

# Agriculture

**General Instructions**

- Reading time – 5 minutes
- Working time – 3 hours
- Board approved calculators may be used
- Write using black or blue pen
- Draw diagrams using pencil
- Write your student number and/or name at the top of every page

**Total marks – 100**

**Section I – Pages 2–19**  
**80 marks**

This section has two parts, Part A and Part B

**Part A – 20 marks**

- Attempt Questions 1–20
- Allow about 30 minutes for this part

**Part B – 60 marks**

- Attempt Questions 21–28
- Allow about 1 hour and 45 minutes for this part

**Section II – Pages 20–21**  
**20 marks**

- Attempt ONE question from Questions 29–31
- Allow about 45 minutes for this section

## Section I – Part A

20 marks

Attempt Questions 1–20

Allow about 30 minutes for this section

Select the alternative A, B, C or D that best answers the question and indicate your choice with a cross (X) in the appropriate space on the grid below.

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- 1 When propagating plants with cuttings, the cut end can be dipped into 'cutting powder' to help stimulate root growth.

Which *plant hormone* is the active ingredient in cutting powder?

- (A) Auxin
- (B) Gibberellin
- (C) Cytokinin
- (D) Absciscic acid

- 2 How does *planting density* affect the vegetative yield of a crop?

- (A) As density increases the yield decreases until it reaches a low point and then it slowly increases.
- (B) As density increases the yield increases until it reaches a high point and then it slowly decreases.
- (C) As density increases the yield increases until it reaches a point where it levels out.
- (D) As density increases the yield increases in an 'S-shaped' curve.

- 3 *Energy from food is used by animals to maintain their bodies, grow and produce. Of the potential energy available in a feed, some may be lost in waste excreted by the animal.*

What is the remaining energy called?

- (A) Digestible energy
- (B) Gross energy
- (C) Metabolisable energy
- (D) Net energy

- 4 *A student is attempting to estimate the texture of a soil sample by feel. The sample feels gritty when rubbed.*

What is the particle type that causes this gritty feel?

- (A) Clay
- (B) Loam
- (C) Sand
- (D) Silt

Use the following information to answer questions 5 – 6.

*An organic vegetable farmer enters a contract to supply red onions to a wholesaler in late October for the average October price.*

**Onion 'Sweet Red'**

**Planting guide**

Position: Full sun

Sow depth: 6 mm

Germination 10 – 14 days

Plant space: 10 cm

Row space: 20 cm

Maturity: 26 – 28 weeks

- 5 When will this farmer need to schedule *sowing* of red onions in the farm management calendar?

- (A) January
- (B) April
- (C) July
- (D) October

- 6 When will it be best for the farmer to sell onions, by *pre-arranged* contract, at the average price for October?

- (A) If prices of onions are lower than average in October, due to lower production
- (B) If prices of onions are lower than average in October, due to higher production
- (C) If prices of onions are higher than average in October, due to lower production
- (D) If prices of onions are higher than average in October, due to higher production

Use the following information to answer Questions 7–9.

*A farmer has collected some information about a cropping enterprise in order to develop a 1 ha gross margin budget for the crop.*

- Seed – 50 kg per ha @ \$1 per kg
- Fertiliser – 40 kg per ha @ \$1.10 per kg
- Tractor – planting - \$12 per ha
- Herbicide - \$16 per ha
- Contract harvest - \$50 per ha
- Tractor servicing - \$325
- Crop yield - 2.8 tonnes per ha
- Crop price - \$300 per tonne

- 7 What can the farmer use the finished cropping enterprise *gross margin* budget for?
- (A) To establish how profitable the farm is
  - (B) To compare with other gross margins
  - (C) To allow agricultural record-keeping
  - (D) When considering environmental sustainability
- 8 What is the calculated *income* in this cropping gross margin budget?
- (A) \$107.14
  - (B) \$300
  - (C) \$804.80
  - (D) \$840
- 9 What is the total of the calculated *variable costs* in this cropping gross margin budget?
- (A) \$50
  - (B) \$172
  - (C) \$470.80
  - (D) \$497



- 10 *An Integrated Pest Management (IPM) program for mastitis disease in dairy cows uses chemical and non-chemical control measures. Good nutrition of the cows and milking hygiene are important preventative measures. Antibiotics are commonly used once an infection is established.*

What are the *target organisms* in this program?

- (A) Antibiotics
- (B) Dairy cows
- (C) Mastitis bacteria
- (D) Cow udders

- 11 *A sheep enterprise has a flock of purebred Merino ewes that are joined with a Border Leicester ram.*

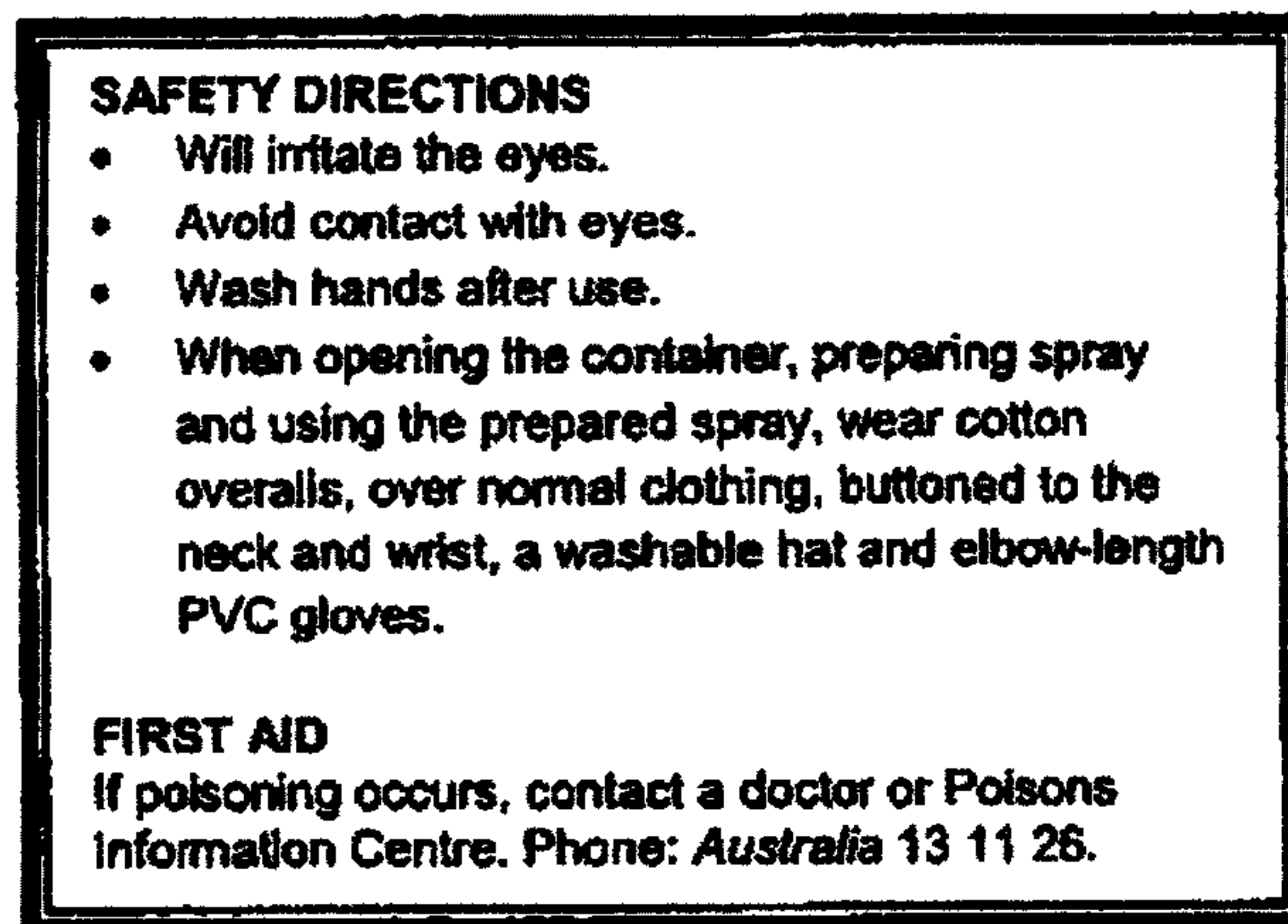
What is this type of breeding system called?

- (A) Inbreeding
- (B) Pure breeding
- (C) Line breeding
- (D) Crossbreeding

- 12 Which statement best describes the concept of a *marketing chain*?

- (A) The steps involved in taking a product from the farm to the final consumer
- (B) The method(s) used to process an agricultural product so that it is ready for the retail market
- (C) Methods used by a supermarket chain to select farm produce
- (D) The sequence of marketing strategies used to convince consumers to purchase the product

- 13 The following safety information is from the label on a chemical container.



The farm manager has a variety of safety equipment available.

What items need to be worn while using this chemical?

- (A) Cotton overalls, sterile gloves, goggles
- (B) Breathing mask, goggles, leather gloves
- (C) Leather gloves, breathing mask, washable hat
- (D) Washable hat, PVC gloves, cotton overalls

- 14 When breeding plants or animals the term *heritability* is likely to be used.

What is heritability?

- (A) A measurement of the proportion of a characteristic due to environment
- (B) A measurement of the proportion of a characteristic due to genotype
- (C) A measurement of the proportion of a characteristic due to management
- (D) A measurement of the proportion of a characteristic due to phenotype

- 15 *A plant breeder produces hybrid corn seed by crossing two inbred parent lines. A farmer plants this seed in 2011 and grows the corn. The farmer likes the characteristics of the corn so much that he keeps a quantity of the corn he has grown to plant in 2012.*

What will be the appearance of the 2012 crop?

- (A) The crop will have the same characteristics as the crop grown in 2011.
- (B) The crop will have the same characteristics as one of the inbred parent lines.
- (C) The crop will have an unpredictable variety of characteristics.
- (D) The corn seed will be unable to germinate, so the crop will not grow in 2012.

16 What is a *green manure* crop?

- (A) A crop that can be cut and fed fresh to cattle
- (B) A crop that causes green animal manure
- (C) A crop that is fertilised with green animal manure
- (D) A crop grown to add organic matter to the soil

17 *Measurements for an experiment are in the table below.*

<b>Treatment 1</b>	4	7	5	4
<b>Treatment 2</b>	6	8	11	7

What is the *mean* value for treatment 1?

- (A) 4
- (B) 5
- (C) 6
- (D) 7

18 A hormone is administered to a flock of ewes in order to synchronise oestrus cycles for an embryo transplant program.

What is the hormone that is used?

- (A) Luteinising hormone
- (B) Oestrogen
- (C) Progesterone
- (D) Prostaglandin

19 *A soil sample is collected and moistened with universal indicator. Barium sulphate is sprinkled over it and the resulting colour is compared to a chart.*

What is the soil characteristic being tested?

- (A) Ion exchange capacity
- (B) pH
- (C) Density
- (D) Porosity

- 20 *In an orchard enterprise the manager notices that chemical X, used to control a pest organism, becomes less effective over time. The new pest control chemical, Y, comes onto the market which controls the same pest organism.*

What should the manager do?

- (A) Continue using chemical X only.
- (B) Use chemical Y only.
- (C) Use chemicals X and Y in rotation.
- (D) Use an IPM program, which includes other control measures as well as chemicals.



Section I – Part B

60 marks  
Attempt Questions 21–28  
Allow about 1 hour and 45 minutes for this section

Answer the questions in the spaces provided. These spaces provide guidance for the expected length of response.

Question 21 (9 marks) Marks

Name ONE farm product you have studied: .....

- (a) Outline the features of a major market for this farm product. 2
- (b) Describe ONE way that *government* influences production or marketing of the product. 3
- (c) Describe factors affecting *demand* for the product. 4

Question 22 (9 marks) Marks

- (a) Describe ONE method used to assess *quality* of a NAMED agricultural product. 3
- (b) Evaluate TWO methods that can be used when *value adding* to farm products. Use examples to illustrate your answer. 6

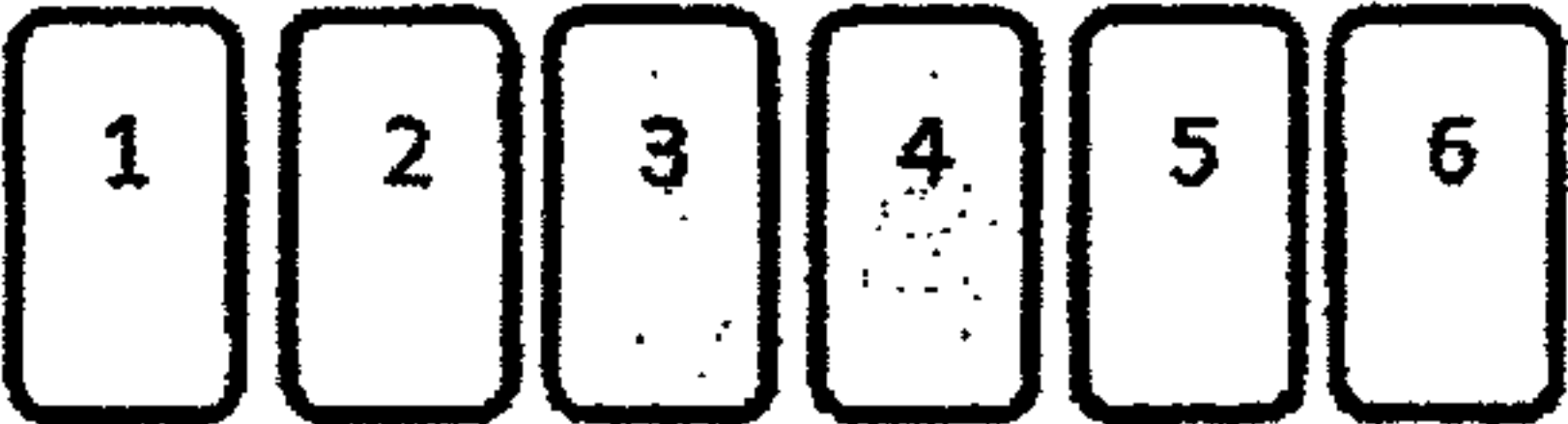
Question 23 (4 marks) Marks

How can individual farmers AND the broader community reduce the harmful *environmental* effects of agriculture? 4

Question 24 (7 marks)

Marks

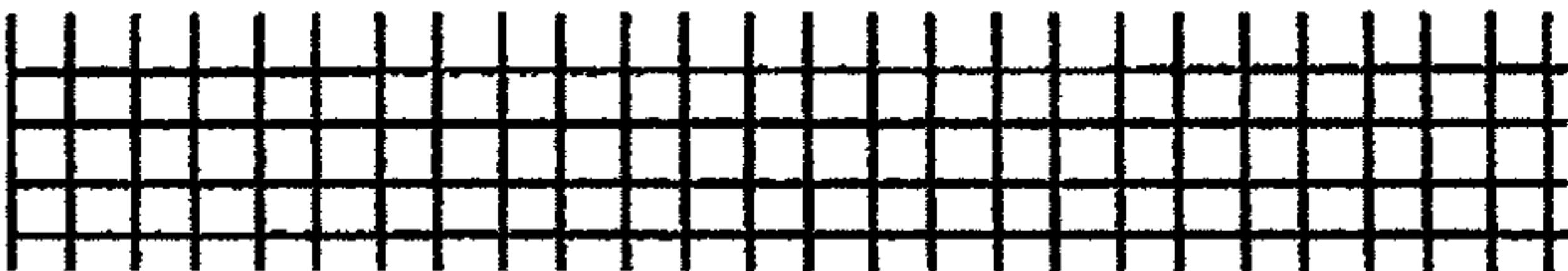
An agriculture class planted radish seeds in a series of six trays. The trays were placed in a protected area so that they all experienced the same environmental conditions, and could be watered using an automatic watering system. Trays 1 and 2 were covered over with shadecloth that excluded 50% of light, trays 3 and 4 were covered with a shadecloth that excluded 75% of light and trays 5 and 6 were left uncovered.



After 6 weeks of growth the radish plants were removed from the trays and dried. The radish dry weight produced in each tray was recorded in the following table

No cover		50% shadecloth		75% shadecloth	
140 g	115 g	110 g	90 g	55 g	90 g

- (a) What was being tested in this experiment?1
- (b) Construct a labelled graph to show the results of the experiment.3



- (c) Suggest an element of the *experimental design* that could be improved AND explain how this change would improve the reliability of results.3

Question 25 (7 marks)

Marks

- (a) Outline the *growth phases* of a NAMED agricultural plant.3
- (b) Evaluate the impact of a recent *technological innovation* on production or marketing of an Australian agricultural plant enterprise.4

Question 26 (7 marks)

Marks

- (a) Identify a pasture plant AND outline the role of the plant in a pasture production system.3
- (b) Explain why *ruminant* animals are more efficient at digesting pasture than monogastric animals.4

**Question 27 (7 marks)**

**Marks**

Discuss factors that should be considered to reduce **negative welfare impacts** on farm animals, when farmers use a NAMED technique, to manipulate reproduction.

7

**Question 28 (10 marks)**

**Marks**

(a) Describe the **negative impacts** of ONE *traditional* farming practice on soil and/or water.

3

(b) Assess the importance of *microbes* and *invertebrates* in decomposition and nutrient cycling.

7

## Section II

**20 marks**

**Attempt ONE question from Questions 29–31**

**Allow about 45 minutes for this section**

Answer part (a) of the question on your own paper or writing booklet, if provided

Answer part (b) of the question on a SEPARATE page of your own paper, or writing booklet.  
Expected length of response for part (b) is *approximately* 3½ pages or 500 words.

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In your answers you will be assessed on how well you:

- demonstrate knowledge and understanding relevant to the question
  - communicate ideas and understanding using relevant examples
  - present a logical and cohesive response
- 

### Question 29 – Agrifood, Fibre and Fuel Technologies (20 marks)

**Marks**

Answer part (a) of the question on your own paper or writing booklet, if provided.

- |     |      |   |   |
|-----|------|---|---|
| (a) | (i)  | Outline a method used to <i>analyse data</i> in a research study on the development and/or implementation of an agricultural biotechnology. | 2 |
|     | (ii) | Describe TWO <i>current developments</i> in biotechnology.  | 6 |

Answer part (b) of the question on a SEPARATE page of your own paper or writing booklet, if provided.

- |     |  |    |
|-----|--|----|
| (b) | Analyse the conflict between <i>increased production and ethical concerns</i> in biotechnology innovation. Outline specific examples to help illustrate your answer. | 12 |
|-----|--|----|

**OR**



Question 30 – Climate Change (20 marks)

Marks

Answer part (a) of the question on your own paper or writing booklet, if provided.

- (a)

(i)

Outline a method used to *analyse data* in a research study of climate variability or management strategies related to climate variability.

2

(ii)

Describe the *variability of climate* in TWO different geographical regions in Australia.

6

Answer part (b) of the question on a SEPARATE page of your own paper or writing booklet, if provided.

- (b)

Analyse issues related to *water storage and trading*. Outline specific examples to help illustrate your answer.

12

OR

Question 31 – Farming for the 21st Century (20 marks)

Answer part (a) of the question on your own paper or writing booklet, if provided.

- (a)

(i)

Outline a method used to *analyse data* in a research study on the development and/or implementation of a recent agricultural technology.

2

(ii)

Describe TWO methods that companies may use to *market* new technological developments.

6

Answer part (b) of the question on a SEPARATE page of your own paper or writing booklet, if provided.

- (b)

Analyse issues related to the *research and development* of technologies. Outline specific examples to help illustrate your answer.

12

End of paper

**NSW INDEPENDENT TRIAL EXAMS – 2012**  
**AGRICULTURE TRIAL HSC EXAMINATION**  
**MARKING GUIDELINES**

**Section I – Part A**

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

**Section I – Part B**

**Question 21(a)**

Criteria	Mark
• Provides TWO or more features of an important market	2
• Provides ONE feature of an important market	1

*Answer will vary depending on the industry and market chosen. For example, beef production for domestic supermarkets needs to be producing a lighter (370 – 500 kg live weight), lower fat (5–16 mm P8 fat) animal than for export trade. MUST NAME PRODUCT STUDIED*

**Question 21(b)**

Criteria	Mark
• Outlines government intervention and makes clear the impact on the production or marketing of the product	3
• Outlines government intervention relevant to the production or marketing of the product	2
• Identifies a form of government intervention	1

*Answer will vary. E.g. Government requirements for NLIS eartags – animals must be tagged before leaving property with correct colour tag. Entails additional work for farmer – acquiring tags, tagging animals, additional paperwork.*

**Question 21(c)**

Criteria	Mark
• Describes TWO or more factors affecting demand	3–4
• Identifies TWO or more factors affecting demand OR	2
• Describes ONE factor affecting demand	1
• Identifies ONE factor affecting demand	

*Answer may include: Advertising campaigns, changes in fashion, time of year, e.g. some products are more popular in summer/winter, religious festivals – turkey at Christmas, price*

**Question 22(a)**

Criteria	Mark
• Provides outline of method, including at least TWO steps in the process, and links this to assessment of a specified quality feature	3
• Provides outline of method, including at least TWO steps in the process	2
• Identifies quality feature OR method	1

*Answer will vary, depending on product, but may include: colour of fruit or vegetable product, blemish free appearance, bacteria level in milk assessed using plate count. MUST NAME PRODUCT*

**Question 22(b)**

Criteria	Mark
• For TWO value adding methods – provides TWO positive and/or negative aspects of each, using examples, and makes a judgement on the benefits of each method	5–6
• Provides positive or negative aspects of TWO value adding methods, using examples	3–4
• Outlines ONE – TWO methods of value adding	1–2

*Answer will vary, depending on product, but may include: processing to make the product easier or healthier to use, e.g. cutting into pieces, precooking, pasteurisation; addition of flavourings or sauces, e.g. flavoured milk; packaging, e.g. individual serves*



**Question 23**

Criteria	Mark
• Discusses ways that farmers AND the broader community can reduce the harmful impact of agriculture on the environment	4
• Discusses ways that farmers OR the broader community can reduce the harmful impact of agriculture on the environment	3
• Identifies methods of reducing the harmful impact of agriculture on the environment	1-2

*Answer may include:*

- Farmers – careful storage and use of water, reduced chemical use, reduced or no-till cropping, reduced use of inorganic fertilisers, tree planting
- Broader community – more discerning purchase decisions – food miles, organic produce, local markets; pressure on governments to mandate environmentally sensitive agriculture; personal involvement – Landcare, tree planting

**Question 24(a)**

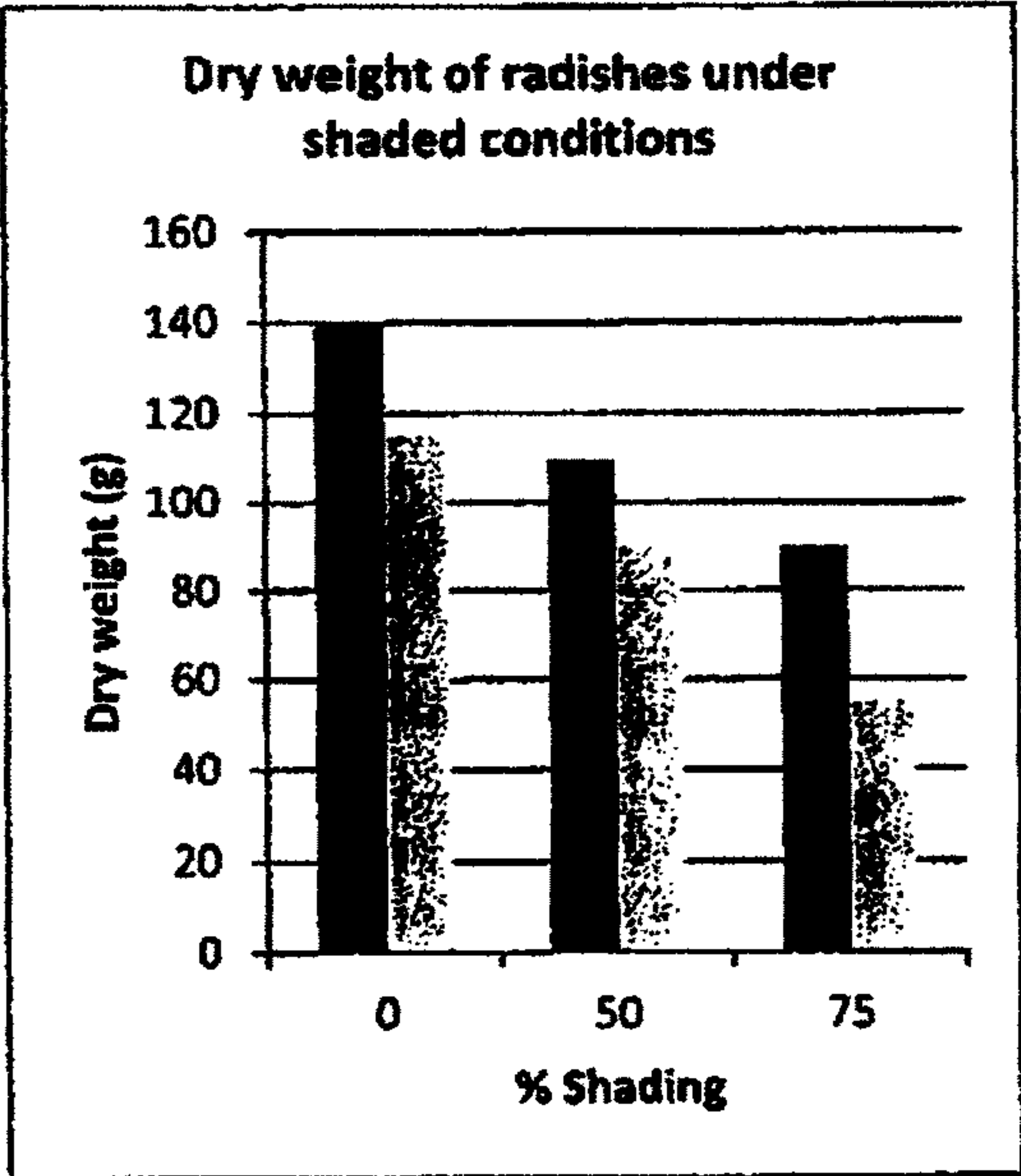
Criteria	Mark
• Identifies light intensity as the variable	1

*Answer:* Light intensity (shading/reduced light or similar) e.g. effect of light on growth of radish plants

**Question 24(b)**

Criteria	Mark
• Correct choice of graph type • Correct height of columns • Labelling of axes and heading	3
• Correct choice of graph type • Correct height of columns	1-2

*Answer:* Produces column graph of given data as below. Also acceptable is a graph/'line of best fit' of the *averages* for each treatment.



**Question 24(c)**

Criteria	Mark
• Identifies an element of experimental design that could be improved, provides an outline of how this could be incorporated in the experiment and links this to improvement in the results	3
• Identifies an element of experimental design that could be improved and provides an outline of how this could be incorporated in the experiment	2
• Identifies an element of experimental design that could be improved	1

*Answer will vary, but may include:*

- Randomisation – allocate tray positions randomly, e.g. with dice, to avoid bias due to position
- Replication – more trays for each treatment would improve the accuracy of the result
- Standardisation – conduct experiment by one person rather than whole class, to remove human differences in sowing, etc
- Greater range of shade-cloth light exclusion percentages.

**Question 25(a)**

Criteria	Mark
• Identifies TWO phases of growth and provides TWO correct features of each phase for a named plant  OR • Identifies THREE or more phases of growth and provides ONE correct feature of each phase	3
• Identifies TWO phases of growth and provides ONE correct feature of each phase for a named plant	2
• Identifies growth phases	1

*Answer will vary, depending on plant: e.g. wheat:*

- Vegetative phase: – Seedling growth and establishment, growth of leaves, stems and roots; tillering – at 3-5 leaf stage may develop tillers
- Reproductive phase: Pre-anthesis – no more leaves produced, internode elongation, spikelet buds develop to boot stage; post-anthesis – flowering occurs, self pollination, grains fill
- Maturation/Senescence: Dehydration of grain – ‘milk’, ‘dough’ and ‘ripe’ stages; loss of colour ‘haying off’ **MUST NAME PLANT**

**Question 25(b)**

Criteria	Mark
• Provides THREE or more positive and/or negative features of a recent technological innovation that is in use in an Australian agricultural plant enterprise • Makes a judgement about the value of the innovation with reference to the positives and negatives	4
• Provides THREE or more positive and/or negative features of a recent technological innovation that is in use in an Australian agricultural plant enterprise	2-3
• Identifies a recent technological innovation that is in use in an Australian agricultural plant enterprise	1

*Answer will vary, depending on innovation and plant enterprise: e.g.:*

- New sowing/harvesting equipment
- New plant varieties that have better production (quantity or quality) characteristics or pest/disease resistance
- New chemicals for removing pests/disease/weeds

Positive features likely to include better quantity or quality of production – better suited to market, less use of resources such as chemicals/fertiliser/water.

Negative features likely to include increased costs of production – new innovations are often more expensive, may have adverse environmental effects.



**Question 26(a)**

Criteria	Mark
• Provides some features of a named plant that make it useful in a pasture production system	2–3
• Identifies a plant used in pasture production systems	1

*Answer will vary, depending on pasture plant selected: e.g. white clover – produces high quality, palatable, easily digested feed. If it has associated *Rhizobia* bacteria will fix atmospheric N, which will encourage growth of grasses.*

**Question 26(b)**

Criteria	Mark
• Identifies a difference between monogastric and ruminant animals and describes why the difference makes pasture digestion more efficient	4
• Outlines differences between the digestion of monogastric and ruminant animals OR • Outlines why differences makes pasture digestion more efficient	2–3
• Identifies a difference between digestion of monogastric and ruminant animals	1

*Answer may include: Fibre (cellulose) in the diet of monogastrics is passed through the digestive tract without being broken down so any food value is lost in faeces. In ruminants, the rumen and rumen microbes means that fibre from pasture is digested and food value is used.*

**Question 27**

Criteria	Mark
• Identifies a technique used to manipulate reproduction in farm animals • Outlines features of at least TWO measures that can be taken to reduce associated negative welfare aspects	6–7
• Identifies a technique used to manipulate reproduction in farm animals • Identifies TWO or more associated negative welfare aspects • Identifies TWO or more methods to reduce negative welfare	4–5
• Identifies a technique used to manipulate reproduction in farm animals • Identifies TWO or more associated negative welfare aspects	2–3
• Identifies a technique used to manipulate reproduction in farm animals	1

*Answer will vary, depending on technique: e.g. artificial insemination (AI):*

- If the AI technician is not performing the technique correctly the reproductive tract could be damaged – it is important that the technician is properly trained and certified.
- If semen from a bull that produces large calves is used on a small heifer, she may experience dystocia, risking the life of both cow and calf – select semen that is appropriate for size.
- Bulls may carry recessive genes for disease that can be passed on to resulting AI calves with associated welfare impacts – semen with absence of some genetic diseases can be selected.

**Question 28(a)**

Criteria	Mark
• Describes the negative impacts of a traditional farming practice on soil and/or water	3
• Outlines the negative impacts of a traditional farming practice on soil and/or water	2
• Identifies a traditional farming practice that has been damaging to soil or water	1

*Answer will vary, depending on farming practice: e.g. tree clearing – soil is not protected from erosion by wind or water, especially on tops of hills. Negative impacts include:*

- Loss of topsoil with associated organic matter and nutrients; reduced arable/useable land area
- Water is not removed by tree roots, causing water table to rise, bringing salts to surface – salination means loss of productive land and also affects waterways
- Eutrophication of waterways via excess nutrients (organic and mineral) flowing from the land, leading to excessive growth of weed and algal blooms in waterways.



**Question 28(b)**

Criteria	Mark
<ul style="list-style-type: none"> <li>• Outlines at least THREE examples of microbes and invertebrates in decomposition and nutrient cycling</li> <li>• Provides a statement assessing the value of microbes and invertebrates in decomposition and nutrient cycling</li> </ul>	7
<ul style="list-style-type: none"> <li>• Outlines examples of microbes and/or invertebrates in decomposition</li> <li>• Outlines examples of microbes and/or invertebrates in nutrient cycling</li> </ul>	2-6
<ul style="list-style-type: none"> <li>• Identifies soil microbes or invertebrates</li> </ul>	1

*Answer may include:* Invertebrates such as ants, beetles and earthworms, consume the remains of plants and animals and their resulting wastes are added to the soil. Fungi and bacteria quickly decompose the pectins and sugars in plant leaves to produce humus. This slowly releases nutrients.

- Nitrogen cycle – Soil bacteria and fungi have 'first call' on the available soil nitrogen, which limits the amount available to plants. When soil nitrogen levels increase compared to carbon, the soil organisms mobilise the nitrogen (ammonification – soil organisms turn nitrogen in organic matter into ammonia).
- Nitrification – Soil organisms turn nitrogen in organic matter into nitrates. Ammonia and nitrates are then available to plants. Blue-green algae and bacteria have a role in fixing atmospheric nitrogen in legume root nodules (e.g. *Rhizobium*) and in soil (e.g. *Clostridium*).
- De-nitrification – Bacteria in low oxygen conditions use nitrate, nitrite or ammonium to produce nitrogen gas, reducing soil N.
- Carbon cycle – Carbon is held in the soil in soil organisms. Microbial decomposition of cellulose, pectin and starch in organic matter, returns carbon dioxide to the atmosphere.

**Section III****Question 29(a)(i)**

Criteria	Mark
<ul style="list-style-type: none"> <li>• Provides information about how the measure is calculated OR used</li> </ul>	2
<ul style="list-style-type: none"> <li>• Identifies a method of data analysis</li> </ul>	1

*Answer will vary depending on study, but may include:* Calculation of mean, SD, variance, T-test, F-test

**Question 29(a)(ii)**

Criteria	Mark
<ul style="list-style-type: none"> <li>• Describes TWO current developments</li> </ul>	5-6
<ul style="list-style-type: none"> <li>• Outlines TWO current developments</li> </ul>	3-4
<ul style="list-style-type: none"> <li>• Provides some relevant information about current developments</li> </ul>	1-2

*Answer will vary but may include:*

- Name of development
- How development works
- Benefit of development

**Question 29(b)**

Criteria	Mark
<ul style="list-style-type: none"> <li>• Outlines several sources of conflict between production and ethics</li> <li>• Outlines at least TWO examples of conflict</li> <li>• Describes the implications for farmers and/or society</li> </ul>	10-12
<ul style="list-style-type: none"> <li>• Outlines several sources of conflict between production and ethics</li> <li>• Outlines at least TWO examples of conflict</li> </ul>	7-9
<ul style="list-style-type: none"> <li>• Outlines several sources of conflict between production and ethics</li> </ul>	4-6
<ul style="list-style-type: none"> <li>• Identifies sources of conflict between production and ethics</li> </ul>	1-3

*Question 29(b) continues on the next page*



**Question 29(b) continued**

**Answer may include:**

- Need for increased production – cost/price squeeze. Increased input costs (e.g. fuel for farm machinery) and decreased prices for agricultural produce (particularly exports with strong \$AUS), increasing interest rates.
- Temptation for farmers to overlook ethical concerns – animal cloning, GM, PVR, food safety, biofuel production etc, have associated ethical issues.
- Implications for farmers and society – need to come to some middle ground between making money and ethical production or solve ethical issues with legislation, e.g. GMO labelling laws.

**Question 30(a)(i)**

Criteria	Mark
• Provides information about how the measure is calculated OR used	2
• Identifies a method of data analysis	1

**Answer will vary depending on study, but may include:** Calculation of mean, SD, variance, T-test, F-test

**Question 30(a)(ii)**

Criteria	Mark
• Describes climate variability for TWO regions	5-6
• Outlines climate variability for TWO regions	3-4
• Provides some relevant climatic information	1-2

**Answer will vary, but should include:**

- Location
- Rainfall information
- Temperature information

**Question 30(b)**

Criteria	Mark
• Outlines several water storage and trading issues	10-12
• Outlines at least TWO examples	
• Describes the implications for farmers and/or society	
• Outlines several water storage and trading issues	7-9
• Outlines at least TWO examples	
• Outlines several water storage and trading issues	4-6
• Identifies water storage and trading issues	1-3

**Answer may include:**

- Water storage issues – variability in rainfall means more storage is needed, evaporation from dams and open canals (up to 70%), disruption of natural flow by dams resulting in damage to downstream ecosystem (loss of natural flooding patterns, fish blocked from spawning, release of cold water from bottom of dam), use of water stored in aquifers, pollution
- Trading issues – removal from rivers to the detriment of natural river ecology and increased salinity downstream, population growth causing increased urban use, some agricultural enterprises use more water than others
- Implications for farmers and society – need to have balance in water use, environmental flows from dams, laws to prevent water pollution, rules about water sharing, market for water trading, household water conservation, Murray-Darling Basin Authority to negotiate between groups

**Question 31(a)(i)**

Criteria	Mark
• Provides information about how the measure is calculated OR used	2
• Identifies a method of data analysis	1

**Answer will vary depending on study, but may include:** Calculation of mean, SD, variance, T-test, F-test

**Question 31(a)(ii)**

Criteria	Mark
• Describes TWO marketing methods	5–6
• Outlines TWO marketing methods	3–4
• Provides some relevant information about marketing methods	1–2

*Answer will vary but may include:*

- Name of method
- Strategy
- Target market

**Question 31(b)**

Criteria	Mark
• Outlines several research and development issues	10–12
• Outlines at least TWO examples	
• Describes the implications for development companies, farmers and/or society	
• Outlines several research and development issues	7–9
• Outlines at least TWO examples	
• Outlines several research and development issues	4–6
• Identifies research and development issues	1–3

*Answer may include:*

- Research issues – Current post WFC funding environment is very restrictive for novel research, need to observe ethical restrictions on animal research, resource limits
- Development issues – Funding, expensive to bring new chemicals to the market, safety and liability issues, agricultural sector already experiencing cost/price squeeze so may be reluctant to spend on expensive new technology so need to spend more on promotion
- Implications for companies, farmers and society – Smaller development budgets, slower innovation, may not be able to retain production edge compared to other countries resulting in higher price of local product, contraction of local research community