Assessment Schedule – 2019

Agricultural and Horticultural Science: Analyse a New Zealand primary production environmental issue (91532)

Assessment Criteria

Achievement	Achievement with Merit	Achievement with Excellence
Analyse involves: • explaining the environmental issue arising from the primary production management practices • explaining potential courses of action to mitigate the negative impacts of the management practices • recommending course(s) of action to support sustainable management practices.	*Critically analyse* involves: • explaining, in detail, the environmental issue arising from primary production management practices • evaluating potential courses of action to mitigate the negative impacts of the production management practices. This may include comparing and contrasting alternative courses of action. • Recommending course(s) of action to support sustainable production management practices that best address the issue.	*Comprehensively analyse* involves: • justifying course(s) of action to support sustainable production management practice(s) that best address the issue; this includes environmental, economic, political, and / or social considerations.

N1	N2	A3	A4	M5	M6	E7	E8
Attempts questions, little relevant information.	**Partially** answers the question, some correct information in a part of the question.	**Explains** the negative environmental effects of producing the primary product (ONE explained and another partially explained) *AND* **explains** the social or economic impact of greenhouse gases in New Zealand *AND* **recommends** a course of action primary producers could take to mitigate negative impacts.	**Explains** the negative environmental effects of producing the primary product (more than one explained) *AND* **explains** the social or economic impact of greenhouse gases in New Zealand *AND* **recommends** a course of action primary producers could take to mitigate negative impacts.	**Explains in detail** the negative environmental effects of producing the primary product (ONE explained in detail and another explained) *AND* **explains in detail** the social or economic impact of greenhouse gases to themselves or to wider society in New Zealand *AND* **recommends in detail** a course of action primary producers could take to mitigate negative impacts.	**Explains in detail** the the negative environmental effects of producing the primary product (more than one explained in detail) *AND* **explains in detail** the social or economic impact of greenhouse gases to themselves or to wider society in New Zealand *AND* **explains in detail** a course of action primary producers could take to mitigate negative impacts.	**Explains in detail** the the negative environmental effects of producing the primary product (more than one explained in detail) *AND* **explains in detail** the social or economic impact of greenhouse gases to themselves or to wider society in New Zealand *AND* **justifies** an economically viable course of action primary producers could take to mitigate negative impacts.	**Explains in detail** the negative environmental effects of producing the primary product (more than one explained in detail) *AND* **explains in detail** the social or economic impact of greenhouse gases to themselves or to wider society in New Zealand *AND* **comprehensively justifies** an economically viable course of action primary producers could take to mitigate negative impacts.
N0 = No response; no relevant evidence.							

Task:

Part	Evidence
(a)	**Primary production system causing greenhouse gas emissions** **Identifies** specific links to how the primary production system contributes to greenhouse gas issues. The specific contributions made in the production of the primary product are **explained**. *Specific contributions (example)* • Grazing ruminant animals cause the release of methane gas, which is a potent greenhouse gas. Over a period of 100 years, methane is 25 times more effective than CO_2 at trapping heat. Methane has an atmospheric lifespan of 12 years. Ruminant animals, such as cows, sheep, deer and goats, release methane from their mouths as a by-product of digestion. As the stocking rate on farms is increased to increase productivity, the volume of methane released increases. Ruminant animals releasing methane makes up 73% of all agricultural greenhouse gases. • Nitrous oxide is a greenhouse gas released by microbes converting nitrogen in fertiliser and animal urine. As farmers apply more fertiliser on their farms to increase plant growth and increase the number of cows grazing, therefore releasing more urine, the release of nitrous oxide is 298 times more effective at trapping heat than CO_2. Nitrous oxide has an atmospheric lifespan of 114 years, so it persists in the atmosphere for a long time. • Clearing scrub or trees to increase the productive area of the farm reduces the ability of the farm to take in carbon dioxide and increases the ability of the farm to carry more stock and release more methane and nitrous oxide. Clearing land of trees and planting more pasture is considered 'improving' the farm, increasing its stock-carrying capacity, and its capital value. • Cultivating paddocks to renew grass or plant crops to increase the production of plant material on farm increases the loss of nitrous oxide through exposed soil. If soil was not cultivated, less nitrous oxide would be able to escape into the atmosphere. • Methane and nitrous gases are released when cow waste is stored and spread on farms. The waste is collected from feed pads and dairy shed wash down, and must be managed in some way, resulting in its storage and distribution over the farm. • In horticultural production systems, more vehicles are used in the production of the fruit, vegetables or other crops. There is also the need for transportation of the produce to processing or sale. This is a large contributor of CO_2 emissions. • Horticultural production systems in the South Island of New Zealand who grow crops such as tomatoes inside or under cover, burn coal for their heating. They are heavily reliant on coal due to its low cost to heat their systems. This contributes to the emissions of CO_2.

(b)	**Social OR economic impacts of greenhouse gas emissions** **Explains** the social OR economic impacts of the release of greenhouse gases from primary production. **Discusses** whether the impacts are positive or negative or both. **Explains** how these social and economic impacts affect the producer and wider society in New Zealand. *Social and economic impacts* • Greenhouse gas emissions contribute to climate change, as greenhouse gases behave like a blanket, retaining heat in the earth's atmosphere. This climate change causes more frequent severe weather events, such as long periods of drought, or intense rainfall. This can be damaging to farms and crops, as there will be loss of production for the farmer, affecting profitability. It may take years to recover from financially, or it may cause damage to the property, such as slips, reducing future production. This will affect a farmer's ability to employ staff now and into the future. People may be affected, as they need to find alternative employment. • Climate change resulting from the release of greenhouse gases is projected to raise sea levels globally. This means a lot of low-lying areas of New Zealand's coastline, which are currently inhabited, will be underwater, causing a loss of housing and displacing people. This is going to have a huge impact on people's livelihoods and investment. Houses or property will lose value and some areas will be protected at huge cost, while some will be abandoned. A lot of fertile flat land is low lying and will be lost to the ocean, reducing our ability to produce food to consume or export. • Changing weather patterns will likely mean a change in the types of primary production around New Zealand. It may become too dry to grow kiwifruit in the Bay of Plenty and apples may struggle to survive without increased irrigation in the Hawkes Bay, which will cause a decrease in productivity and perhaps farm value. Populations that have developed locally over time to service an industry and the structures of the industry will be stranded. Pests may become hard to manage, affecting our ability to produce crops. Many of our production systems are situated close to the natural services they need. This is why our level of productivity is so high currently. This will change. • Due to climate change, the productivity in local regions could be affected heavily, resulting in a loss of jobs and perhaps less exports through the local port. Less productivity will affect the supporting businesses such as packhouses, meatworks and tractor sales.
(c)	**Course of action to reduce greenhouse gases** **Justifies** how a course of action reduces greenhouse gas emissions. Covers how the course of action will improve the environmental, social and economic outcomes. *Courses of Action (example)* • Planting trees on marginal land. This land is not very productive, so the loss of stock-carrying capacity will be low. There are financial benefits as to whether the land is planted in *Pinus radiata* or manuka for logs or honey in our current system. • Buying in stock that has been bred to release less methane as they digest plant material. The stock would be able to consume the same feeds as they currently do and release less methane. Currently our selection of stock is driven by weight gains per day, carcass size, fat cover, fertility. We may be able to incorporate this trait into the DNA of the stock we run. • Feeding plants that release less methane when broken down in the animal's rumen. These are generally higher quality feeds that already are incorporated into the diet of stock on some properties, or it may be using novel feeds such as seaweed, which releases very low levels of methane when digested. • Lower stock rates to reduce the quantity of methane released from ruminant animals burping, as well as reducing nitrous oxide released from the microbial action on animal urine. In many cases, there is the possibility that a lower stock rate may not affect a farm's profitability, with a lower level of inputs required to get lower levels of outputs.

	• Direct drilling crops or grasses into unploughed land, rather than cultivating, reduces the release of carbon dioxide. This is due to less tractor use and therefore less disturbance of the soil. • Reduced fertiliser inputs, to reduce the loss of nitrous oxide to the atmosphere by microbial action. The quantity of fertiliser applied in some systems is too high, as Ravensdown CEO acknowledges. Less fertiliser can be applied with little effect on productivity. The justified course of action **analysed comprehensively**, will allow for sustainable production, which means to be able to carry on into the future, meeting social, economic, environmental and political demands. *Chosen course of action* • Buying or breeding stock that release less methane gas when food is fermented in their rumen. The aim is to have efficient stock on the property that release less methane gas. • Landcare Research has recorded that sheep can range in their release of methane gas between 9 g and 35 g per day. Breeding into your flock of sheep, individuals who release less methane gas will go a long way to reduce methane emissions from agriculture, which is a major gas from this sector. • These suggested courses of action would not have any negative effects 'on the farm' that the farmer would have to mitigate. Current stock rates and feeds could continue to be used. This new knowledge will enable the farmer and farm staff to run the farming operation with little adjustment. • There will be little effect noticed by the wider community, as the current production systems will be able to continue across the country. • New Zealand's exports of sheep meat will continue largely unaffected, which is good for the industry and for the government, as sheep meat is a significant export. • This change in genetics should get New Zealand farmers methane emissions down to a level that allows our government to meet its targets under the Paris agreement. The agreement is to reduce our methane emissions from between 10 to 22% from current levels.

Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 2	3 – 4	5 – 6	7 – 8