2024 HSC Agriculture Marking Guidelines

Section I, Part A

Multiple-choice Answer Key

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

Section I, Part B

Question 21 (a)

Criteria	Marks
• Identifies TWO farming practices leading to a decline in water quality	2
• Identifies ONE farming practice leading to a decline in water quality OR • Provides some relevant information	1

Sample answer:

- Fertiliser application/eutrophication
- Tillage near waterways

Question 21 (b)

Criteria	Marks
• Explains how grassed waterways improve water quality	4
• Describes features of grassed waterways	3
• Outlines the nature of grassed waterways	2
• Provides some relevant information	1

Sample answer:

Grassed waterways act as a natural barrier reducing soil erosion by binding the soil with their roots and slowing water flow. They filter run-off and prevent sediments reaching the stream which reduces turbidity of water and sedimentation.

Question 22 (a)

Criteria	Marks
• Outlines a possible marketing chain for the named product showing some details between producer and consumer	3
• Shows a basic marketing chain with some process/action linking producer and consumer	2
• Provides some relevant information	1

Sample answer:

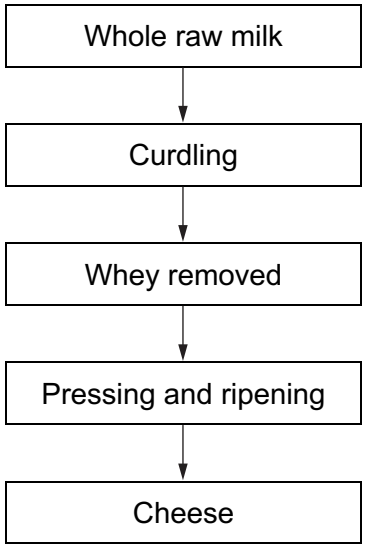
Product milk:

Question 22 (b)

Criteria	Marks
• Provides a sound flow chart that indicates main processes/actions to convert the raw named product into a different form	3
• Provides a basic flow chart with some processes evident between the raw and final product	2
• Provides some relevant information	1

Sample answer:

Product milk:



Question 22 (c)

Criteria	Marks
• Describes TWO factors affecting demand for a named product	4
• Describes ONE factor affecting demand for a product • Outlines a second factor affecting demand for a product	3
• Outlines TWO factors affecting demand for the product OR • Describes ONE factor affecting demand for a product	2
• Provides some relevant information	1

Sample answer:

Availability of milk alternatives

Milk consumption has fallen as more consumers have opted for non-dairy alternatives such as almond and oat milk. As demand for these beverages has risen, demand for milk has fallen.

Price

Milk consumption rises when major supermarket chains discount the price. When milk prices are low, there is more demand because it's cheaper than the alternatives.

Question 23 (a)

Criteria	Marks
• Outlines a fate of the product when it does not meet market specifications	2
• Provides some relevant information	1

Sample answer:

Lettuces that do not meet market specifications can be left in the paddock and ploughed back into the field.

Question 23 (b)

Criteria	Marks
• Outlines a government influence on the production or marketing of the product	2
• Provides some relevant information	1

Sample answer:

Governments can control visa conditions whereby foreign visitors are required to work on a lettuce farm for a period of time.

Question 23 (c)

Criteria	Marks
• Provides a detailed discussion of TWO ways a named product can be value added	6
• Provides a detailed discussion of ONE way a named product can be value added AND some discussion of a second way the product can be value added	5
• Provides some discussion of TWO ways a named product can be value added	4
• Provides a detailed discussion of ONE way a named product can be value added OR • Demonstrates some understanding of ways a named product can be value added	2–3
• Provides some relevant information	1

Sample answer:

Lettuce can be value added by removing the outer leaves, washing and packaging into clear plastic bags. This allows the product to be displayed in a more appealing way. Consumers may prefer to purchase lettuce packaged this way for hygiene reasons or because it is easier to pick up and place into the shopping basket.

Another way to value add is to chop up the lettuce and then package into salad kits which include other ingredients such as dressings and crispy noodles. This targets consumers who prefer not to make their own salad or who don't have the time to prepare meals. The processor can make a larger profit by creating these kits as the price received for the value added lettuce is much higher than the price of a whole lettuce.

In both cases there is an issue with disposing of the plastic items used in packaging as this can add to land fill which contributes to environmental issues.

Question 24

Criteria	Marks
• Describes in detail the advantages of vertical integration AND contract selling as ways to market farm products	6
• Provides a description of the advantages of vertical integration AND contract selling as ways to market farm products	5
• Describes the advantages of vertical integration OR contract selling as ways to market farm products AND describes the other method of selling	4
• Describe the advantages of vertical integration OR contract selling as ways to market farm products OR • Describes vertical integration or contract selling OR • Outlines vertical integration and contract selling	2–3
• Provides some relevant information	1

Sample answer:

Vertical integration is where a single company owns and operates several or all stages of the supply and processing chain. The advantages of this form of marketing are an increase in the efficiency of production as all steps in the chain are coordinated, thus reducing supply bottlenecks or oversupply. There is also a cost saving due to the control of the steps in processing, which removes intermediate profit margins from other suppliers.

Contract selling is the process of having a contract between a producer and the processor or wholesaler. This contract will include the quantity and quality of produce supplied, and the price structure based on quality. This system of selling has advantages for both parties. The wholesaler/processor has an assured supply of a consistent quality product, and the producer has a consistent market for their produce, and the guarantee of a price even when open market prices fluctuate.

Question 25 (a)

Criteria	Marks
• Explains the purpose of replication and provides a specific example that could be used for this investigation	4
• Explains the purpose of replication in an investigation	3
• Demonstrates some understanding of replication in this investigation	2
• Provides some relevant information	1

Sample answer:

The purpose of replication is to reduce bias and increase accuracy by having multiple samples tested.

In the first-hand investigation, different coloured cellophane sheets could be used to change the colour of light on pots of chrysanthemum plants. There could be 5 plants used for each colour, a total of 15 plants.

Having 5 plants for each colour would allow the student to take an average of each of the values being measured. This would ensure that one poorly performing plant would not affect the validity of the experiment, providing a more accurate indication of the results.

Question 25 (b)

Criteria	Marks
• Provides a comprehensive explanation of a technique, other than modifying light, that can be used to manage an environmental constraint in plant production	4
• Provides some explanation of a technique, other than modifying light, that can be used to manage an environmental constraint in plant production	3
• Describes a technique, other than modifying light, that can be used to manage an environmental constraint in plant production OR • Provides a link between a technique and plant production	2
• Provides some relevant information	1

Sample answer:

The use of windbreaks either by planting rows of trees or by creating a physical barrier can reduce the velocity of the wind both in front and behind the windbreak. This stops the buffeting of the plants, reducing injury such as lodging, to the crop plants.

Question 26 (a)

Criteria	Marks
• Discusses in detail the use of line breeding in animal production	4
• Provides some discussion on the use of line breeding in animal production	3
• Describes some features of line breeding	2
• Provides some relevant information	1

Sample answer:

Line breeding involves breeding closely related animals within the same breed eg father/daughter. Breeding within the same lineage aims to intensify specific desirable traits by concentrating the genes responsible for those traits. The risk of this inbreeding is an increased likelihood of transmitting undesirable traits, eg Angus cattle had a genetic disease transmitted throughout the breed due to the high use of an affected bull.

Question 26 (b)

Criteria	Marks
• Describes the role of objective measurement AND heritability for a specific industry on the breeding programs of farms	4
• Describes the role of objective measurement OR heritability on the breeding program of a farm AND outlines the other	3
• Outlines the role of objective measurement AND heritability on the breeding program of a farm OR • Describes the role of objective measurement OR heritability	2
• Provides some relevant information	1

Sample answer:

A Charolais beef breeding program using Breedplan is targeting increasing objective measurements of Intramuscular Fat (IMF) and Eye Muscle Area (EMA). The breeder identifies suitable bulls for use in their breeding program that have above average Estimated Breeding Values (EBVs) for these traits. This causes an increase in these traits in the offspring.

Heritability is a measure of the proportion of a trait that can be attributed to an animal's genes. Breedplan data provides percentage heritability, showing the degree to which a trait is likely to be passed on.

Question 26 (c)

Criteria	Marks
• Comprehensively explains a purpose of oestrus synchronisation in an animal breeding program	4
• Provides some explanation of a purpose of oestrus synchronisation in an animal breeding program	3
• Outlines a purpose of oestrus synchronisation in an animal breeding program OR • Describes oestrus synchronisation in animal breeding	2
• Provides some relevant information	1

Sample answer:

In sheep, oestrus synchronisation is used to allow all the females in a breeding program to cycle together so they will all be ready for joining to rams or to be artificially inseminated at the same time. This is done to be more time efficient and allow a shorter birthing period to better monitor parturition. The breeder can weigh lambs, eartag and mother up newborns, as they are all the same age.

Question 27

Criteria	Marks
• Comprehensively evaluates an IPM program for the named plant or animal host and target organism	8
• Provides some evaluation of an IPM program for the named plant or animal host and target organism	6–7
• Discusses an IPM program for a named plant or animal host and/or target organism	4–5
• Describes an IPM program or an element of a program for a plant or animal and/or pest	2–3
• Provides some relevant information	1

Sample answer:

IPM for Diamond Back Moth in Canola

IPM for Diamond Back Moth (DBM) involves a combination of control measures that are strategically applied in conjunction with the monitoring of pest numbers.

Biological: A range of predators and parasites attack DBM and can give good control of the pest. The most significant of these is *Diadegma* sp., a small, black wasp.

These are naturally occurring and cannot be artificially introduced so while effective they must be carefully managed regarding any chemical use. These play a key role in helping to keep populations in check.

Environmental: Trap cropping: A form of companion planting which uses plants that are highly attractive to the target pests. This method has shown excellent results for DBM in Brassica crops but has little application in broad acre Canola.

Chemical: With resistance to three key insecticide groups already established, canola growers need to understand how to minimise the further development of resistance.

Overall

IPM for DBM is the only viable option for control in Canola as the moths have developed resistance to a huge range of chemicals. While current IPM programs for DBM are quite effective they require a very high level of monitoring and management but are the only real option.

There is one commercially available biological control in Australia and this biopesticide BT is already showing resistance being developed. Producers have to carefully manage naturally occurring predators which can be quite difficult.

Some chemical control is still possible, but this is becoming more limited due to resistance issues and must be carefully managed to protect natural predators.

Cultural controls are often difficult to implement on a large scale and have been more successful with DBM in other field crops eg cabbage.

Section II

Question 28 (a) (i)

Criteria	Marks
• Provides a clear link between an issue and why the research was conducted	4
• Provides some link between an issue and why the research was conducted	3
• Describes the issue being researched	2
• Provides some relevant information	1

Sample answer:

The native Macadamia seed weevil causes significant crop losses in Australia's macadamia growing areas. Current controls use insecticides which are harmful to other insects. This research looked at the potential of using various insect killing fungi as an alternative to toxic chemicals to reduce the harm to beneficial non-target organisms.

Question 28 (a) (ii)

Criteria	Marks
• Provides a description of the way the data was collected and how it was presented in the study	4
• Provides an outline of the way the data was collected and how it was presented in the study	3
• Provides a description of the way the data was collected OR • Provides a description of the way the data was presented	2
• Provides some relevant information	1

Sample answer:

Several strains of two different insect killing fungi were chosen from the field and commercial strains. These were applied directly to containers containing a set number of adult weevils. Dead weevils were collected daily and evaluated for fungal infection. The data from these experiments were presented as tables showing fungal strain and its mortality rate.

Question 28 (b)

Criteria	Marks
• Provides a clear evaluation of biofuel production in terms of world food demands and environmental sustainability • Provides a logical and cohesive response • Uses relevant examples	10–12
• Provides a clear evaluation of biofuel production in terms of world food demands OR environmental sustainability OR • Provides some evaluation of biofuel production in terms of world food demands and environmental sustainability • Provides a mostly logical and cohesive response • Includes an example	7–9
• Describes the production of biofuel in terms of world food demands and/or environmental sustainability • Provides an organised response • Identifies an example	4–6
• Outlines the production of biofuel OR • Provides some relevant information	1–3

Answers could include:

- Algae could potentially provide more fuel/ha than other crops making it more environmentally sustainable and not competing with demands for crops for human consumption
- Algae does not use as much land resources as conventional crops and can be produced in vertical towers, therefore being space-efficient
- Biofuels can replace fossil fuels but currently needs the fossil fuels, fertiliser, and water to grow, harvest, and produce the biofuel therefore creating a conflict in sustainability
- Biodiesel requires harvesting of vegetable oils for production which could be used for human consumption
- Land resources are still being used to grow conventional crops which require chemical pest control, fertiliser use (eg nitrogen), and water. Nitrogen fertiliser being the predominant nutrient used which can cause excessive algal growth in waterways via leaching
- Crops are being harvested for production of the fuels rather than meeting the demands for human consumption, particularly in third world countries where crops such as corn are a dietary staple
- Plant and animal waste which can’t be used for human consumption can be converted into biofuel, reducing landfill demands
- More land clearing may occur to try and balance the need for food demands and production of biofuels

Question 29 (a) (i)

Criteria	Marks
• Provides a clear link between an issue and why the research was conducted	4
• Provides some link between an issue and why the research was conducted	3
• Describes the issue being researched	2
• Provides some relevant information	1

Sample answer:

Climate change has the potential to affect yields of wheat in Australia's growing areas. This study used a crop growth model called APSIM to investigate the effect on wheat yield if temperatures increase. This crop growth model allows researchers to predict what would happen with predicted changes in temperature, rainfall and CO_2 concentration.

Question 29 (a) (ii)

Criteria	Marks
• Provides a description of the way the data was collected and how it was presented in the study	4
• Provides an outline of the way the data was collected and how it was presented in the study	3
• Provides a description of the way the data was collected OR • Provides a description of the way the data was presented	2
• Provides some relevant information	1

Sample answer:

Eight sites across the wheat growing areas of South Australia were chosen, and their climate data was changed across different rainfall, temperature and CO_2 levels. Over 80 different simulations were run. The yield prediction from each simulation was collected.

The data was shown as both a table showing yield change as a range for each location and also a 3-dimensional graph for each location showing the interaction of temperature, rainfall and CO_2 changes.

Question 29 (b)

Criteria	Marks
• Provides a clear analysis of river flows in terms of water storage and water trading • Provides a logical and cohesive response • Uses relevant and recent examples	10–12
• Provides a clear analysis of river flows in terms of water storage OR water trading OR • Provides some analysis of river flows in terms of water storage and water trading • Provides a mostly logical and cohesive response • Includes an example	7–9
• Describes river flows in terms of water storage and/or water trading • Provides an organised response • Identifies an example	4–6
• Outlines issues related to river flows OR • Provides some relevant information	1–3

Answers could include:

- Disruption to natural river flows by water storage reservoirs impacting ecosystems and displacing communities during construction time
- Accumulation of sedimentation in reservoirs over time reducing storage capacity and impacting downstream habitats
- Changing precipitation patterns can lead to challenges in predicting water availability for water storage which will affect agriculture with release of water from dams and river flows
- Water trading issues include the equitable distribution of water from rivers, environmental concerns and legal/regulatory challenges
- Water trading can lead to disparities in access to water, which can raise concerns about social equity and fair distribution especially in regions where water is source
- Environmental concerns may arise from unregulated water trading where economic gain can be prioritised over environmental sustainability and health of rivers
- Excessive water removal can harm ecosystems and affect river flows, leading to long term environmental damage
- Establishing effective regulatory frameworks for water trading can be complicated and it's crucial that clear policies and governance mechanisms exist to prevent exploitation and ensure sustainable water use
- River flows can be disrupted by water storage and removal of water, which affect its biodiversity, ecological balances, aquatic habitats and wildlife migrations
- Inconsistent water flows from water storage and draining can lead to river flow variability

Question 30 (a) (i)

Criteria	Marks
• Provides a clear link between an issue and why the research was conducted	4
• Provides some link between an issue and why the research was conducted	3
• Describes the issue being researched	2
• Provides some relevant information	1

Sample answer:

Myrtle rust is a problem in lemon myrtle plantations, accurate detection of this disease allows targeted and more cost-effective treatment with fungicides. Detection by eye or with handheld hyperspectral sensors is slow and inaccurate. The research using drone based hyperspectral sensors was conducted to see if they could provide higher accuracy detection than ground and human based methods.

Question 30 (a) (ii)

Criteria	Marks
• Provides a description of the way the data was collected and how it was presented in the study	4
• Provides an outline of the way the data was collected and how it was presented in the study	3
• Provides a description of the way the data was collected OR • Provides a description of the way the data was presented	2
• Provides some relevant information	1

Sample answer:

In this study a drone was used to take 5 band hyperspectral images of a lemon myrtle plantation. The images were aligned and combined using high accuracy settings in an image processing software package. The ground data was removed to only leave the tree images. The categorised image was then processed using another software package to identify the trees with different spectral characteristics. This data was presented in the study as a graph of wavelength versus reflectance to show the difference in spectral image of diseased and disease-free trees. This involved the use of colour to represent data of similar values, therefore giving a clearer representation of the results.

Question 30 (b)

Criteria	Marks
• Provides a clear evaluation of a recent technological development in terms of its social and environmental impacts • Provides a logical and cohesive response • Uses relevant and recent examples	10–12
• Provides a clear evaluation of a recent technological development in terms of its social OR environmental impacts OR • Provides some evaluation of a recent technological development in terms of its social and environmental impacts • Provides a mostly logical and cohesive response • Includes an example	7–9
• Describes the technological development in terms of environmental and/or social impacts • Provides an organised response • Identifies an example	4–6
• Outlines a recent technological development OR • Provides some relevant information	1–3

Answers could include:

- Reduction in pesticide usage eg with precision spray technology or GM crops
- Reduction in fuel use eg technologies that reduce reliance on fossil fuel
- More efficient use of natural resources eg solar powered technologies
- Replacing labour – social impacts of reduction in labour needs
- Enhancing safety – reduction of health risks in workers
- Reduction in tedious tasks eg robotics replacing humans for repetitive or manual jobs
- More profitable – increased social consequences for farmers and family
- Access for more technically challenged farmers is limited as they are less likely to adopt technology and will be left behind
- As technology level increases in sophistication, there is an increased reliance on outside providers
- Some technology leads to increased monoculture and decreased biodiversity
- In some cases, new technology leads to an increase in the disparity between wealthy communities and poorer ones ie technology use and benefits

2024 HSC Agriculture Mapping Grid

Section I Part A

Question	Marks	Content	Syllabus outcomes
1	1	The role of advertising and promotion	H3.3
2	1	Agricultural pesticide label	H2.2
3	1	Process of growth and development in plants	H2.1
4	1	Plant breeding and variety improvement	H2.1
5	1	Family vs corporate farms	H3.1
6	1	Animal welfare	H2.2
7	1	Sources of competition in plant communities	H2.1
8	1	Techniques used to manage soil fertility	H1.1
9	1	Role of microbes and invertebrates in decomposition	H1.1
10	1	The place of the farm in the wider agribusiness sector	H3.1
11	1	Diverse pasture mix	H2.1
12	1	Animal disease	H2.2
13	1	Factors that limit the fertility of farm animals	H2.2
14	1	Land capability	H1.1
15	1	Cation exchange capacity	H2.1
16	1	Present data in appropriate form	H4.1
17	1	Ruminant and monogastric digestion	H2.2
18	1	Gross margin and return to capital	H3.1
19	1	Plant hormones	H2.1
20	1	Experimental design	H4.1

Section I Part B

Question	Marks	Content	Syllabus outcomes
21 (a)	2	Farming practice	H1.1
21 (b)	4	Water quality, grassed waterways	H1.1
22 (a)	3	Marketing chain	H3.2
22 (b)	3	Processing of raw product	H3.2
22 (c)	4	Product demand	H3.1, H3.2, H3.3, H3.4
23 (a)	2	Market specifications	H3.2, H3.3
23 (b)	2	Government influence on production and marketing	H3.2, H3.3
23 (c)	6	Value adding to a product	H3.2, H3.3
24	6	Marketing strategies	H3.1, H3.2
25 (a)	4	Experimental design	H4.1
25 (b)	4	Environmental constraints on plants	H2.1

Question	Marks	Content	Syllabus outcomes
26 (a)	4	Breeding systems	H2.2
26 (b)	4	Objective measurement	H2.2
26 (c)	4	Reproductive techniques	H2.2
27	8	Integrated pest management (IPM)	H1.1, H2.1, H2.2

Section II

Question	Marks	Content	Syllabus outcomes
28 (a) (i)	4	Research study	H4.1
28 (a) (ii)	4	Research study	H4.1
28 (b)	12	Biofuel production	H3.4, H5.1
29 (a) (i)	4	Research study	H4.1
29 (a) (ii)	4	Research study	H4.1
29 (b)	12	Water strategy and trading	H3.4, H5.1
30 (a) (i)	4	Research study	H4.1
30 (a) (ii)	4	Research study	H4.1
30 (b)	12	Technological developments	H3.4, H5.1