mass movement made by animals from their breeding area to another area that has a good food supply and optimum temperatures. True migration involves a return trip. **Timing of migration** The timing of migration is sometimes affected by maturation because as the sex organs mature, there is a need or desire to reproduce. **Environmental cues** A drop in temperature and a shortening in the length of the day. E.g. changes in the length of the day are sensed directly through the skin and feathers by the pineal gland. This triggers migratory restlessness (zugunruhe). **Genetic drive** Some behaviour is genetic and innate, and is endogenously controlled. **Methods of migration** Most birds navigate using a range of methods including using the Earth's magnetic fields to determine where they are in relation to the other fields. **Solar** – some use the position of the Sun and their direction. However, when using this method, it is important that the animal also has a biological clock to take into consideration the rotation of the earth, which causes the movement of the sun across the sky. **Stellar –** some use the position of the stars to guide them during the night on their migration. **Visual cues** – some landmarks are used in migration like coast lines and mountain ranges. For migration to be worthwhile, the benefits gained from migration must outweigh the costs associated with migration. Some **advantages** include: • The animals remain in favourable temperatures; this means that they will not use as much energy to keep warm. • They can grow larger and store energy reserves for	**Describes migration.** E.g.: • **Migration** is the annual or seasonal mass movement made by animals from their breeding area to another area that has a good food supply and optimum temperatures. **Describes reasons that can determine the time for migration.** • **Genetic drive** Some behaviour is genetic and innate, and is endogenously controlled. • **Maturation** because as the sex organs mature, there is a need or desire to reproduce. • **Environmental cues** E.g. A steady drop in temperature and a shortening in the length of the day. **Describes Navigation methods.** • Using the earth's **magnetic fields** to determine where they are in relation to the other fields • **Solar** – some use the position of the sun and their direction,. • **Stellar –** Some use the position of the stars to guide them during the night on their migration. • **Visual cues** – some land marks are used in migration like coast lines and mountain ranges.	**Explains how the sooty shearwater might determine the time for migration.** Recognizes that it is more likely a combination of contributing factors such as: Genetic drive where the sooty shearwater has DNA that endogenously controls the timing of migration. As well as maturation; but this might not take place until the sex organs have matured and there is a need and desire to reproduce. The timing of migration can also be affected by the change in day length, which is detected by the suprachiasmatic nucleus of the hypothalamus in the brain **Explains how they might navigate during migration.** • Combination of methods for navigation: if one method is not used (for example, solar navigation on a cloudy day), then other methods can be used. • When using solar and stellar navigation, a map sense is important to be aware of the latitude and longitude of an area and a sense of timing, so that the internal clock can compensate for the movement of the sun during the day, or the stars at night. • Accept explanations of other forms of navigation such as magnetic field.	**Comprehensively discusses the** costs and benefits of migration to the sooty shearwater. Some advantages include: (Any 3) • The animals remain in favourable temperatures; this means that they will not use as much energy to maintain suitable body temperature. • They have a constant supply of food so they can grow larger and store energy reserves for the return trip. • Better breeding conditions, so they can leave more offspring, as their offspring have a higher chance of survival. • Reduction of predation / parasitism / disease as the predators have no prey and parasites no host etc • Greater genetic mixing due to different populations sharing breeding grounds Some of the costs include: (Any 3) • They could get lost or blown off course and not have enough energy to complete the journey. • They might get eaten by predators during the journey • They might starve and die during the migration due to lack of food en route. • Its huge investment in energy, so they may arrive depleted and unable to court/mate/breed successfully. * Benefits of migration must outweigh the costs associated with migration.

	the return trip. • They can leave more offspring, as their offspring have a higher chance of survival. • They have a constant supply of food, reducing predation / parasitism / disease. • Greater genetic mixing. • Better breeding conditions. Some of the **disadvantages** include: • They could get lost or blown off course and not have enough energy to complete the journey. • They might get eaten by predators. • They might starve. • Its huge investment in energy.	• **Identifies a cost OR a benefit that applies to the shearwater.**	**Explains a cost AND a benefit** that applies to the shearwater.	(Survival and reproductive success must be increased.)

Not Achieved			**Achievement**		**Merit**		**Excellence**	
NØ = no response; no relevant evidence.	N1 = 1 point, e.g. one definition.	N2 = 2 points from Achievement.	A3 = 3 points	A4 = 4 points	M5 = 1 point.	M6 = 2 points.	E7 = A cost and a benefit discussed, AND linked to overall survival advantage	E8 = 2 costs and 2 benefits discussed AND linked to overall survival advantage.

Q3	Evidence	Achievement	Merit	Excellence
	Photoperiodism is the regulation of seasonal activity by day length. Both the bee and the mānuka plant benefit from this relationship, as the bees get nectar from the mānuka plants, and the plants get pollinated by the bees. The bees use the sun to navigate to mānuka plants and therefore nectar more than 50 m away. The mānuka plant flowers when the day length is long and the night length is short. In this plant, Pfr promotes flowering.  During the day, the Pr is converted rapidly into Pfr and then converted back to Pr during the night. Because the night is short, not all the Pfr is converted back to Pr. This means Pfr encourages the release of the flowering hormone, and the mānuka trees flower. The mānuka plants flower all at the same time, which ensures sexual reproduction occurs at the same time that the pollinators (bees) are most active; this ensures that a higher chance of cross pollination and therefore genetic diversity. It also measures time so that leaves and photosynthetic pigments are produced when day length and light intensities are greatest to ensure maximum photosynthesis occurs to provide the energy for growth and seed production.	**Mutualism behaviour described** Both the bee and the mānuka plant benefit from this relationship, as the bees get nectar from the mānuka plants and the plants get pollinated by the bees. **Photoperiodism described** The regulation of seasonal activity by day length. **An aspect of Pfr is described (ANY ONE).** • Phytochrome is a pigment that helps the plant to measure day length. • Pfr is the active form of the phytochrome system. • In long day plants, Pfr promotes flowering. **Phytochrome system described fully (In words or diagram) but NOT linked to Pfr promoting flowering)** •  **Adaptive advantages described:** • By using this phytochrome system all the mānuka plants	**Explanation how the phytochrome system works in mānuka, a long day flowering plant** The mānuka plant flowers when the day length is long and the night length is short; in this plant Pfr promotes flowering.  During the day the Pr is converted rapidly into Pfr and then converted back to Pr during the night. Because the night is short not all the Pfr is converted back to Pr. This means Pfr encourages the release of the flowering hormone, and the mānuka trees flower. **AND / OR** **Explains critical day length as:** • Manuka plants will flower when the photoperiod exceeds a certain length of the day / is long enough, which means that the length of the day is greater than 12 hours/ night is less than 12 hours. • LDP (the length of the night) is short enough for not all of the Pfr to be converted into Pr and therefore there is enough Pfr left to promote	**Discussion** of the importance in the role of the phytochrome system to the health and survival of the mānuka plant. The mānuka plants all flower at the same time which ensures sexual reproduction occurs. It also occurs at the same time that the pollinators (bees) are most active; this ensures a higher chance of cross pollination and therefore increased genetic diversity. It also measures time, so that leaves and photosynthetic pigments are produced when day length and light intensities are greatest, to ensure maximum photosynthesis occurs to provide the energy for growth and seed production. The bees gain an adaptive advantage as they are most active when there is lots of nectar available, which is during late spring and summer due to an increase in flowering of the mānuka trees. Because there are more flowers and therefore more nectar available & more energy can be used for reproduction. This is a form of mutualism where both species benefit from the interaction as the bees get the nectar while the mānuka trees get pollinated, which provides the population with genetic diversity and the population will be able to better survive changes in the environment.

		flower at the same time / more pollination can occur OR • Bees have a source of nectar/food that is high in energy.	flowering. **AND / OR** **explains how photoperiodism in the mānuka tree provides an adaptive advantage to either the bees or the mānuka plant** Bees get access to energy rich nectar, which the bees need after winter and low activity.The timing of the mānuka tree flowering coincides with the demand for the nectar requirements of the bees for increased activity, and growth of the population. **OR** The mānuka plants are flowering at the same time that the pollinators (bees) are most active; this ensures that a higher chance of cross pollination and therefore populations of mānuka have a greater genetic diversity due to cross pollination.	

Not Achieved			Achievement		Merit		Excellence	
NØ = no response; no relevant evidence.	N1 = 1 point, e.g. one definition.	N2 = 2 points from Achievement.	A3 = 3 points.	A4 = 4 points.	M5 = phytochrome explained **OR** critical day-length explained **OR** Adaptive advantage explained.	M6 = Phytochrome explained OR critical day-length explained AND explains an adaptive advantage for either species.	E7 = discusses the adaptive advantage of photperiodism to the mānuka **AND** the bee.	E8 = discusses adaptive advantage to both the mānuka **AND** the bee, with clear links to the role of the phytochrome system.

Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 6	7 – 12	13 – 18	19 – 24