



ANIMAL PRODUCTION SYSTEMS

ATAR course examination 2017

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

Section Two: Short answer

50% (93 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

(14 marks)

- (a) (i) Use the information in the table above to calculate (2 marks)

Description	Marks
A = (\$)59,000	1
B = (\$)65,000	1
Total	2

- (ii) Which herd of steers is the most profitable? (1 mark)

Description	Marks
B - Use HGP Implants	1
Total	1

- (b) (i) If the abattoir was willing to pay only \$2.70/kg live weight for HGP treated steers, would it still be as profitable to use HGP implants? Show all workings. (2 marks)

Description	Marks
No	1
$350 \text{ kg} \times \$2.70 = \$945 \times 100 = \$94\,500 - 40\,000 = \$54\,500$	1
Total	2

- (ii) Describe why the abattoir would pay less for steers that had been treated with HGP implants? (2 marks)

Description	Marks
Describes why the abattoir would pay less	2
Brief statement	1
Total	2
Answers could include: <ul style="list-style-type: none"> • some markets will not accept HGP treated beef • EU export market has a ban on HGP treated products. 	

Question 21 (continued)

- (c) (i) Using the Pearson Square method, calculate Ration B and compare its cost to that of Ration A. State which is the least cost ration. Show all workings. (5 marks)

Description		Marks
Correct Pearson Square setting out		1
Correct ratio		1
Correct cost of each part of ration		1
Correct cost per tonne of feed		1
States ration B (lupins and oaten hay) is least cost ration		1
Total		5
Lupins 25	5 $\$300 \times 5/15 = \100	
	15	= \$167/ tonne
Hay 10	10 $\$100 \times 10/15 = \67	

- (ii) What legal requirements do you need to adhere to when selecting ingredients to make up a ruminant feed ration? (2 marks)

Description		Marks
States that Restricted Animal Material laws prevent producer from using animal based meals as part of a ruminant feed mix.		2
States that offal, swill or antibiotics cannot be used.		1
Total		2

Question 22

(15 marks)

- (a) If livestock producers follow the labelled directions on drenches accurately, describe why resistance still occurs? (2 marks)

Description		Marks
Describes why resistance occurs		2
States a fact about resistance breaking down		1
Total		2
Answers could include:		
<ul style="list-style-type: none"> resistance is heritable, so some worms in the population survive the chemical and gradually reproduce with other resistant worms to rebuild the population. failure to rotate chemical groups. 		

- (b) Describe **two** strategies a producer can use to reduce resistance to drenching. (4 marks)

Description	Marks
Two marks for each strategy. Maximum of 4 marks.	
Describes a strategy and how it can reduce resistance	2
States a strategy	1
Total	4
Answers could include: <ul style="list-style-type: none"> • monitor worm egg populations – FWEC • carry out a drench resistance test to determine which drench/s is most effective • grazing management – create safe pastures for weaners, rotational is better than set stocking • rotating the chemical mode of action • ensuring dose is sufficient for the heaviest animal • maintain sheep in CS3, improves their immunity • have a compact lambing and early weaning to reduce egg burden at a time when ewes are at a low point in their immunity • breed resistant sheep, use rams with favourable breeding values. 	

- (c) State the difference between systemic and contact modes of action. (2 marks)

Description	Marks
States a clear difference between systemic and contact modes of action	2
States a fact about the difference between systemic and contact modes of action	1
Total	2
Answers could include: <ul style="list-style-type: none"> • systemic need to be translocated into the animal. When the pest comes in contact with the chemical, the chemical is soluble enough to be taken up and moved around inside the pest and the pest can be eradicated • contact needs for the pest to come into direct contact with some part of its body. 	

- (d) Given the choice between a systemic and a contact chemical to control an external parasite, which would be more effective against the parasite? State your reason. (2 marks)

Description	Marks
States systemic and gives a reason	2
States systemic	1
Total	2
Answers could include: <ul style="list-style-type: none"> • systemic does not need to come into contact with parasite, can enter the animals bloodstream and control the parasite when it feeds on blood, e.g. tick • systemic does not need to cover the entire animal to control the pest • systemic is not as prone to environmental events such as heavy rainfall that may remove them from the animal. If candidate selects contact chemical, then candidate must give relevant reasons as to why it is a preferred chemical control. <ul style="list-style-type: none"> • contact chemical provides immediate effectiveness against the parasite. 	

Question 22 (continued)

- (e) (i) Using the diagram provided below, explain the relationship between Economic Injury Level (EIL) and Economic Threshold (ET) as it applies to decisions that are made about pest control. (4 marks)

Description	Marks
Explains in detail how EIL and ET are used to plan effective pest control procedures	4
Explains the difference between EIL and ET	3
States the difference between EIL and ET	2
States a fact about the diagram	1
Total	4
<p>Answers could include:</p> <ul style="list-style-type: none"> • During low populations the amount of damage caused by the pest is below the cost of the control method. As that pest population grows, causing more damage it moves past the ET, the point where damage/loss of production has started and control needs to be implemented. If the pest crosses the EIL the cost of control is covered by the reduction in losses. • The ET and EIL can be used when making a pest control decision. If you control a low pest population that was doing minimal damage you will be wasting your money, however the pest population needs to be monitored so that when the pest population does increase it is controlled before it reaches the EIL. 	

- (ii) On the pest population line in the diagram above, show with an 'X' when the control should be implemented. (1 mark)

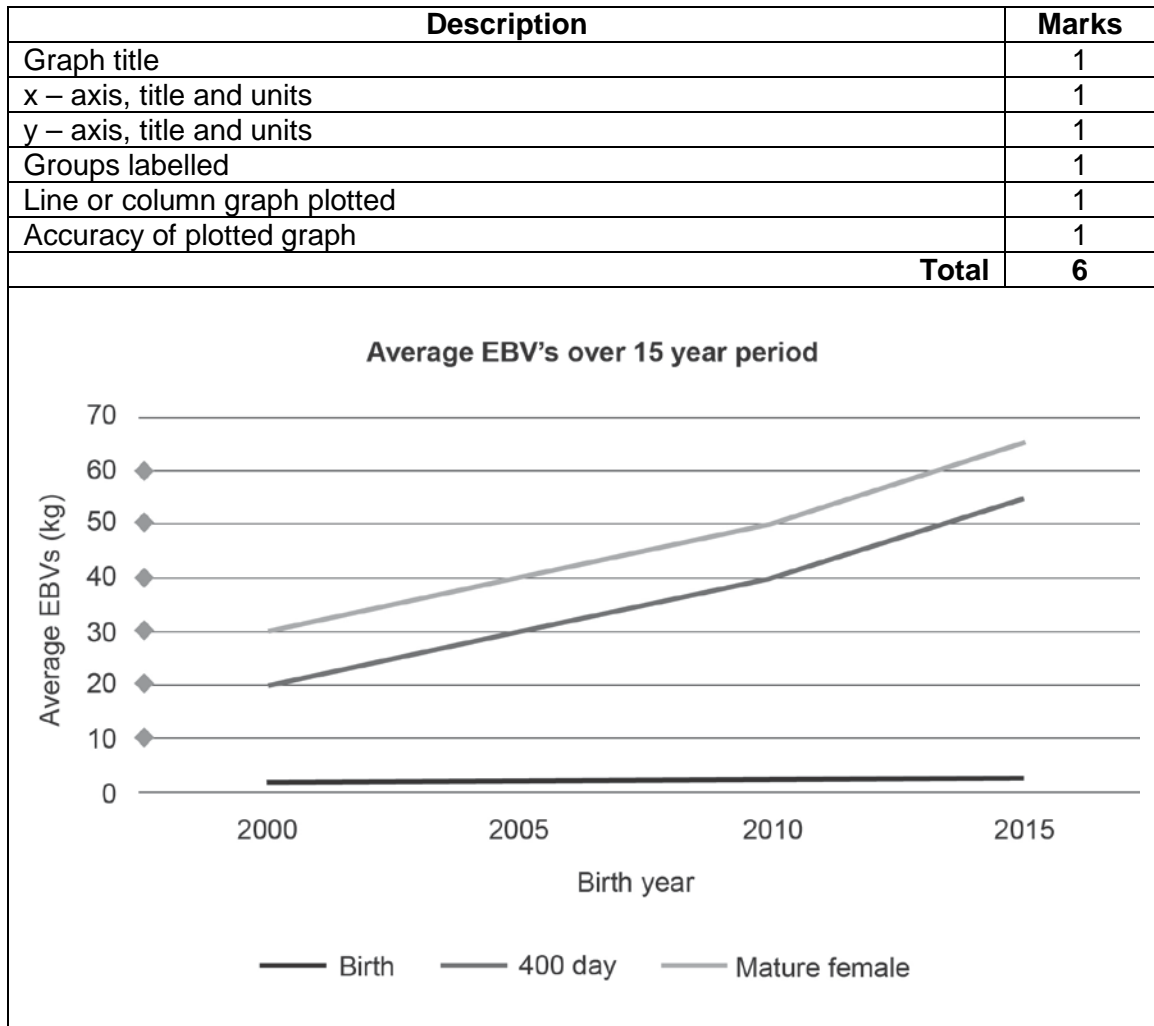
Description	Marks
	1
Total	1

Question 23

(13 marks)

(a) Graph the EBV trends for this breed.

(6 marks)



Question 23 (continued)

- (b) Analyse the EBV trends in part (a) and interpret how they could be utilised by producers. (4 marks)

Description	Marks
Analysis of EBV trends	2
States a fact about EBV trends	1
Interprets how it is utilised by producers	2
States a fact on how it is utilised by producers	1
Total	4
Answers could include: EBV Trends: <ul style="list-style-type: none"> • 400 day and mature female weights are increasing over the 15-year period • birth weights have only increased by +1 kg over the 15-year period Utilised: <ul style="list-style-type: none"> • producers aim is to improve growth rates whilst still ensuring that there isn't a corresponding issue with birthing difficulties • as 400 day weights increase there is a corresponding increase in the mature cow weights. Breeders would need to ensure that their replacement females aren't too heavy – additional feeding costs/demands • breeders need to balance requirement of growth with replacement females and birthing weights as each trait is interlinked and have implications on the production system. 	

- (c) List **one** breeding technology and describe how it can assist in meeting market specifications. (3 marks)

Description	Marks
Lists a breeding technology	1
Describes how breeding technology can assist with meeting market specifications	2
Describes briefly how breeding technology can assist with meeting market specifications	1
Total	3
Answers could include: Breeding technology: <ul style="list-style-type: none"> • artificial insemination, In vitro fertilisation and embryo transfer, gene transfer, sex control, animal identification (DNA and biometric methods), marker assisted selection (MAS), ultrasound Meeting market specifications: <ul style="list-style-type: none"> • identify market specifications and utilise BT to reach these more efficiently, effectively and economically • select desirable trait leaders within breeding program to achieve stated outcomes • increased likelihood of breeding/selecting animals that will perform as predicted ensuring a uniform product that meets market specs when expected • new technologies to improve selection (to increase the rate of genetic change through more efficient selection of sires and replacement females) • animal identification – DNA fingerprinting allows more information to be harvested. In combination with other identification technologies it could increase the amount of data available from commercial animals, most notably for carcass traits • ultrasound provides more information on hard-to-measure carcass traits. This information can assist in ensuring animals meet necessary specifications. 	

Question 24

(12 Marks)

- (a) (i) State an hypothesis for this trial. (2 marks)

Description	Marks
States a valid hypothesis	2
Hypothesis is limited in its statement	1
Total	2
<p>A valid hypothesis must include the relationship between the dependent and independent variables.</p> <p>Answers could include:</p> <ul style="list-style-type: none"> Breeding animals with access to additional pasture and lupin will have an increased ovulation rate. 	

- (ii) Discuss the results of the trial and their importance to a breeding program. (4 marks)

Description	Marks
Discusses results and importance	4
Limited discussion of results and importance	3
Mentions briefly either results or importance	2
Limited understanding of result or importance	1
Total	4
<p>Answers could include:</p> <p>Results:</p> <ul style="list-style-type: none"> increasing access to both pasture or with additional lupins increases ovulation rates in breeding animals additional lupins further boosts ovulation rates. This however plateaus at around 3kg/DM/female/day of pasture allowance. The ovulation rate still remains higher than those females placed solely on pasture allowances those females placed solely on the pasture allowance continue to increase ovulation rates as quantity increases. <p>Importance:</p> <ul style="list-style-type: none"> provides evidence that flushing is beneficial in increasing ovulation rates. This should also potentially improve birthing numbers and enterprise profitability. additional lupin feeding will improve ovulation rates up until a certain level of pasture allowance (3kg/DM/female/day in this trial) where upon there is no additional benefit. This signals that the producer must be aware of the feed availability and quality of pastures before deciding on the economic benefit of additional supplementing of lupins. <p>Accept other relevant answers in relation to cost effectiveness.</p>	

Question 24 (continued)

- (b) Describe the importance of randomisation and replication in ensuring results of this trial are valid. (4 marks)

Description	Marks
For each aspect of experimental design:	
Describes the importance	2
Limited understanding of importance	1
Total	4
Answers could include: Randomisation: <ul style="list-style-type: none"> breeding animals should be distributed randomly and evenly into groups or so placed that results are not impacted by other variables – breed, condition score, weight, age, breeding history, etc. removes bias and therefore more reliable. Replication: <ul style="list-style-type: none"> trial/treatment should be replicated a number of times to avoid atypical responses impacting on results such as environmental conditions allows for increased reliability. 	

- (c) Outline an alternative variable that is linked to ovulation rates and would provide useful data for a breeding program. (2 marks)

Description	Marks
Outlines another variable of investigation useful for a breeding program	2
Limited outline of another variable of investigation	1
Total	2
Answers could include: Further investigation examples <ul style="list-style-type: none"> differences between breeds, ages, bloodlines, etc. on ovulation rates when feeding at different levels correlations between increasing ovulation, birthing rates, difficulties and post birth survival profitability changes as a result of increasing ovulation rates impact of condition score prior to commencing trial. Also implications of female condition scores at higher feeding regimes on birthing complications Type and quantity of grain and/or pasture composition necessary for optimum ovulation results. 	

Question 25

(13 marks)

- (a) Describe how heritability can impact genetic gain? (2 marks)

Description	Marks
Describes in detail how heritability can impact on genetic gain	2
States a fact about how heritability can impact on genetic gain	1
Total	2
Answers could include: <ul style="list-style-type: none"> the higher the heritability the higher the genetic gain provided that it is a productive trait the lower the heritability the lower the genetic gain. 	

- (b) Using the information in the table above

- (i) calculate the genetic gain passed on by the parents. (1 mark)
- (ii) calculate the expected gain based on heritability. (1 mark)
- (iii) calculate the expected gain of the offspring. (1 mark)

Description	Marks
(i) Dam: $1.8 - 1.5 = 0.3$ kg Sire: $2.0 - 1.5 = 0.5$ kg $(0.3 + 0.5)/2 = 0.4$ kg	1
(ii) $0.4 \times 0.45 = 0.18$ kg	1
(iii) $0.18 + 1.5 = 1.68$ kg per head per day	1
Total	3

- (c) State whether the joining of the proposed sire and dam would assist the producer to achieve the breeding goal to improve the daily weight gain of his cattle. Justify your response. (3 marks)

Description	Marks
Yes, the joining would assist the producer in achieving this goal	1
Justifies why the joining would assist the producer in achieving this goal in detail	2
States a reason for why the joining would assist the producer in achieving this goal	1
Total	3
Answers could include, but are not limited to the following: <ul style="list-style-type: none"> the trait selected has high heritability assisting with faster genetic improvement the sire and dams are both superior to the average of the herd and will pass this onto their offspring the offspring has an expected gain of 0.18 kg/hd/day above the herd average. 	

Question 25 (continued)

- (d) (i) Using the EBV provided in the table above, calculate the estimated genetic gain in eye muscle area in the progeny of both bulls. (2 marks)

Description	Marks
Bull A $+8.8/2 = +4.4$	1
Bull B $+9/2 = +4.5$	1
Total	2

- (ii) Based on the information calculated in part (d)(i) and the table, which bull would be the better option for beef production? Justify your response. (3 marks)

Description	Marks
Selects Bull A	1
Justifies the selection of Bull A	2
States a reason for selecting Bull A	1
Total	3
<p>Answers could include, but are not limited to the following:</p> <ul style="list-style-type: none"> • Bull A is the soundest choice as it has an accuracy of 85% • although Bull A has an EBV .1 lower than Bull B, Bull A has an accuracy that is 19% higher. This increases the chances of the progeny from Bull A having a genetic gain of +4.4. 	

Question 26

(16 marks)

- (a) (i) List **two** hormones that are used in an oestrous synchronisation program. (2 marks)

Description	Marks
Lists a hormone that is used in an oestrous synchronisation program	1–2
Total	2
Answers could include, but are not limited to the following: Progesterone Oestrogen Prostaglandin Follicle stimulating hormone (FSH) Luteinising hormone (LH) Testosterone Melatonin	

- (ii) Describe the role of the **two** hormones you listed in part (a)(i) when they are used in an oestrous synchronisation program. (4 marks)

Description	Marks
Two marks for each hormone. Maximum of four marks.	
Describes the role of the hormone in oestrous synchronisation	2
States a fact about the hormone	1
Total	4
Answers could include, but are not limited to the following: Administration of hormones and timing varies depending on the type of oestrous synchronisation program as well as the type of livestock being synchronised. <ul style="list-style-type: none"> • Progesterone – stops the female from coming ‘on heat’/maintains pregnancy until the desired mating period. • Oestrogen – causes an LH surge to initiate ovulation and synchronises follicle growth. • Prostaglandin – brings females into heat and shortens the oestrous cycle, is generally given (injection) just before or after a CIDR is removed – only effective if a corpus luteum is present. Prostaglandin injections can be used for synchronisation without the use of CIDRs. • Follicle stimulating hormone (FSH) – encourages the development of the follicles and is generally administered (injected) when a CIDR is removed. In some animals it increases the ovulation rate. • Luteinising Hormone (LH) – in females with mature follicles, an injection of LH can be used in order to induce ovulation. • Testosterone – is injected into teasers to encourage ‘ram/bull’ like behaviour and encourage 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. 	

Question 26 (continued)

- (b) Describe
- two**
- advantages of an oestrous synchronisation program. (4 marks)

Description	Marks
Two marks for each advantage. Maximum of four marks.	
Describes an advantage of oestrous synchronisation	2
States an advantage of oestrous synchronisation	1
Total	4
Answers could include, but are not limited to the following: <ul style="list-style-type: none"> management – manipulate breeding to suit a calendar of operations, cuts down on heat detection and insemination time, more uniformity for animal husbandry activities to decrease labour, shorter calving and breeding season, assists in record keeping markets – offspring are more uniform which allows turning off of even pens, can control breeding to target a specific seasonal market nutrition – improve nutrition based on gestation stage to minimise costs of excessive feeding and meet the females demand, breeding for suitable feed availability and/or finishing. 	

- (c) Explain
- one**
- artificial method that can be used to manipulate the breeding cycle. (3 marks)

Description	Marks
Explains a detailed method used to manipulate the breeding cycle	3
Describes a method used to manipulate the breeding cycle	2
States a method used to manipulate the breeding cycle	1
Total	3
Answers could include, but are not limited to the following: <ul style="list-style-type: none"> artificial insemination – enables breeding as required (timing) outside of seasons and choice of genetic material supplementary feeding – enables flushing which is increasing ovulation rates and probability of twinning embryo transfer – enables selected genetic material in breeding cycle. melatonin – can be used on sheep that are short day breeders to encourage strong cycling outside of their preferred breeding season CIDR – contains progesterone to synchronize oestrous oestrodial – stimulate onset of oestrous for animals not on heat. 	

- (d) Explain a potential ethical issue associated with an artificial breeding technology. (3 marks)

Description	Marks
Explain a valid ethical issue in detail	3
Outlines a valid ethical issue	2
States a valid ethical issue	1
Total	3
Answers could include, but are not limited to the following: <ul style="list-style-type: none"> artificial insemination and embryo transfer – can be invasive, can cause damage to the animal, stress, embryo mortality, less genetic diversity and some people believe nature should not be interfered with genetic modification – invasive, potential to upset the ecosystem, public perception – not natural, deformities, potential disease spread due to lack of genetic diversity, animal welfare during the trialing phases, undesired traits cloning – animal welfare such as higher producing animals under more strain, low embryo survival rate, placenta and fetal abnormalities, high mortality rate, reduced life span, less ability to adapt to changing environment. 	

Question 27

(10 marks)

- (a) Explain why it is important for producers to have a sound understanding of the digestive systems of livestock. (3 marks)

Description	Marks
Explains the importance in understanding the digestive systems of livestock	3
Describes the importance in understanding the digestive systems of livestock	2
States an importance in understanding the digestive systems of livestock	1
Total	3
Answers could include, but are not limited to the following: <ul style="list-style-type: none"> • allows producers to provide livestock with feeds that are best suited to the type of digestive system they possess • provide feeds that are palatable and digestible • assists in avoiding nutritional diseases and deficiencies • create and alter rations for stock to suit their production needs. 	

- (b) (i) Outline how proteins are utilised by livestock. (2 marks)

Description	Marks
Outlines how the nutrient is utilised	2
States a fact about how the nutrient is utilised	1
Total	2
Answers could include, but are not limited to the following: <ul style="list-style-type: none"> • Animals require protein for growth and repair. Age, condition, size, stress and weather can all have an effect on the amount of protein needed by an animal. • Growing animals have increasing demands for protein. Protein is needed for tissue growth and development. Lack of protein can lead to stunting or bone growth at the expense of muscle. • Older animals need less protein as they have completed the majority of their growth. • Increases in protein are important to ensure good body condition in order to increase conception rates. It also assists with improving ovulation rates and sperm quality. • Pregnancy increases demand to assist in the development of the offspring as well as the increase in demands of the female. • Lactation protein is needed to ensure an adequate milk supply and should be dropped off when it comes time to dry off the female. Lack of protein can lead to reduced lactation and lactation length. • Increase in demands in order to produce meat, milk and wool to ensure the quantity and quality of the product. 	

Question 27 (continued)

- (ii) Outline how carbohydrates are utilised by livestock. (2 marks)

Description	Marks
Outlines how the nutrient is utilised	2
States a fact about how the nutrient is utilised	1
Total	2
<p>Answers could include, but are not limited to the following:</p> <ul style="list-style-type: none"> Animals require carbohydrates for maintenance first then production. Maintenance – age, condition, size, stress and weather can all have an effect on the amount of energy needed by an animal. Animals require energy for movement, body function and to maintain body temperature. Growth – growing animals have increasing demands for energy, energy assists with the use of proteins and fats in the body. If they don't receive adequate energy, growth rates decrease and can lead to weight loss. Older animals require more energy than they do protein for maintenance. Larger animals require more energy for maintenance due to their larger body mass. Joining – energy is important to ensure good body condition in order to increase conception rates. It also assists with improving ovulation rates and sperm quality. Pregnancy – demand increases to assist in the development of the offspring as well as the increase in demands of the female. Energy deficiencies lead to lower conception rates, fewer multiple births and low birth weights. In sheep, energy and protein assist in ensuring good wool follicle development in lambs. Lactation – needed to ensure an adequate milk supply and should be dropped off when it comes time to dry off the female. Lack of energy and protein can lead to reduced milk yields and lactation length. Production – energy is important in order to maintain productivity. If stock don't get enough energy there will be a decrease in milk, wool growth and fibre diameter and meat production. Animals also need adequate energy in order to maintain condition and immunity. Lack of energy can lead to and an increase in mortality rates, susceptibility to parasites and disease. 	

- (c) Explain how microbial and gastric digestive systems differ in their ability to digest proteins. (3 marks)

Description	Marks
Explains the differences between the digestive processes	3
Outlines the differences between the digestive processes	2
States the differences between the digestive processes	1
Total	3
<p>Answers could include, but are not limited to the following:</p> <ul style="list-style-type: none"> microbial digestive systems are able to create microbial protein unlike a gastric system. Microbes create this protein from feed they consume and/or from NPN sources such as urea and ammonia. microbial – proteins are broken up into peptides and amino acids by the micro-organisms (bacteria, protozoa and fungi), these microbes then create microbial protein from the amino acids and also from non-protein nitrogen such as urea and ammonia. Microbes pass from the rumen into the abomasum and small intestine where they are digested and absorbed as microbial protein. gastric – protein digestion takes place in the stomach where pepsin breaks protein down into polypeptides and then the small intestine where trypsin break polypeptides into amino acids which are absorbed into the bloodstream through the small intestine. 	

Section Three: Extended answer

30% (40 Marks)

Question 28

(20 marks)

- (a) Explain the market requirements for your enterprise's marketable product and how these requirements can affect financial returns. (5 marks)

Description	Marks
Explains market requirements	3
Discusses briefly market requirements	2
Limited discussion of market requirements	1
Outlines effect on financial returns	2
Limited understanding of effect on financial returns	1
Total	5

Answers could include:

Market requirements (specific to enterprise product):

- Lamb
 - supermarket lamb – carcass weight 18 to 22, fat scores 2 and 3 with a preference for second cross
 - food service lamb – carcass weight 20 to 25, fat scores 2 and 3 with a preference for lean and high yielding carcasses
 - Haj export – live weight 35 to 41, 6 to 12 month old lambs, entire males with a preference for long tail intact.
- Beef
 - local trade – HSCW 320 to 420, P8 fat depth (mm) 6 to 22, muscle shape A to C, Fat colour score 0 to 3, no bruising
 - EU market – HSCW 300 to 420, P8 Fat depth 7 to 22, muscle shape A to C, Fat colour score 0 to 3, no bruising or HGP, eye muscle area (cm²) > 85.
- Wool
 - requirements based on wool class, mean fibre diameter, vegetable matter content, yield, staple length and strength, position of break
- Seed stock
 - requirements could be based on breed type, age, estimated breeding values, structure, muscling, maturity, bloodlines, growth rate.

General market requirements could include:

- free from chemical residues
- traceability – transfer of animals via NLIS, animal identification (e.g. ear marking, NLIS tag, tattoo, branding, etc.)
- health status – vaccination, disease free
- QA stipulations – access to water, days of feed, approved abattoir.

Impact on financial returns:

- a successful farming enterprise ensures market requirements are constantly achieved to assist in economic sustainability
- producers who consistently achieve high compliance rates in high value markets are able to maximise financial returns
- failure to meet market specifications results in lower dollar returns
- lower returns could be in the form of discounts, penalties, loss of premium, rejection of delivery, excessive trim.

Question 28 (continued)

- (b) Explain how each of the factors below could negatively affect the enterprise's ability to meet the market requirements identified in part (a): (9 marks)
- nutrition
 - handling and transport
 - weather

Description		Marks
For each factor 3 marks. Maximum of 9 marks.		
Explains how the factor negatively affect the enterprise's ability to meet the market requirements		3
Explains how briefly the factor negatively affect the enterprise's ability to meet the market requirements		2
Identifies how the factor negatively affect the enterprise's ability to meet the market requirements		1
Total		9
Answers could include:		
Factor	Possible reasons the factor negatively affects the enterprise's ability to meet the market requirements	
Nutrition	<ul style="list-style-type: none"> • failure to understand the nutritional requirements of animals at different age, weights and/or stages of production, e.g. animals require a balanced ration that supplies all their nutritional requirements to achieve their full growth potential – possibility not meeting market weight/condition score • changes in feed availability or diet can result in severe ramifications in meeting market specifications. If feed consumption reduced will have direct negative impact on an animal's growth and development, reproductive performance and susceptibility to disease. For example, break in wool, acidosis/grain poisoning, reduced growth rates • inadequate availability to sufficient levels of essential nutrients to meet desirable market requirements. For example, low protein and/or energy in the ration, overstocking of pastures, poor management of feeding programs (timing and/or feed availability) • feeding system – lot feeding vs supplementary vs pasture. Influence's fat colour – consumer preference for white vs yellow fat. 	
Handling and transport	<ul style="list-style-type: none"> • poor handling techniques can impact greatly on stress levels thus potentially impacting on the quality of the end product – depletion of muscle glycogen occurs when the animal is exposed to stress. Low glycogen levels increase risk of dark cutting meat and subsequently decreasing eating quality • poor handling facilities subject animals to potential bruising and injury causing carcass damage • mixing of mobs prior to transportation increases potential for dark cutters and/or injury • not adhering to recommended feed curfews prior to transporting, access to water prior whilst in holding yards, time from sale to slaughter all potentially impact on eating quality. 	
Weather	<ul style="list-style-type: none"> • animals subject to environmental stress eat less, have higher mortality rate, can result in carcass downgrading, light body weight, poor colouring and rough skin(poultry), animals grow unevenly, reduced fertility, poor semen quality and female infertility • extremes in weather conditions, e.g. dry periods resulting in subsequent shortages of feed and there for unable to meet the market requirements for product quantity &/or quality. 	

(c) Explain how your nominated enterprise could alter its operation to:

- meet changing circumstances
- improve its efficiency.

(6 marks)

Description	Marks
Explains how nominated enterprise could alter operation to meet changing circumstances	3
Discusses briefly how nominated enterprise could alter operation to meet changing circumstances	2
Identifies how nominated enterprise could alter operation to meet changing circumstances	1
Explains how nominated enterprise could alter operation improves its efficiency	3
Discusses briefly how nominated enterprise could alter operation improves its efficiency	2
Identifies how nominated enterprise could alter operation improves its efficiency	1
Total	6
<p>Answers could include:</p> <p>Meet the requirements of a different market or changing circumstances:</p> <ul style="list-style-type: none"> • a shift from producing 21 micron wool (on average) to 19 micron wool, while holding fleece weight at current levels via Selective breeding program, AI and ET program, stocking rates • targeting the Japanese beef export market in preference to the local domestic market – selection of stock, changing of feeding management, backgrounding of animals prior to feedlotting, meeting market access requirements • more severe weather conditions – awareness of short and longer term weather forecasts to assist in planning for extremes in weather conditions (floods – movement of livestock to higher ground, heat wave – providing sheltered paddocks, access to water) <p>Improve enterprise efficiency:</p> <ul style="list-style-type: none"> • utilise computer hardware/software – record keeping, financial management • adopt advances in farming equipment, techniques, technologies • adopt breeding technologies (ET, AI) to improve genetic gain • satellite technology – ongoing monitoring and reviewing of existing practices • soil and water monitoring equipment – analysis of current status to enable correct decisions (fertiliser, nutrient deficiencies, identify potential toxins). 	

Question 29

(20 marks)

- (a) Explains **two** potential impacts that climate change could have on an animal production system and how this could affect sustainability. (10 marks)

Description	Marks
4 marks for each impact; maximum of 8 marks.	
Explains a potential impact on an animal production system	4
Describes a potential impact on an animal production system	3
Outlines a potential impact on an animal production system	2
States a potential impact on an animal production system	1
One mark for each effect on sustainability	
Total	10
<p>Answers could include, but are not limited to the following:</p> <ul style="list-style-type: none"> • Pests and disease: The migration and increase in the number of pests and diseases into areas in which they are not normally found which can lead to increased outbreaks in animals with little to no immunity. This could result in decreased production and increase the costs of control which could impact a producer's ability to remain sustainable due to increased production costs and decreases in income. • Temperatures: Increases in temperatures could lead to heat stress in livestock, which can also reduce feed intake. Production levels may drop (weight gain, milk yield, wool and conception rates etc.) due to less feed being consumed and heat stress. There could also be an increase in animal welfare issues. This could affect a producer's reputation, market opportunities and potential income, making it harder to remain sustainable. Less pasture availability due to less soil moisture, the growing seasons may be shorter and less fodder available for storage. Could lead to higher supplementary feed costs and lower stocking rates. Increased costs and lower returns per head/hectare can have an impact on a producer's ability to remain sustainable. • Rainfall: Average rainfall decreases and periods of drought also lead to less water for storage. Plant growth can also be severely affected. The timing of rainfall or lack of rainfall can impact on the stages of growth and development in plants, resulting in lower yields and lack of feed availability. Excessive rainfall can also result in damage as it can negatively impact plant growth, soil degradation, feed quality and runoff can pollute drinking water. It can also result in larger pest numbers and disease incidence. Skin, wool and foot problems can increase. In severe cases, livestock can be stranded and cut off from feed becoming a welfare issue. All of these issues can lead to decreases in production and increase livestock mortality. • Each of these factors has the ability to affect sustainability by reducing the overall potential income as well as increasing production costs, reducing carrying capacity, reducing yields and damaging a producer's reputation. • The rise in extreme weather events such as droughts, bushfires, cyclones, thunderstorms, wind, frost and floods can impact on livestock production and health as well as the soil condition, water storage, plant growth, plant yields, pest and disease occurrence and property infrastructure. 	

- (b) In planning for sustainability, explain the short-term and long-term strategies that animal producers could implement in their production systems in order to respond to the impacts of climate change. (10 marks)

Description	Marks
Explains the short-term strategies that could be implemented	4
Describes the short-term strategies that could be implemented	3
Outlines a short-term strategy that could be implemented	2
States a potential short-term strategy that could be implemented	1
Explains the long-term strategies that could be implemented	4
Describes the long-term strategies that could be implemented	3
Outlines a long-term strategy that could be implemented	2
States a potential long-term strategy that could be implemented	1
One mark for sustainability for a short-term strategy and one mark for sustainability for a long-term strategy. Maximum of two marks.	1–2
Total	10
<p>Answers could include, but are not limited to the following:</p> <p>Short term</p> <p>Pests and diseases: Monitoring and managing of pests and diseases to prevent outbreaks. Increase in biosecurity measures to prevent outbreaks and contraction. Regular vaccinations, WEC and treatment/prevention plans.</p> <p>Temperatures: Adjust the timing of certain husbandry operations to suit weather and minimise stress. Provide adequate shade and cooling systems for intensive production systems. Ensure an adequate water supply is available for livestock. Manage animal condition to prepare them for extreme weather occurrences.</p> <p>Rainfall: Reduce water usage (technologies and plant species could assist with this). Select shorter growing season pasture species and ensure appropriate management of available feed. Store supplementary feed in case available feed is not adequate. Establish perennial pastures rather than annual pastures, select varieties that are drought/frost tolerant.</p> <p>Long term</p> <p>Pests and diseases: Genetic modification could assist with producing pest and disease resistant in plants used for animal feeds and potentially for animal resistance. Selective breeding for parasite resistance or using breeds with natural resistance could also be beneficial. Integrated pest management programs may need to adapt to meet the changes, biological controls may play a key role.</p> <p>Temperatures: Development and use of new breeds of animals and pasture/plant species suited to the changing conditions – heat tolerance. Plant trees to create shelter belts and shade.</p> <p>Rainfall: Improve or invest in water storage catchments to make better use of available water and to ensure adequate supplies for drier times of the year. Implement strategies to minimise water evaporation from catchments/dams.</p>	

Question 30

(20 marks)

- (a) Select **one** Australian animal export and state its major market. Explain the strategies Australia has in place to maintain this market at the international, national and farm levels. (11 marks)

Description	Marks
Animal export	1
Its major export market destination	1
For each strategy. Maximum 1 strategy per international, national and farm for 9 marks.	
Explanation of how the strategy helps to maintain the market	3
Describes briefly how the strategy helps to maintain the market	2
Identifies a strategy related to the appropriate level	1
Total	11
<p>Answers could include:</p> <ul style="list-style-type: none"> • Wool – China • Beef – Japan • Lamb – USA <p>Strategies could include:</p> <p>International – AWI developing and implementing marketing campaigns in fashion, to build demand in consumer demand for merino wool and wool blend products. Promoting Australian products as 'clean, green', supported by strict import/export laws, comprehensive checks by AQIS at all ports and airports.</p> <p>National – AWEX standards applied to all woolclips by accredited woolclassers. Wool description is standardized. Ongoing wool classer, shedhand and shearer training to maximize the wool harvest. NLIS traceability system for cattle and sheep, product testing to maintain clean, healthy status.</p> <p>Farm – woolgrowers using effective sheep husbandry and nutrition guides to produce high quality wool. Shearing sheds maintained and kept clear of potential contaminants. On farm biosecurity and use of QA programs that provide a set of standards to maintain buyer confidence.</p> <p>Any other relevant answer for beef/lamb or any other exports.</p>	

- (b) Identify a market in which Australia has a comparative advantage for an animal product and explain why this exists. Discuss the advantages and disadvantages of introducing tariffs to protect this market. (9 marks)

Description	Marks
Identifies a market where comparative advantage exists and explains in detail reasons	3
Identifies a market where comparative advantage exists and briefly explains the reasons	2
Identifies a market where comparative advantage exists	1
Advantages of tariffs	
Detailed discussion of more than two advantages for tariffs	3
Brief discussion that includes two advantages for tariffs	2
States an advantage of a tariff	1
Disadvantages of tariffs	
Detailed discussion of more than two disadvantages for tariffs	3
Brief discussion that includes two disadvantages for tariffs	2
States a disadvantage of a tariff	1
Total	9
<p>Answers could include:</p> <ul style="list-style-type: none"> comparative advantage of natural resources, climate, market proximity, in livestock production with the middle-class Asian consumers Indonesian beef trade: because Australia has comparative advantage due to space/resources, market proximity and large breeding herds wool to China: because Australia has a wool growing environment with large high quality pure bred flocks to make high quality garments live sheep export to Middle East: Australia has high quality sheep flock and grazing capacity. <p>Advantages of tariffs –</p> <ul style="list-style-type: none"> protects domestic producers from overseas competition offering cheaper goods. Competitors generally withdraw their product because they can't compete, thus reducing competition protects new industries while they establish themselves increased government tax revenue reduces the balance of trade/balance of payments for imported goods encourages employment opportunities. <p>Disadvantages of tariffs –</p> <ul style="list-style-type: none"> lack of competition reduces an incentive from local producers to keep their costs, thus their price down has a negative impact on trade balance and could also lead to reciprocal tariffs, thus raising the price of imported goods decrease in product quality due to lack of market competition discourage competition. 	

ACKNOWLEDGEMENTS

- Question 22(e)(ii)** Graph adapted from: Barbercheck, M. E., & Zaborski, E. (2011). *Insect pest management: Differences between conventional and organic farming systems* (Fig. 1). Retrieved July, 2017, from www.extension.org/pages/19915/insect-pest-management:-differences-between-conventional-and-organic-farming-systems#.VWVleU3vrcs
Figure credit: Ed Zaborski, University of Illinois.
- Question 23(c)** Bourdon, R. (1999). Cattle breeding technologies in perspective: Animal identification DNA fingerprinting. *Beef Magazine*. Retrieved October, 2017, from www.beefmagazine.com/mag/beef_cattle_breeding_technologies

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