

2021 HSC Agriculture Marking Guidelines

Section I, Part A

Multiple-choice Answer Key

Question	Answer
1	A
2	C
3	A
4	B
5	C
6	B
7	C
8	D
9	B
10	B
11	A
12	C
13	C and D
14	A
15	A
16	D
17	D
18	B
19	D
20	C

Section I, Part B

Question 21 (a)

Criteria	Marks
<ul style="list-style-type: none"> • Outlines how ONE management practice contributes to a soil degradation problem 	2
<ul style="list-style-type: none"> • Provides some relevant information 	1

Sample answer:

The removal of vegetation can reduce the ability of soil particles to be bound together and therefore erosion can occur.

Question 21 (b)

Criteria	Marks
<ul style="list-style-type: none"> • Provides links between a procedure and the alleviation of a soil degradation problem with reference to long-term sustainability 	4
<ul style="list-style-type: none"> • Provides links between a procedure and the alleviation of a soil degradation problem <p>OR</p> <ul style="list-style-type: none"> • Outlines a procedure to alleviate a soil degradation problem with some reference to long-term sustainability 	3
<ul style="list-style-type: none"> • Outlines a procedure to alleviate a soil degradation problem 	2
<ul style="list-style-type: none"> • Provides some relevant information 	1

Sample answer:

The use of minimum tillage assists with reducing the incidence of soil erosion. The stubble left in the paddock reduces wind velocity or water flow at the soil surface, removing the erosive power of these factors.

Minimum tillage contributes to long-term sustainability of a soil by improving the structure of the soil and increasing the amount of organic matter in the soil.

Question 22 (a)

Criteria	Marks
<ul style="list-style-type: none"> Provides characteristics and features of the roles of grasses and non-grasses in a pasture mix 	4
<ul style="list-style-type: none"> Provides characteristics and features of the roles of grasses or non-grasses in a pasture mix Outlines the other's role 	3
<ul style="list-style-type: none"> Provides the features of grasses and/or non-grasses in a pasture mix 	2
<ul style="list-style-type: none"> Provides some relevant information 	1

Sample answer:

A pasture mix which comprises both grass and non-grass species such as legumes offers a balanced form of nutrition for livestock. Grasses provide a lot of energy and fibre needs and respond quickly for regrowth. Legume species can provide higher amounts of protein and replenish nutrients, as they're normally deep rooted.

Question 22 (b)

Criteria	Marks
<ul style="list-style-type: none"> Provides points for and/or against the use of native plant species in grazing systems 	4
<ul style="list-style-type: none"> Provides characteristics and features of native plant species, with one point for or against their use in grazing systems 	3
<ul style="list-style-type: none"> Provides features of native plant species or grazing systems 	2
<ul style="list-style-type: none"> Provides some relevant information 	1

Sample answer:

Native pasture species require lower inputs for production, assist with the maintenance of stock in times of adverse climatic conditions and are adaptable to a wide range of Australian soils and weather conditions. However, native pasture plants are unable to carry high stock numbers, are slow to establish and recover from grazing. Nutrient availability for specific stock needs is not as high as introduced species. Due to these features they are useful additions to pastures in low rainfall zones with extensive grazing enterprises.

Question 23 (a)

Criteria	Marks
<ul style="list-style-type: none"> Provides features of line breeding and provides the outcome and industry use of crossbreeding 	4
<ul style="list-style-type: none"> Provides features of line breeding and provides the outcome or industry use of crossbreeding OR <ul style="list-style-type: none"> Provides a feature of line breeding and provides the outcome and industry use of crossbreeding 	3
<ul style="list-style-type: none"> Provides features of line breeding OR <ul style="list-style-type: none"> Provides features of line breeding and provides the outcome or industry use of crossbreeding OR <ul style="list-style-type: none"> Provides the outcome and industry use of crossbreeding 	2
<ul style="list-style-type: none"> Provides some relevant information 	1

Sample answer:

	<i>Line breeding</i>	<i>Crossbreeding</i>
Features of the breeding system	<p><i>Genetically related animals are used as parents.</i></p> <p><i>The breeding animals have identified superior characteristics.</i></p>	<p>Animals of different lines or breeds are bred together.</p> <p>Each line or breed has desirable characteristics.</p>
Outcome of the breeding system and its industry use	<p>Offspring are uniform in appearance and are similar to the parents as well.</p> <p>This is widely used in the stud breeding industry.</p>	<p><i>The offspring will exhibit superior production due to hybrid vigour.</i></p> <p><i>Commonly used in meat or egg production.</i></p>

Question 23 (b)

Criteria	Marks
• Describes the role of objective measurement in a livestock breeding program related to one specific industry	4
• Describes the role of objective measurement in livestock breeding	3
• Outlines objective measurement in livestock breeding	2
• Provides some relevant information	1

Sample answer:

In the beef industry, objective measurements on an animal are used along with those of closely related animals to develop Estimated Breeding Values (EBV) for a large number of production-related characteristics. EBVs are then used to choose breeding bulls which are chosen on the basis of being superior in the characteristics the producer wishes to exhibit in the progeny. The chosen characteristics will be based on the market specifications the producer is trying to meet.

Question 24 (a)

Criteria	Marks
• Provides general features of the steps in processing the named product	3
• Identifies aspects of the processing of this product into a different form	2
• Provides some relevant information	1

Sample answer:

Chickens:

Live birds are stunned via electricity or gas, slaughtered, bled, plucked, eviscerated, cleaned, cooled and packaged as whole birds or further processed into other cuts.

Question 24 (b)

Criteria	Marks
<ul style="list-style-type: none"> Provides detailed links between the manipulation of the product and the subsequent enhanced value in the marketplace, using a specific example 	5
<ul style="list-style-type: none"> Provides a link between the manipulation of the product and its enhanced value, using a specific example 	4
<ul style="list-style-type: none"> Describes a specific example of value adding for the product 	3
<ul style="list-style-type: none"> Outlines an example of value adding for the product 	2
<ul style="list-style-type: none"> Provides some relevant information 	1

Sample answer:

In broiler chicken production the raw whole chicken can be value added to increase the return on the initial cost of production.

The overall price paid by the consumer is greater than the initial production cost and any additional processing expense for the 'value added' version.

As an example, a whole raw chicken retails for about \$7/kg. If the breast fillets are removed, skinned and packaged the retail value is around \$12/kg. These same fillets sliced as 'stir fry strips' can be sold for \$17/kg.

The cost of processing the whole chicken into each of these packaged versions/cuts is far lower than the considerable increase in return (\$/kg) that consumers are willing to pay.

Question 25 (a)

Criteria	Marks
<ul style="list-style-type: none"> Provides why market specifications are important in marketing products 	3
<ul style="list-style-type: none"> Provides a feature of the role of market specifications in marketing products 	2
<ul style="list-style-type: none"> Provides some relevant information 	1

Sample answer:

For any product, market specifications guide the producer in meeting the requirements of their market, whether processor or consumer. There is then confidence that the product will be consistently of a known quality and safe for human consumption.

Question 25 (b)

Criteria	Marks
<ul style="list-style-type: none"> Provides clear relationships between strategies and meeting a specific market specification for the identified product 	6
<ul style="list-style-type: none"> Provides some relationships between strategies and meeting a specific market specification for an identified product 	5
<ul style="list-style-type: none"> Provides a relationship between strategies and meeting a specific market specification for an identified product OR <ul style="list-style-type: none"> Describes some aspect of strategies used to meet the market specification OR <ul style="list-style-type: none"> Provides a clear relationship between one strategy and meeting a specific market specification 	3–4
<ul style="list-style-type: none"> Outlines strategies to meet a market specification OR <ul style="list-style-type: none"> Describes some aspect of one strategy to meet a market specification 	2
<ul style="list-style-type: none"> Provides some relevant information 	1

Sample answer:

A quality criterion/market specification of milk is ‘bulk milk cell count’ (BMCC) which correlates to mastitis levels in a herd. A maximum of 400 000 cells/ml is allowed. Quality payments are made for levels under 90 000 cells/mL.

Techniques a farmer can use to meet the BMCC requirement and collect quality payments involve the management of mastitis on the farm.

Maintaining milking machine function and having good consistent milking technique is important. Incorrect pressures, cracked rubber fittings and poor milking techniques can damage the cow’s teats and increase the rate of spread and infection. Regular maintenance and regular inspection of milking hands is necessary.

Another technique is to use post-milking teat disinfection as milking machines can transfer the bacteria from cow to cow. Disinfecting the whole teat (and into the open teat canal) can decrease infection by 50%. 20mL of iodine-based spray per cow thoroughly applied will decrease bacterial load and possible infection.

Question 26 (a)

Criteria	Marks
• Sketches in general terms the signs or symptoms of the pest/disease	2
• Provides some relevant information	1

Sample answer:

Sheep blowfly (*Lucilia cuprina*)

A sign of flystrike is a discolouration of the wool, usually around the breech or on the back/flanks of the sheep.

Question 26 (b)

Criteria	Marks
• Provides a clear link between the pest/disease and its significance to the industry	3
• Outlines the significance of the pest/disease to the industry	2
• Provides some relevant information	1

Sample answer:

Sheep blowfly strike is the most significant health issue for the wool industry. It can severely affect the quality and quantity of the harvested wool.

The cost to the industry in losses and prevention is very high.

Question 26 (c)

Criteria	Marks
• Demonstrates comprehensive knowledge of the IPM program and makes a clear judgement on its value	6
• Provides points for and/or against an IPM program for the pest/disease and makes some judgement	5
• Provides points for and/or against an IPM program for the pest/disease	3–4
• Provides features of an IPM program	2
• Provides some relevant information	1

Sample answer:

An IPM program uses a range of chemical, cultural and genetic approaches to reduce the occurrence of the pest/disease and to control it without developing chemical resistance in the pest.

There is a tool to assist in the strategic planning of flystrike called Fly Boss. This tool helps to plan the optimal time of shearing, crutching and chemical treatments to reduce the risk of flystrike.

Fly Boss also assists the integration of management options like breech modification and correct length tail docking to reduce the attractiveness of sheep to flies. Long-term genetic selection for plain body sheep without daggy breeches and with tight fleeces also reduces the risk of flystrike.

Strategic use of chemicals and the mode of application during high-risk periods is also an aspect of this program.

Odour baited fly traps can also be used to reduce fly numbers.

The use of an integrated program allows wool producers to have a strategic plan for control of this pest. Timing of management operations coupled with less susceptible sheep will reduce the need for costly chemical treatments. This also reduces the problem of chemical residues in wool affecting shearing and wool sales.

Integrating multiple control measures does require increased management/oversight, can be more expensive than simple controls eg chemical use and relies on accurate monitoring.

Overall an integrated pest management approach can be of benefit to the producer by reducing losses and maximising productivity of the sheep flock by reducing the incidence of flystrike. It is beneficial to the environment by reducing the usage of dangerous chemicals and decreases the rate of chemical resistance.

Question 27 (a)

Criteria	Marks
• Outlines the impact of both the irregular nature of income and high input costs on decision making	4
• Outlines the impact of irregular income or high input costs on decision making	3
• Outlines the irregular nature of income and/or high input costs for farmers	2
• Provides some relevant information	1

Sample answer:

Farming is a seasonal activity, which means a farmer might only be paid a few times a year. They need to strategically budget to ensure that money is available to pay bills all year round.

Input costs for farming are high relative to the income received, so the farmer will need to improve the efficiency of the farming operation eg by adopting new technologies.

Question 27 (b)

Criteria	Marks
• Provides points for and/or against the use of gross margins in on-farm financial planning	6
• Describes the use of gross margins in on-farm financial planning	5
• Outlines the use of gross margins in on-farm financial planning	3–4
• Provides features of gross margins	2
• Provides some relevant information	1

Sample answer:

Gross margins are used to compare the relative profitability of alternative enterprises that can be part of a farm system. They take into account the gross income from each enterprise and the variable costs associated with it. Fixed costs which relate to the whole farm are not included.

The main benefits of their use include; they are quick and easy to calculate by giving a good comparison between enterprises which have similar inputs; they are free and readily available through many sources and can provide feedback on the strengths and weaknesses of the enterprises of your business.

The major problems with their use include; capital equipment and facilities across enterprises can be different; as they are typical to an area, they are not reflective of all climates and soil types; they become out of date due to price changes and cannot be used to make valid comparisons between enterprises with very different resource inputs.

Section II

Question 28 (a) (i)

Criteria	Marks
• Outlines the purpose of the research study	3
• Identifies the aim of the research study	2
• Provides some relevant information	1

Sample answer:

The purpose of the study was to assess the effectiveness of Golden Bananas in delivering elevated levels of vitamin A. This was done to see if it is a viable option for populations deficient in vitamin A.

Question 28 (a) (ii)

Criteria	Marks
• Demonstrates a comprehensive understanding of both the conclusions and the recommendations of the study	5
• Demonstrates a sound understanding of both the conclusions and the recommendations of the study	4
• Demonstrates some understanding of the conclusions and/or the recommendations of the study	3
• Demonstrates a limited understanding of the conclusions or recommendations of the study	2
• Provides some relevant information	1

Sample answer:

The conclusions of the study indicated that bananas can deliver elevated levels of vitamin A (beta-Carotene). The singular use of photogene synthase 1 gene, photogene synthase 2a gene and PaCv+1 gene demonstrated an elevated level of vitamin A as well as in the crops where combinations of these genes were used.

The elevated level of beta-Carotene meant that all gene options were valid. Also as the banana is grown from suckers, the elevation in beta-Carotene was seen in subsequent generations.

One recommendation of the study was that it needed to be further replicated with a larger number of plants. Another recommendation was to see the viability of growing the bananas in the target countries with different levels of vitamin A to ensure the banana could grow effectively and the desired levels of beta-Carotene would be present to reduce any environmental bias.

Question 28 (b)

Criteria	Marks
<ul style="list-style-type: none"> Identifies issues and provides comprehensive points for and/or against biofuel production in relation to world food demand and the efficient use of carbon Provides a logical and cohesive response Uses relevant examples 	10–12
<ul style="list-style-type: none"> Identifies issues and provides some points for and/or against biofuel production in relation to world food production and the efficient use of carbon Provides a mostly logical and cohesive response Includes an example 	7–9
<ul style="list-style-type: none"> Identifies issues and provides points for and/or against biofuel production with respect to world food demand or the efficient use of carbon Provides an organised response Identifies an example <p>OR</p> <ul style="list-style-type: none"> Describes biofuel production with respect to world food demand and the efficient use of carbon Provides an organised response Identifies an example 	4–6
<ul style="list-style-type: none"> Outlines biofuel production <p>OR</p> <ul style="list-style-type: none"> Identifies some aspect of the tension between food production and biofuel production <p>OR</p> <ul style="list-style-type: none"> Provides some relevant information 	1–3

Answers could include:

- Use of biofuels versus non-renewable fossil fuels
- Issues of subsidies and biofuel production
- Conflict between using crops for animal production and human consumption
- Resources (land, water) being used for biofuel production
- Use of fossil fuels (carbon emissions) in biofuel production
- Destruction of ecosystems to meet the needs for biofuel production
 - Regional suitability with land use changes
 - Monocultures, genetic engineering and biodiversity.

Question 29 (a) (i)

Criteria	Marks
• Outlines the purpose of the research study	3
• Identifies the aim of the research study	2
• Provides some relevant information	1

Sample answer:

The research examined the extent to which forecasting data provided farmers with a means to respond to climate constraints. This enabled them to see if traditional growing regions are the best areas to grow rice.

Question 29 (a) (ii)

Criteria	Marks
• Demonstrates a comprehensive understanding of both the conclusions and the recommendations of the study	5
• Demonstrates a sound understanding of both the conclusions and the recommendations of the study	4
• Demonstrates some understanding of the conclusions and/or the recommendations of the study	3
• Demonstrates a limited understanding of the conclusions or recommendations of the study	2
• Provides some relevant information	1

Sample answer:

The research used crop modelling technology to examine the growth of rice under different climate change regimes.

From this experiment, it was concluded that with the modelled climate change there would be a significant impact on rice yields in the traditional growing areas.

Recommendations from the experiment were to re-model using different parameters such as plant variety characteristics and management practices such as planting time.

It was also recommended that this modelling study be proved by appropriate pot area field trials.

Question 29 (b)

Criteria	Marks
<ul style="list-style-type: none"> Provides clear links between ruminant livestock and greenhouse gas production and provides a detailed description of methods to reduce greenhouse gas emissions from ruminant livestock Provides a logical and cohesive response Uses relevant examples 	10–12
<ul style="list-style-type: none"> Provides some links between ruminant livestock and greenhouse gas production and provides a description of a method to reduce greenhouse gas emissions from ruminant livestock Provides a mostly logical and cohesive response Includes examples 	7–9
<ul style="list-style-type: none"> Provides links between ruminant livestock and greenhouse gas emissions Provides an organised response Identifies an example <p>OR</p> <ul style="list-style-type: none"> Describes a method to reduce greenhouse emissions from ruminant livestock Provides an organised response Identifies an example <p>OR</p> <ul style="list-style-type: none"> Describes greenhouse gas emissions by ruminant animals and how these emissions can be reduced Provides an organised response Identifies an example 	4–6
<ul style="list-style-type: none"> Outlines the contribution of ruminant livestock to greenhouse gas emissions <p>OR</p> <ul style="list-style-type: none"> Outlines a way to reduce greenhouse gas emissions by ruminant animals <p>OR</p> <ul style="list-style-type: none"> Provides some relevant information 	1–3

Answers could include:

- Rumen processes which generate methane and CO₂
- Effect of high energy feed on greenhouse gas production
- Rumen modifiers
- Feed additives to reduce methane production
- Breeding to reduce methane emissions.

Question 30 (a) (i)

Criteria	Marks
• Outlines the purpose of the research study	3
• Identifies the aim of the research study	2
• Provides some relevant information	1

Sample answer:

The purpose of the study was to assess the effectiveness of multispectral aerial technology in the detection of myrtle rust found on lemon myrtle plants. This would allow fast and effective remote detection of the disease and its spread.

Question 30 (a) (ii)

Criteria	Marks
• Demonstrates a comprehensive understanding of both the conclusions and the recommendations of the study	5
• Demonstrates a sound understanding of both the conclusions and the recommendations of the study	4
• Demonstrates some understanding of the conclusions and/or the recommendations of the study	3
• Demonstrates a limited understanding of the conclusions or recommendations of the study	2
• Provides some relevant information	1

Sample answer:

It was concluded that drone mounted multispectral imaging was successful in identifying lemon myrtle rust. Numerical data was derived from the multispectral aerial images using QGIS software. It was possible to align this data with the known blocks of plants that were rust free following fungicide treatment and those lemon myrtle trees which were untreated and suffering rust symptoms.

Because of the cost of drones and availability of professional image scanning technology and software from QGIS, it was recommended that the use of multispectral aerial imaging was very viable in commercial lemon myrtle production. It was also recommended that this new technology be tested in the identification of disease in other tree crops.

Question 30 (b)

Criteria	Marks
<ul style="list-style-type: none"> Provides clear and detailed points for and/or against the developments in robotics and biotechnology in identified agricultural industries Provides a logical and cohesive response Uses a relevant and recent example of each 	10–12
<ul style="list-style-type: none"> Provides some points for and/or against the developments in robotics and biotechnology in identified agricultural industries Provides a mostly logical and cohesive response Includes an example for each 	7–9
<ul style="list-style-type: none"> Provides points for and/or against the developments in robotics or biotechnology in an identified agricultural industry Provides an organised response Identifies an example <p>OR</p> <ul style="list-style-type: none"> Describes some development of robotics and biotechnology in identified agricultural industries Provides an organised response Identifies an example 	4–6
<ul style="list-style-type: none"> Outlines a recent development in robotics and/or biotechnology <p>OR</p> <ul style="list-style-type: none"> Provides some relevant information 	1–3

Answers could include:

- Aspects of robotics in terms of sensor decision response or control
- Weeding robots
- Irrigation flume gates
- Robotic milking
- Smart scales and livestock drafting
- Greenhouse climate control systems
- Horticultural robots
- Genetically modified crops such as cotton, canola, safflower
- Marker genes in livestock
- Molecular markers
- Pharmaceuticals for agriculture industries such as vaccines.

2021 HSC Agriculture Mapping Grid

Section I Part A

Question	Marks	Content	Syllabus outcomes
1	1	Interpret an agricultural pesticide label – p22	H2.1
2	1	Farming practices affecting water quality – p20	H1.1
3	1	Marketing chain – p26	H3.1
4	1	Marketing strategies – p25	H3.2
5	1	Chemical and physical characteristics of a soil –p19	H1.1
6	1	Processes of growth and development/ Stages of growth – p21	H2.1
7	1	Process of photosynthesis – p21	H1.1, H2.1
8	1	Root nodules – p21	H2.1
9	1	Chemical and physical characteristics of a soil – p19	H1.1
10	1	Management of nutritional requirements – p22	H2.2
11	1	Techniques to manipulate reproduction – p23	H2.2
12	1	Experimental design – p24	H4.1
13	1	Experimental design – p24	H4.1
14	1	Experimental design – p24	H4.1
15	1	Government influence – p20	H1.1, H5.1
16	1	Plant breeding systems – p22	H2.1
17	1	Relationship between rumen and microbes – p22	H2.2
18	1	Collection and analysis of data – p24	H3.1, H4.1
19	1	Hormones and the regulation of reproduction – p23	H2.2
20	1	Nitrogen cycle – p19	H1.1

Section I Part B

Question	Marks	Content	Syllabus outcomes
21 (a)	2	Farming practices that contribute to soil degradation – p20	H1.1
21 (b)	4	Farming practices that contribute to soil degradation – p20	H1.1
22 (a)	4	Diverse pasture mix – p21	H2.1
22 (b)	4	Native and introduced pasture species – p21	H2.1
23 (a)	4	Breeding systems – p23	H2.2
23 (b)	4	Objective measurement – p23	H2.2, H3.4
24 (a)	3	Processing raw agricultural commodities – p26	H3.2, H3.3
24 (b)	5	Value adding to a product – p26	H3.3
25 (a)	3	Analyse market specifications – p26	H3.2
25 (b)	6	Management strategies to meet market specifications – p26	H3.2
26 (a)	2	Integrated pest management – p23	H2.2

Question	Marks	Content	Syllabus outcomes
26 (b)	3	Integrated pest management – p23	H2.2
26 (c)	6	Integrated pest management – p23	H2.2
27 (a)	4	Impact of financial pressures – p25	H3.1
27 (b)	6	Techniques to analyse the financial situation – p25	H3.1, H3.4

Section II

Question	Marks	Content	Syllabus outcomes
28 (a) (i)	3	Research into technological developments – p28	H4.1
28 (a) (ii)	5	Research into technological developments – p28	H4.1
28 (b)	12	Biofuel production, food and carbon – p28	H3.4, H5.1
29 (a) (i)	3	Research into climate variability – p31	H4.1
29 (a) (ii)	5	Research into climate variability – p31	H4.1
29 (b)	12	Ruminants and greenhouse gases – p30	H2.2, H5.1
30 (a) (i)	3	Research into technological developments – p33	H4.1
30 (a) (ii)	5	Research into technological developments – p33	H4.1
30 (b)	12	Evaluate a range of technological developments – p32	H3.4, H5.1