



ANIMAL PRODUCTION SYSTEMS

ATAR course examination 2018

Marking Key

Marking keys are an explicit statement about what the examining panel expect of candidates when they respond to particular examination items. They help ensure a consistent interpretation of the criteria that guide the awarding of marks.

Section One: Multiple-choice

20% (20 Marks)

Question	Answer
1	a
2	d
3	c
4	b
5	All *
6	a
7	d
8	d
9	b
10	c
11	c
12	a
13	b
14	d
15	a
16	b
17	c
18	d
19	c
20	a

* Question 5 – all distractors were deemed correct; all candidates were awarded 1 mark.

Section Two: Short answer

50% (89 Marks)

Note: Specific examples have been chosen to illustrate responses. In many cases where the question allows for responses in various contexts, the example given reflects one specific context.

Question 21

(16 marks)

- (a) (i) Use the information in the table above to calculate (3 marks)
- (A) gross revenue
 - (B) gross margin
 - (C) gross margin per bird

Description	Marks
(A) $800\,000 \times 2/100 = 16\,000$ deaths therefore $784\,000$ birds @ $\$0.60 = \$470\,400$	1
(B) $470\,400 - 283\,000 = \$187\,400$	1
(C) $187\,400 / 800\,000 = \$0.23 / \text{bird}$	1
Total	3

- (ii) Identify a possible reason for the increase in the mortality rate and describe its impact on the economic sustainability of the enterprise. (3 marks)

Description	Marks
Identifies a reason for mortality rate increase	1
Describes clearly impact on economic sustainability	2
Basic statement outlining impact on economic sustainability	1
Total	3
<p>Answers could include:</p> <p>Possible reasons:</p> <ul style="list-style-type: none"> • disease outbreak – poor hygiene and biosecurity practices • environmental disaster – flooding, extremities in weather (heat/cold), cyclone etc. • management practices – not meeting nutritional requirements, failure to monitor and adjust production environment as a result of changing circumstances. (e.g. heat wave). <p>Economic sustainability:</p> <ul style="list-style-type: none"> • producers will be unable to fulfil contract obligations of supplying stated number of birds to processing company. This could impact on future contract negotiations • increase in mortality rate due to disease outbreak may result in quarantining of producer's property • welfare agencies/animal activist groups may become involved if deaths are caused by operator incompetence or negligence. 	

Question 21 (continued)

- (b) Explain **one** short- and **one** long-term strategy to minimise the mortality rate of **any** animal production enterprise. (6 marks)

Description	Marks
For one short- and one long-term strategy (2x3)	
Explains strategy to minimise mortality rates	3
Describes a strategy to minimise mortality rates	2
Statement outlining a strategy to minimise mortality rates	1
Subtotal	3
Total	6
<p>Answers could include:</p> <p>Short-term strategy:</p> <ul style="list-style-type: none"> implement best practice disease/pest control management practices – vaccination and drenching programs, follow integrated pest management principles, monitor pest populations, apply treatments at optimum times, hygienic working environment integrate biosecurity measures to minimise introduction/outbreak of pests and diseases, secure farm boundaries, quarantining of introduced livestock, wash down bays for vehicles, controlling access to property and buildings, complying with animal traceability schemes (the National Livestock Identification System) timing of husbandry operations that minimise the likelihood of stock losses – avoid exposure to extreme weather conditions. <p>Long-term strategy:</p> <ul style="list-style-type: none"> breeding animals with specific characteristics that discourage pest infestation (e.g. sheep with bare breeches to prevent fly strike). Initiating a genetic change in the animal enables them to withstand environmental conditions. upgrading infrastructure to limit the impact of weather extremes – cooling/heating systems in intensive production facilities breeding animals with pest/disease tolerance e.g. worm-resistant sheep. 	

- (c) Describe **one** benefit and **one** limitation of using gross margins for financial planning purposes. (4 marks)

Description	Marks
For one benefit and one limitation (2x2)	
Describes clearly benefit/limitation for financial planning	2
Basic statement outlining benefit/limitation for financial planning	1
Subtotal	2
Total	4
<p>Answers could include:</p> <p>Benefit:</p> <ul style="list-style-type: none"> gross margins (GMs) are an easy way of comparing the economic efficiency of each enterprise through each individual contribution to overall farm profitability enables financial comparisons between enterprises competing for the same resources data from GM analysis can assist in the decision making process – expanding production, altering enterprise mix, benchmarking individual enterprises against industry/regional performance. <p>Limitation:</p> <ul style="list-style-type: none"> doesn't factor in additional fixed costs associated with an enterprise – cost of infrastructure, return to capital invested, machinery and plant depreciation doesn't allow comparison between enterprises that are using different resources. 	

Question 22

(13 marks)

- (a) State a farming practice that has been investigated closely by an animal rights group and outline the reason for their concern. (3 marks)

Description	Marks
States a targeted farming practice	1
Outlines clearly a reason	2
States a reason	1
Total	3
<p>Answers could include:</p> <p>Farming practice being targeted and reason:</p> <ul style="list-style-type: none"> intensive production systems – pig farrowing crates, battery hen systems – object to animals not being able to express natural behaviour, cramped conditions, animal losses mulesing of lambs – cruelty towards animals, no sedation (anaesthesia) prior to operation handling of animals – overcrowding, exposed to excessive temperature, disposal of animals with no commercial value selling and consuming of bobby calves and lambs – removal of young from their mother, removal from feed prior to processing use of animals for experimental reasons – cruel, inhumane use of animals. 	

Question 22 (continued)

- (b) Describe the potential impact that animal rights groups could have on: (4 marks)
a production system.
access to global markets.

Description	Marks
Describes clearly impact on the production system	2
States an impact on the production system	1
Describes clearly impact on access to global markets	2
States an impact on access to global markets	1
Total	4
<p>Answers could include:</p> <p>Production system:</p> <ul style="list-style-type: none"> • potential serious economic threat to both Australian producers and regional communities • consumers purchase alternative products – meat vs vegetarian diets, wool vs synthetic clothing • animal welfare issues that arise from not undertaking the disputed operation – flystrike as a consequence of not mulesing • additional costs of changing production systems – possibly less productive and efficient (battery vs barnyard vs free range egg laying systems) • decrease marketing options – saleyards vs direct to abattoirs. <p>Access to global markets:</p> <ul style="list-style-type: none"> • advertising campaigns by animal welfare advocates can result in overseas companies refusing to purchase/sell Australian products • complying with animal welfare concerns could result in additional costs of production or becoming less efficient. This in turn impacts on the competitiveness of Australian commodities in global markets, restriction on the use of animals for experimental work/trials essential for productivity gains. 	

(c) Describe how each of the following stakeholders can assist in addressing consumers' animal welfare concerns. (6 marks)

- Producer
- Industry groups
- Government

Description	Marks
For each of the following – Producer, Industry groups, Government (3x2)	
Describes clearly how the group/individual can assist in satisfying animal welfare concerns	2
Outlines how the group/individual can assist in satisfying animal welfare concerns	1
Subtotal	2
Total	6
<p>Answers could include:</p> <p>Producer:</p> <ul style="list-style-type: none"> • clearly establish and maintain appropriate animal welfare practices that incorporate all personnel involved in animal husbandry practices (farm owners, workers, contractors, livestock agents etc.) • apply best practice to all aspects of production • implement a quality assurance program • maintain animals in appropriate health and body conditions with suitable access to feed, water and shade • adopt new practices that are both economically viable and meet changing consumer trends – barnyard eggs, free range poultry meat. <p>Industry groups:</p> <ul style="list-style-type: none"> • actively work alongside welfare organisations such as the Royal Society for the Prevention of Cruelty to Animals (RSPCA) to develop appropriate animal welfare standards • educate producers in the importance of maintaining animal welfare standards • use advertising campaigns to counterbalance information being circulated by animal rights groups. This could incorporate print and social media, television and the internet • facilitate research into new technology and/or practices that better align with consumer expectations • assist government in establishing and maintaining appropriate protocols and quality assurance programs for our live export markets – e.g. only allowing credited overseas abattoirs to have access to Australian live export animals • assist in removing rogue elements of the industry who are not complying with acceptable animal welfare standards. <p>Government:</p> <ul style="list-style-type: none"> • develop and enforce legislation that ensures all members of the production chain adhere to appropriate welfare standards. It is essential that the legislation involves consultation with industry groups • ensure fines for serious breaches of animal welfare legislation are large enough to be a deterrent • provide suitable resourcing to legitimate welfare organisations to assist in both enforcing legislation and education. 	

Question 23

(15 marks)

- (a) (i) For an animal production system that relies on exports for its ongoing sustainability, list **one**:
 export product.
 export market.
 major competitor. (3 marks)

Description		Marks
Lists an export product		1
Lists an export market		1
Lists a major competitor		1
Total		3
Answers could include:		
Export product	Export market	Major competitor
Beef	Japan, United States, Korea	Brazil
Live cattle exports	Indonesia, Vietnam, China	Brazil
Dairy products	South-east Asia, China, Japan, Middle East	New Zealand
Lamb	USA, China, United Arab Emirates	New Zealand
Mutton	China, Malaysia, United States	New Zealand
Live sheep	Kuwait, Qatar, Jordan	New Zealand
Wool	China, India, Italy	New Zealand

- (ii) For the export product identified in Question 23 a(i), describe **two** ways in which the Australian industry maintains its global competitiveness. (4 marks)

Description		Marks
For each of two ways (2x2)		
Describes clearly a way the Australian industry maintains its global competitiveness		2
States a way the Australian industry maintains its global competitiveness		1
Subtotal		2
Total		4
Answers could include:		
<ul style="list-style-type: none"> • proximity to markets – approximately 60% of the world's population lives within easy and safe reach of Australia • have a reputation for supplying premium products which are ethically and sustainably produced • guaranteed supplier of clean, safe and high-quality products • Australia is one of the most pest and disease free agricultural areas of the world • very effective food safety and biosecurity systems • significant investment in agricultural research and development • agricultural sector extremely efficient through integration of new technologies, farm management practices and limited government protectionism • 		
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- (b) Using an example, explain what is meant by comparative advantage. (4 marks)

Description	Marks
Uses an example	1
Explains what is meant by comparative advantage	3
Describes what is meant by comparative advantage	2
Outlines what is meant by comparative advantage	1
Total	4
<p>Answers could include:</p> <ul style="list-style-type: none"> comparative advantage relates to producing goods and services at a lower opportunity cost than other producers <div style="border: 1px dashed gray; padding: 10px; text-align: center; margin: 10px 0;"> <p>For copyright reasons this text cannot be reproduced in the online version of this document.</p> </div> <ul style="list-style-type: none"> new technologies include advances in livestock breeding and genetics, electronic livestock identification, remote sensing systems, computerised decision support technologies efficiency gains through new technologies have enabled Australian agriculture to keep ahead of our international competitors. On average, productivity growth in the Australian agriculture sector has averaged around 2.7% over a 30 year period. 	

- (c) Explain, using a relevant example, **one** Australian quarantine strategy that ensures our industry is protected against exotic diseases. (4 marks)

Description	Marks
Uses a relevant example	1
Explains a quarantine strategy	3
Describes a quarantine strategy	2
Outlines a quarantine strategy	1
Total	4
<p>Answers could include:</p> <p>Quarantine strategies:</p> <ul style="list-style-type: none"> • Department of Agriculture and Water Resources has strict biosecurity requirements for the import of goods into Australia. All live animals and reproductive material are not permitted to be imported into Australia if they are deemed to be high pest or disease risk to the agricultural sector. The Biosecurity Import Conditions System (BICON) is used to determine whether a commodity can be imported into Australia • Commonwealth Government enforces some of the strongest quarantine measures in the world, applying to passengers, cargo and vessels • The Department of Agriculture and Water Resources has developed a Biosecurity Incident Management System (BIMS) which provides a framework for the management of a disease outbreak • Quarantine WA has the responsibility of preventing the introduction of exotic disease, pests and weeds found in other states and territories. All imported organisms and potential carriers must be declared to Quarantine WA. Commercial transporters and importers must declare goods at least 24 hours before arrival at the state border checkpoint • Quarantine WA also assists in preventing the spread of pests and diseases throughout WA. A number of pests are present but confined to specific parts of WA through quarantine practices such as controlling movement of vehicles and mandatory recording of livestock movement • mandatory reporting of exotic disease and possible subsequent destruction of animals and/or quarantine of property. 	

Question 24

(15 Marks)

- (a) (i) Describe a possible legal issue with using 'Profit++' in Australia. (2 marks)

Description	Marks
Describes clearly a legal issue	2
Outlines a legal issue	1
Total	2
<p>Answers could include:</p> <ul style="list-style-type: none"> • all states in Australia have introduced legislation that prohibit feeding ruminants any meal derived from animal origin, including fish and birds – known as 'restricted animal material'. Especially relevant if the farmer is considering using Profit++ with ruminant animals • Profit++ must meet government requirements before being legally imported and used in Australia • Profit++ must not contain any constituents prohibited in Australia – (e.g. antibiotics, hormones, meat meal, etc.) • restricted animal material (RAM) is defined as any material taken from a vertebrate animal other than tallow, gelatin, milk products or oils. It includes rendered products, such as blood meal, meat meal, meat and bone meal, fish meal, poultry meal and feather meal, and compounded feeds made from these products • Profit++ must meet Australian stockfeed regulations and standards? • Profit++ must be registered by the Australian Pesticides and Veterinary Medicines Authority (APVMA) • Profit++ label must meet APVMA regulations, those being: <div style="border: 1px dashed gray; padding: 10px; text-align: center; margin: 10px 0;"> <p>For copyright reasons this text cannot be reproduced in the online version of this document.</p> </div>	

Question 24 (continued)

- (ii) Based on the information provided about 'Profit++', would you recommend that the producer use this product? Justify your recommendation. (4 marks)

Description	Marks
No (you couldn't justify using this product solely on promotional brochure) or Possibly (based on further research)	1
Articulates clearly a valid justification of 'no' recommendation	3
Provides a general justification of 'no' recommendation	2
Limited justification of 'no' recommendation	1
Total	4
<p>Answers could include:</p> <p>Justification of 'no' recommendation:</p> <ul style="list-style-type: none"> • need to further investigate company's reputation as a reputable manufacturer of feed additives • a similar product that has met all the requirements • no information on the experimental design used by the American company to support their claims • require independent trials to validate the stated performance data • performance data based on only one trial – no replication to eliminate possible experimental error • possible experimental bias if company conducted the trial internally or funded research. 	

Question 24 (continued)

- (b) (i) Write an hypothesis for the proposed trial. (1 mark)

Description	Marks
Writes a valid hypothesis for the investigation	1
Total	1
Answers could include: If the medicated feed additive Profit++ is added to a ration then growth rates and feed efficiency will improve.	

- (ii) Describe, using specific examples, **two** aspects of experimental design you would use to minimise possible errors in the results. (4 marks)

Description	Marks
For each of two aspects (2x2)	
Describes clearly an aspect of experimental design using a relevant example	2
States an aspect of experimental design	1
Subtotal	2
Total	4
Answers could include: Control <ul style="list-style-type: none"> component of the experiment that doesn't receive any treatment. The control is used as a point of comparison with other treatment/s the animals that didn't have the Profit++ added to the ration would be the control. Replication <ul style="list-style-type: none"> using a treatment on number occasions improves accuracy by reducing atypical results repeat investigation a number of times under the same conditions. Randomisation <ul style="list-style-type: none"> the unbiased distribution of replicates to groups and treatments to groups. Prevents favouring particular treatments animals randomly allocated to the control and Profit++ groups. Standardisation <ul style="list-style-type: none"> ensuring the conditions other than the independent variable are the same. manage all animals in the investigation the same way except for those receiving Profit++ e.g. animals within the groups should be same sex, age, weight, breeding, environment, pen size, feeding system. 	

Question 24 (continued)

- (c) List **one** feed additive and **one** growth promotant used in the Australian livestock industry. Outline how each optimises production. (4 marks)

Description	Marks
Lists a feed additive	1
Outlines how feed additive optimises production	1
Lists a growth promotant	1
Outlines how growth promotant optimises production	1
Total	4
<p>Answers could include:</p> <p>Feed additives:</p> <ul style="list-style-type: none"> • antibiotics – disease prevention • coccidostats – control parasites • antioxidants – prevents feed from going rancid • flavouring agents – improves feed intake • mineral/vitamin supplements – assists with balancing rations, improves digestion, corrects imbalances • molasses – protein supplement, increases pasture intake. <p>Growth promotants:</p> <ul style="list-style-type: none"> • hormonal growth promotants – promotes improved growth rates by enabling animals to convert feed to meat more efficiently • Compudose 100 and Revalor S – growth promotant implants used in cattle. 	

Question 25

(17 marks)

- (a) (i) Draw a line graph on the grid provided on page 19 to represent the trial data in the above table. (5 marks)

Description	Marks
Graph title	1
x – axis, title and units	1
y – axis, title and units	1
Drench A labelled and plotted as a line graph	1
Drench B labelled and plotted as a line graph	1
Total	5

Answers could include:

Comparison of controlled release drenches

Month	Drench A (eggs per gram)	Drench B (eggs per gram)
Jan	0	0
Feb	0	500
Mar	0	500
Apr	0	1000
May	200	1500
June	500	3000
July	600	3000

Economic threshold line

- (ii) Describe the conclusion you can draw from the graph and the standard deviation. (4 marks)

Description	Marks
For each of the graph and the standard deviation (2x2)	
Describes clearly the conclusion	2
Outlines a basic conclusion	1
Subtotal	2
Total	4

Answers could include:

Graph:

- Drench A effectively controls the worm burden for 6 months
- Drench B has no effective ongoing control of the worm burden. Faecal worm egg counts (FWECs) increase significantly from April to July.
- FWEC for Drench B follows the normal population curve of a pest subject to no control measures.

Standard deviation:

- a low standard deviation indicates that the data (FWECs) were relatively close to the mean. This in turn indicates that the mean is a reliable indicator of the response of the drench's to FWECs. That is, no outliers that are significantly impacting on the mean
- low standard deviation supports correct experimental design procedures
- high standard deviation = higher probability of experimental error.

- (b) (i) Plot the economic threshold line on the graph on page 19. (1 mark)

Description	Marks
Plots in the economic threshold line	1
Total	1

- (ii) Describe how incorrect economic principles of pest and disease control have been applied in this situation. Identify **one** possible consequence of not adhering to these principles. (3 marks)

Description	Marks
Describes clearly how incorrect economic principles have been applied	2
Outlines how incorrect economic principles have been applied	1
Identifies a possible consequence	1
Total	3
<p>Answers could include:</p> <p>How incorrect economic principles have been applied:</p> <ul style="list-style-type: none"> the farmer has applied the controlled release capsule in January when the worm burden is below the economic threshold – 100 eggs per gram should have implemented control measure/s when the pest is causing a financial loss to the producer – 500 eggs per gram the group Drench A reach the economic threshold (ET) again in June. Based on the economic principles of pest control this group should have been drenched at this time. <p>Possible consequence:</p> <ul style="list-style-type: none"> pesticide resistance through not applying chemicals at ET loss of production due to not using chemical once worm burden passes ET. 	

Question 25 (continued)

- (c) Define pesticide resistance and outline **two** ways in which a producer could contribute to this issue through poor management practices. (4 marks)

Description	Marks
Defines clearly pesticide resistance	2
Basic understanding of pesticide resistance	1
Outlines two poor management practices	2
Outlines one poor management practice	1
Total	4
<p>Answers could include:</p> <p>Definition:</p> <ul style="list-style-type: none"> pesticide resistance is the decreased susceptibility of a pest population to a pesticide that was previously effective at controlling the pest. <p>Poor management practices:</p> <ul style="list-style-type: none"> not implementing appropriate biosecurity policies on the property – secure boundary fencing, purchasing stock from reputable source, quarantining of animals newly introduced onto the farm applying chemicals at incorrect dosage rates and when not required not calibrating chemical administration equipment not rotating chemicals with different active constituents relying solely on chemical control strategies in preference to an integrated pest management approach. 	

Question 26

(13 marks)

- (a) For an animal breeding program, list an economically-important trait and outline how a producer could measure improvements in this trait. (2 marks)

Description	Marks
Lists an economically-important trait	1
Outlines how improvement is measured	1
Total	2
<p>Answers could include:</p> <p>Economically-important traits:</p> <ul style="list-style-type: none"> • Beef cattle – growth rate (200, 400 and 600 day weights) , meat yield, marbling • Dairy cattle – milk yield, protein and fat content, calving ease, birth weight • Sheep – wool fibre diameter, clean fleece weight, weaning weight • Pigs – average daily weight gain, backfat, 21 day litter weights, litter sizes. <p>Measure improvements:</p> <ul style="list-style-type: none"> • improvements in conception rates (success rates of AI, ET or natural mating programs) • production records – measuring improvements in production (intervals between offspring, increase marking %, carcass feedback) • financial analysis/comparisons – benchmarking production of enterprise with district and industry results e.g. gross margin per breeding animal • improvement in progeny breeding values. 	

- (b) Using an example from the table, describe how heritability affects breed performance. (3 marks)

Description	Marks
Selects appropriate example	1
Describes how heritability affects breed performance	2
Outlines how heritability affects breed performance	1
Total	3
<p>Answers could include:</p> <ul style="list-style-type: none"> • heritability measures how strongly a trait is passed on from one generation to the next. It is expressed on a scale of 0–1. Trait scores above 0.30 are considered highly heritable • both milk protein and fat % have extremely high heritability so therefore there would be high genetic gain when selecting for these traits. 	

Question 26 (continued)

- (c) (i) Which ram best suits the wool producer's breeding goal? Justify your selection. (3 marks)

Description	Marks
Selects Ram 2	1
Justifies clearly the selection	2
Basic statement that justifies selection	1
Total	3
Answers could include: Reasons for selecting Ram 2: <ul style="list-style-type: none"> • whilst ram has the lowest fleece weight breeding value (+40) it has the highest accuracy. Also fibre diameter stays the same. Faults of other cut rams: <ul style="list-style-type: none"> • Ram 1 – very high breeding value for fibre diameter (+3) • Ram 3 – very low accuracy for both fibre diameter and fleece weight – unproven sire. 	

- (ii) Calculate the estimated increase in fleece weight of the progeny from your recommended ram. (1 mark)

Description	Marks
Correctly calculates the estimated increase in fleece weight of selected ram	1
Total	1
Answers could include: Will depend on what ram the student recommended <ul style="list-style-type: none"> • Ram 1 = $45/2 = 22.5$ grams per year • Ram 2 = $40/2 = 20$ grams per year • Ram 3 = $42/2 = 21$ grams per year 	

- (d) Explain, using an example, how you could use information from an animal's pedigree to assist in meeting **one** of the following breeding goals: (4 marks)
- Improve enterprise profitability
- Meet changing market requirements

(Indicate with a tick the breeding goal on which your answer is based).

Description	Marks
Lists an applicable example	1
Explains clearly how animal's pedigree assists in meeting breeding goal	3
Outlines how animal's pedigree assists in meeting breeding goal	2
Basic understanding of how an animal's pedigree assists in meeting breeding goal	1
Total	4
<p>Answers could include:</p> <p>An animal's pedigree can be used to select appropriate traits that target selected breeding goal. Interrelationships between parents and offspring, over generations, regarding improvements in a relevant trait. Knowledge on the performance of an animal's ancestry can give a good indication of the genetic potential of the progeny in transmitting the selected traits.</p> <p>Improving enterprise profitability: Improve profitability by selecting economic important traits. For example:</p> <ul style="list-style-type: none"> • cattle growth rates • milk yield • fibre diameter. <p>Meeting changing market requirements:</p> <ul style="list-style-type: none"> • demand for A2 milk – selecting traits in dairy cattle that have a genetic variation of the beta-casein milk protein • trend towards leaner meat – traits related to fat and eye muscle (Eye muscle area EBV, Fat EBV, Intramuscular Fat EBV's). 	

Section Three: Extended answer

30% (40 Marks)

Question 27

(20 marks)

- (a) Define 'duty of care' in the workplace and state why it is important. Describe **two** practices that people involved in your animal enterprise follow to ensure that their 'duty of care' obligations are met. (6 marks)

Description	Marks
Defines 'Duty of Care' and states its importance in the workplace	2
Basic understanding of 'Duty of Care'	1
For each of the two practices (2x2)	
Describes a practice that meets duty of care obligations	2
Outlines a practice that meets duty of care obligations	1
Subtotal	4
Total	6

Answers could include:

Duty of Care:

- (Tort Law) is a legal obligation whereupon an individual has to take reasonable care whilst undertaking any activity that may potentially harm another. It is the first component that must be established if deciding if there was negligence of this duty.

Importance:

- provides the foundation for all OHS policies and practices.

Practices that would assist in meeting 'duty of care' obligations:

- all parties involved with work have responsibilities for safety and health at work
- an employer (Teachers and Technical Officers) must, as far as practicable, provide a work environment in which employees are not exposed to hazards
- employees (students) must take reasonable care for their own safety and health, and that of others, at work
- self-employed persons (contractors) must, as far as practicable, ensure the work does not adversely affect the safety and health of others.

Examples – accept specific responses that relate to the type of enterprise and educational facility.

Employers:

- provide a workplace where employees are not exposed to hazards
- provide a safe system of work which reduces the risk of injury
- all plant and machinery must be installed or erected so it can be used safely
- employers and employees must consult and cooperate in matters related to safety and health at work
- provide employees with information, instructions, training and supervision to allow them to work in a safe manner
- provision of personal protection
- reporting of injuries and diseases
- provide a safe work environment – buildings, structures, vehicles, work processes, work arrangements, physical and psychological environment
- identification of hazards, assessment and control
- undertake suitable instructions and training including - safety and health induction training, industry based training, on-the-job training
- obtain certification or accreditation where appropriate
- ensure that employees are suitable supervised.

Employees:

- follow employer's safety and health instructions
- use personal protective clothing and equipment
- take good care of equipment and operate as instructed
- report hazards and work-related injuries.

- (b) Describe **one** economic risk and **one** climate change risk that could affect the sustainability of your animal enterprise. Explain the mitigation strategies used to manage these risks. (10 marks)

Description	Marks
For both economic and climate change risk (2x2)	
Describes a risk that could affect sustainability	2
States a risk that could affect sustainability	1
Subtotal	4
For both economic and climate change risk (2x3)	
Explains a mitigation strategy used to manage the risk	3
Describes a mitigation strategy used to manage the risk	2
Outlines a mitigation strategy used to manage the risk	1
Subtotal	6
Total	10
<p>Answers could include:</p> <p>Economic risks:</p> <ul style="list-style-type: none"> • changes in supply and demand that affect prices of inputs and outputs • cost price squeeze – increasing input costs and decreasing commodity prices – availability and cost of hiring suitable labour, feed major component of production costs (50–75%) – closely correlated with climatic factors • changes in demand for product quality or quantity, food safety requirements or timing of product delivery • contamination of product from pests and diseases • failure to meet market specifications. <p>Mitigation strategies – economic:</p> <ul style="list-style-type: none"> • supply product/s that meets market specifications i.e. weight and condition, micron, disease free, no chemical residues etc. • select a market that optimises return i.e. domestic vs export, niche markets. • laws of supply and demand i.e. timing of production, don't supply goods out of season • minimise input costs – use cheapest and most suitable feeds that meet production system requirements. Selecting animals that have superior nutritional traits i.e. FCR, weight gains, hardier in adverse conditions etc. Source the most cost effective product • purchase insurance policies. <p>Climate change risks:</p> <ul style="list-style-type: none"> • weather related risks affecting enterprise include drought, excess rainfall and flood, periods of either extended and unseasonal high or low temperatures, excessive winds, severe cyclonic conditions etc. • climate change factors – increase in weather related risks • contamination of local ecosystem and loss of biodiversity – chemicals impacting on non-targeted organisms, effluent run off • land degradation – soil erosion, salinification, acidification, compaction etc., as a result of enterprise operations and/or unfavourable climatic conditions • an increase in extreme weather events • declining pasture quality and growth • reduced stream flow and quality of water supply across southern Australia • crop yields may be vulnerable to reduced rainfall • increased risk of heat-related stress and disease in stock and crops • migration of some pests to southern areas • widening distribution and abundance of some exotic weeds. <p>(all have potentially severe consequences to the sustainability of the enterprise)</p>	

Question 27 (continued)

Mitigation strategies – climate change:

Mitigation is the lessening or limitation of the adverse impacts of hazards and related disasters. Possible examples include

- manage weather risks that minimises impact on enterprise – freshly shorn sheep placed in sheltered paddock if adverse weather forecasted.
- develop resources and farming practices that assist with climate change – water catchments, dams, selection of drought tolerant pasture species, temperature control in intensive enterprises
- incorporate industry best practice into all aspects of enterprise management – stocking rates, chemical application, use of integrated pest management
- protect existing remnant vegetation, plant shelter belts, fence off degraded areas.

- (c) Discuss how a new technology could be used to improve the sustainability of your animal enterprise. (4 marks)

Description	Marks
Discusses how a new technology impacts on sustainability	4
Describes how a new technology impacts on sustainability	3
Outlines how a new technology impacts on sustainability	2
States how a new technology impacts on sustainability	1
Total	4
<p>Answers could include:</p> <p>Examples of new technology:</p> <ul style="list-style-type: none"> • precision farming techniques • soil and crop sensors • mobile computers – internet accessibility • drought resistant variety • automotive equipment • breeding technologies – AI and embryo transfer, gene marking • x-ray and 3D digital imaging for accurately measuring live animals. <p>Improve sustainability:</p> <ul style="list-style-type: none"> • availability of information from computer apps and network will facilitate better decision-making capabilities via improved diagnostic capabilities, updated market information, sourcing cost efficient inputs • enhance ability to accurately meet market specifications • improve efficiency and accuracy of enterprise operations. 	

Question 28

(20 marks)

- (a) Explain how **two** different breeding technologies can be used to improve animal enterprise performance. Describe **one** potential ethical issue associated with breeding technologies. (8 marks)

Description	Marks
For each of two breeding technologies (2x3)	
Explains how a breeding technology improves performance	3
Describes how a breeding technology improves performance	2
States how a breeding technology could improve performance	1
Subtotal	6
For one ethical issue	
Describes one ethical issue associated with using breeding technologies	2
States one ethical issue associated with using breeding technologies	1
Subtotal	2
Total	8
<p>Answers could include:</p> <p>Breeding technologies:</p> <ul style="list-style-type: none"> artificial insemination (AI), embryo transfer, cloning, genetically modified organisms (GMO), genetic markers. <p>Improve productivity:</p> <p>AI and embryo transfer</p> <ul style="list-style-type: none"> enables a genetically superior animal to be utilised to a greater extent select traits that are linked to profitability increases – e.g. increased milk production, growth rates, fertility access the best desirable genetics from Australia and potentially overseas without the necessity to purchase the animal reduction in the number of males required – savings in purchase and management costs. <p>Cloning, GMO's and gene markers</p> <ul style="list-style-type: none"> genetically superior animals could be identified and reproduced to replicate the desirable performance rapid decrease in generation intervals specific genes influencing production can be identified for potential alteration or replication. <p>Potential ethical issues:</p> <ul style="list-style-type: none"> animal welfare and ethical concerns negative public perception of consuming GMO animal products decrease of genetic pool/genetic diversity as a result of overuse of specific trait leaders additional costs associated with purchase genetics, labour success reliant on expertise of operators – additional expertise required, timing of operations critical. 	

Question 28 (continued)

(b) Explain the processes involved in implementing a successful breeding technology in an animal production system, including:

- establishing breeding goals
- hormone manipulation of oestrus
- management of breeding animals.

(12 marks)

Description	Marks
For each of the three dot points (3x4)	
Explains the processes involved in implementing a successful breeding technology	4
Describes the processes involved in implementing a successful breeding technology	3
Outlines the processes involved in implementing a successful breeding technology	2
States a process involved in implementing a successful breeding technology	1
Subtotal	4
Total	12
<p>Answers could include:</p> <p>Establishing breeding goals:</p> <ul style="list-style-type: none"> • breeding goals based on specified market requirements. The performance targets centre on the ability to achieve these market specifications • improve fertility rates – improve conception rates, increase twinning and birthing percentages • uniformity of product – decrease in birthing period, more uniformity in weaning weights, reduced weaning weights • selection of genetics that correspond to breeding goals • targeting of traits with both proven economic importance and high heritability. <p>Hormone manipulation of oestrus: process will be determined by the program being undertaken. Important to have a basic understanding of the role hormones play in a successful synchronisation program</p> <ul style="list-style-type: none"> • Prostaglandin – hormone produced by the uterus to regress the corpus luteum. This allows the female to come into oestrus. This hormone is administered via an injection that shortens the reproductive cycle. It is only effective on females that are already actively cycling. A common application is a 10 day program with heat detection and insemination twice a day • Progesterone – hormone produced by the corpus luteum which keeps the female from its oestrus cycle and maintains pregnancy. This is applied via a removable implant placed inside the vagina or under the skin behind the ear. This delays the start of oestrus until two days after its removal. The implants are usually left in for 8–11 days • Testosterone – hormone injected into castrated males to simulate ‘teaser’ behaviour as a means of encouraging cycling in females • Melatonin – subcutaneous injection that ‘tricks’ short day breeders into cycling. It can be used in spring to encourage ewes to cycle in the summer (instead of autumn) when the majority of joining occurs. <p>Management of breeding animals:</p> <ul style="list-style-type: none"> • health status – all animals should be in optimal condition, free of any pest or diseases. This would encompass such measures as – suitable vaccination program, an integrated pest management plan, regular observation, immediate preventative and/or corrective actions in response to factors impacting on health. • nutritional management – correct condition score prior to and during the insemination program. Rising plane of nutrition, feeding of increased protein to males prior to semen collection 	

- handling – use of low stress techniques, minimise handling in extreme weather conditions, avoid unnecessary disturbance throughout insemination, embryo implementation
- have an accurate and early heat detection system in place – teaser rams with crayon harnesses, heat patches
- accurate recording systems – collecting performance data, matching females with offspring
- animal identification – electronic vs manual tags.

Question 29

(20 marks)

- (a) Explain the function of both the gastric and microbial digestive systems. Discuss how a producer can assist an animal's effective use of protein and energy for **one** of these digestive systems. (11 marks)

Description	Marks
For each digestive system (gastric and microbial) (2x4)	
Explains the function of the digestive system	4
Describes the function of the digestive system	3
Outlines the function of the digestive system	2
Statement about the function of the digestive system	1
Subtotal	8
For one of these systems	
Discusses how producer can assist with an animal's effective use of protein and energy.	3
Outlines how producer can assist with an animal's effective use of protein and energy.	2
States how producer can assist with an animal's effective use of protein and energy.	1
Subtotal	3
Total	11
<p>Answers could include:</p> <p>Pigs = gastric system (accept monogastric or non-ruminant) Cattle/Sheep = microbial system (accept ruminant)</p> <p>Gastric system:</p> <ul style="list-style-type: none"> • very efficient in conversion of high quality feed into growth • one stomached animals which are well suited to be fed complete concentrated based rations • more refined digestive system – require a higher quality diet • has less ability to utilise energy from fibre so percentage in diet should be kept low • more suitable to feed grains that are high in starch and easily digested (high feeding value) – concentrates • stomach is responsible for storage and initiating breakdown of nutrients. Gastric glands in this area secrete hydrochloric acid resulting in a pH of 1.5 to 2.5 which in turn kills bacteria ingested in feed. Other secretions are present in the form of digestive enzymes which are responsible for protein breakdown • salivary and oesophageal glands secrete enzyme amylase that commences breakdown of carbohydrates. <p>Microbial system:</p> <ul style="list-style-type: none"> • less efficient in the conversion of feed into growth • four stomached animals – reticulum, rumen, omasum and abomasum (true stomach) • rumen-reticulum is a fermentation chamber containing large microbial populations. This assists in ruminants being able to derive energy from fibrous feedstuffs • ruminants require appropriate levels of fibre in the diet to enable digestion • abomasum secretes gastric juices, hydrochloric acid and digestive enzymes to assist digestion. <p>Effective use of protein and energy:</p> <ul style="list-style-type: none"> • provide a diet that meets the protein, energy and mineral requirements of the animal • the way in which feed is fed can have a significant impact on utilisation of protein and energy (e.g. pelleted, crushed grain, mash) • ensure water is accessible and clean • animals are in healthy condition and preventative action taken where appropriate – vaccination against pulpy kidney • use of feed additives – feeding urea as a means of assisting with the making of microbial protein (MS) • change from high fibre diets to high grain diets slowly. 	

(b) For a stated market, explain the feeding strategies a producer could implement to:

- meet specified market requirements
- avoid product variations.

(9 marks)

Description	Marks
1 mark for stating a market	1
Explains feeding strategies to meet specified market requirements	4
Describes feeding strategies to meet specified market requirements	3
Outlines feeding strategies to meet specified market requirements	2
States a market requirement or feeding strategy	1
Explains feeding strategies to avoid product variations	4
Describes feeding strategies to avoid product variations	3
Outlines feeding strategies to avoid product variations	2
States a possible product variation or feeding strategy	1
Total	9
<p>Answers could include:</p> <p>Market: Beef – Japan Milk – Domestic market</p> <p>Market requirements:</p> <ul style="list-style-type: none"> • requirements based on weight, fat score, meat colour, bacteria count, fibre diameter • provide animals with feed that meet production requirements – higher quality feed for growth and development (grains and quality hay) vs poorer quality for maintenance (poorer pastures) • digestibility and palatability testing of feeds • adjusting stocking rates in accordance to feed type and quality • introduction of feed in accordance to digestive system – grain introduction to ruminants • supplementary feeding to meet production requirements • non ruminants – feed highly digestible feeds (concentrates vs roughages) • grazing management that best utilises available feed • feed free from contamination • feed additives – Flavouring agents to improve palatability – molasses. Antioxidants to prevent feed from becoming rancid • availability of appropriate proportions of roughages, concentrates and additives • feeding programs centred around regular objective and subjective assessment – condition scoring, fat scoring. <p>Product variations:</p> <ul style="list-style-type: none"> • differences in eating quality that can be influenced by nutritional management include, pH levels, marbling, ossification, fat colour and depth • avoid sudden changes in diet and water supply • only select animals for sale that meet specifications • feeding facilities should be suitable for animals being fed – feed accessibility, treatment of shy feeders. 	

ACKNOWLEDGEMENTS

- Question 23(a)(i)** Table under 'Answers could include' information from: National Farmers' Federation. (2017). *Food, fibre and forestry facts: A summary of Australia's agriculture sector* (pp. 25, 34, 45, 51). Retrieved August, 2018, from <https://www.nff.org.au/farm-facts.html>
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- Question 23(b)** Text under 'Answers could include' (2nd dot point) adapted from: National Farmers' Federation. (2017). *Food, fibre and forestry facts: A summary of Australia's agriculture sector* (p. 19). Retrieved August, 2018, from <https://www.nff.org.au/farm-facts.html>
- Question 23(c)** Text under 'Quarantine strategies' (1st dot point) 2nd sentence adapted from: Department of Agriculture and Water Resources. (2018). *Importing live animals and reproductive material*. Retrieved August, 2018, from <http://www.agriculture.gov.au/import/goods/live-animals>
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- Question 24(a)(i)** Text under 'Answers could include' (1st and 4th dot point) adapted from: Animal Health Australia. (2018). *Australian ruminant feed ban*. Retrieved August, 2018, from <https://www.animalhealthaustralia.com.au/what-we-do/disease-surveillance/tse-freedom-assurance-program/australian-ruminant-feed-ban/>
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- Question 25(c)** Text under 'Definition' (1st dot point) adapted from: Pesticide resistance. (2018). In *Wikipedia*. Retrieved August, 2018, from https://en.wikipedia.org/wiki/Pesticide_resistance
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- Question 27(a)** Text under 'Duty of Care' information from: Duty of Care. (2018). In *Wikipedia*. Retrieved August, 2018, from https://en.wikipedia.org/wiki/Duty_of_care
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Text under 'Practices that would assist in meeting 'duty of care' obligations' (1st to 4th dot point), 'Employers' (1st to 12th dot point) and 'Employees' (1st to 4th dot point) adapted from: Department of Mines, Industry Regulation and Safety. (2005). *Guidance note: General duty of care in Western Australian workplaces*. (pp. 1, 6, 19, 22, 25, 27, 30, 31, 38). Retrieved August, 2018, from <http://www.commerce.wa.gov.au/publications/guidance-note-general-duty-care-western-australian-workplaces>
- Question 29(a)** Text under 'Gastric system' (6th dot point) adapted from: DeRouchey, J., Goodband, B., Tokach., et al. (2009). *Digestive system of the pig: Anatomy and function*. Retrieved August, 2018, from <http://www.thepigsite.com/articles/2749/digestive-system-of-the-pig-anatomy-and-function/>

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