Government of **Western Australia**
School Curriculum and Standards Authority

ANIMAL PRODUCTION SYSTEMS

ATAR course examination 2016

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.

2016/64731

Section One: Multiple-choice **20% (20 Marks)**

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

Section Two: Short answer **50% (92 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 **(22 marks)**

(a) (i) Complete the table for the breeding (oestrus) cycle of an animal you have studied. (2 marks)

Description	Marks
No marks for animal	0
Correct length of breeding cycle (within range)	1
Correct duration of oestrus (within range)	1
Total	**2**

Answers could include, but are not limited to the following:

Animal	Length of breeding (oestrus) cycle – days	Duration of oestrus (standing heat) – hours
cow	19 – 23	12 – 24
ewe	14 – 19	18 – 48
sow	19 – 23	48 – 96

(ii) Describe the role of **two** hormones involved in the breeding cycle. (4 marks)

Description	Marks
Two marks for each hormone. Maximum four marks.	
List hormone	1
Describes role in breeding cycle	1
Total	**4**

Answers could include, but are not limited to the following:

Hormone	Role in the breeding cycle
Follicle Stimulating Hormone (F.S.H.)	stimulates the follicle to develop
luteinising hormone (L.H.)	converts the empty follicle into the corpus luteum and stimulates it to produce progesterone. Initiates ovulation. Influences the development of the corpus luteum
Oestrogen	Stimulates the mammary glands to develop. Prepares the lining of the uterus to receive a fertilised egg.
Progesterone	Prepares the lining of the uterus for the fertilised ovum and readies the mammary glands for milk production

Question 21(a) (continued)

(iii) Explain how the breeding cycle can be manipulated to meet a given breeding goal. (3 marks)

Description	Marks
States breeding goal	1
Explains clearly the manipulation of the breeding cycle	2
Outlines the manipulation of breeding cycle	1
Total	**3**

Answers could include, but are not limited to the following:

Breeding goal:
- group females for parturition – reduce birthing intervals, more uniform weaning weights
- synchronisation of female ovulation for artificial insemination program
- hormonal induction of ovulation for an embryo transfer program
- increase fertility levels of breeding animals
- increased conception rates

Manipulation:
- nutritional management – raising plane of nutrition prior to mating, introduce a high quality feed supplement
- sudden introduction of male – isolated females can be stimulated to start ovulation by sudden introduction of males. This can occur through the use of teaser males
- artificial synchronisation of oestrus through products containing prostaglandins, progestin's and gonadotropin.

(b) (i) Explain why a producer might use artificial insemination in preference to a natural breeding program. (3 marks)

Description	Marks
Explains clearly a valid reason	3
Outlines a valid reason	2
States briefly some information about AI	1
Total	**3**

Answers could include, but are not limited to the following:

Reason for using AI *vs* natural breeding:

- a tool that allows access to sires of high 'genetic merit' that are not readily available or too expensive to purchase
- allows a sire to be used over large numbers of females compared to natural service
- crossbreeding programs can utilise AI for additional hybrid vigour or in the production of replacement females in a terminal sire program
- for the breeding of replacement heifers with superior genetics – AI use sires can be selected specifically for maternal traits such as milk production, calving ease, birth weight, docility, and others to provide maternal improvement
- reduce the number of males required in the breeding system – decrease management issues + feed costs
- by regular examination of semen after collection and frequent checking on fertility make early detection of interior males and better breeding efficiency is ensured
- it prevents the spread of certain diseases and sterility due to genital diseases, e.g. contagious abortion, vibriosis
- the semen of a desired size can be used even after the death of that particular sire Improve genetic productivity of the enterprise
- rapid genetic gain
- improve certain trait/s within breeding animals.

Question 21(b) (continued)

(ii) Describe **two** management practices that affect the success rate of an artificial insemination program. (4 marks)

Description	Marks
Two marks for each management practice. Maximum four marks.	
Describes clearly the management practice to AI success	2
States briefly the management practice to AI success	1
Total	**4**

Answers could include, but are not limited to the following:

- nutritional management – ensure females are in correct condition score – ewes score 2–3 for mating, good nutrition is essential for at least six weeks before and after an AI program
- husbandry – ensure no physical operations occur in the six weeks leading up to AI
- animal health – worm and parasite control implemented well before AI, vaccination against infectious diseases that affect pregnancy and calving/lambing rates must be implemented
- all artificial insemination operations performed in clean, dust free area to reduce risk of infection
- accurate and early detection of oestrus/heat detection is essential – use of heat patches, vasectomised rams (teasers) wearing harnesses with marking crayons
- clear identification of individual animals, record keeping, visual observations for signs of heat and, where necessary, the use of heat detection aids are all critical factors in an AI program
- management of oestrus synchronisation – correct timing and application of polyurethane sponge, or controlled internal drug-releaser (CIDR)
- after insemination management – quietly move the females to a holding paddock close to the shed and away from daily traffic and disturbance by dogs
- avoid unnecessary disturbance and stress for 10–14 days over the critical period of embryo implantation
- semen – have semen sourced from a reputable centre meeting national guidelines and quality control.

(c) (i) Discuss a potential benefit from the use of genetically-modified organisms (GMOs) within the animal production industry. (3 marks)

Description	Marks
Discusses clearly a potential benefit	3
Outlines a potential benefit	2
States briefly some information about GMO's	1
Total	**3**

Answers could include, but are not limited to the following:

- the desired genotype can be created instantly in the current generation whereas Traditional breeding can be very slow because it might take several generations before the desired trait is sufficiently brought out and the offspring must reach sexual maturity before they can be bred
- animals could be engendered to improve productivity – require less food, grow quicker, and leave behind less environmentally damaging waste, to provide leaner meat, and to make more milk, reproduce much faster, resistant to pest/diseases
- GMO technology has the potential to be more predictable that traditional breeding – instead of the random transfer of genes to offspring gene marking will allow discrete genes or blocks of genes with desired traits to be transferred.

(ii) Discuss a potential issue with the use of GMOs. (3 marks)

Description	Marks
Discusses clearly a valid issue	3
Outlines a valid issue	2
States briefly some information about a valid issue	1
Total	**3**

Answers could include, but are not limited to the following:

- many believe the alteration of genes through inserting genetic material into an organism in a laboratory, bypassing the natural mating process is unethical
- consumer perception that the regulation of GM animals have a potential to cause health related issues if eaten
- concern with the experimental/research process involved in 'fine tuning' the GM process
- potential for GMO animals/plants to interbreed with wild populations creating issues such as ecosystem imbalances, offspring with dangerous traits.

Question 22 (16 marks)

(a) Write an hypothesis for this trial. (2 marks)

Description	Marks
Hypothesis correctly stated as a prediction between two variables	2
Statement made about trial animals and GP	1
Total	**2**

Answers could include, but are not limited to the following:

- animals treated with the GP will on average gain more weight than the control group
- animals treated with GP will not experience an increased weight gain.

(b) (i) Describe an aspect of experimental design that might have influenced the results of this trial. (2 marks)

Description	Marks
Describes clearly a valid aspect	2
States briefly a valid aspect	1
Total	**2**

Answers could include, but are not limited to the following:

- randomisation – animals should be distributed randomly and evenly into groups or so placed that results are not impacted by other variables – breed, starting weight, temperament
- replication – trial/treatment should be replicated a number of times to avoid atypical responses impacting on results such as environmental conditions
- standardising conditions – animals in each group must be exposed to the same conditions except the treatment – pasture feed, husbandry treatment, handling, general management practices
- data recording – animal weight gain/loss data collected in manner that eliminates possibility of incorrect data collection – electronic recording, equipment calibration
- scale of trial – should be sufficient animal numbers in each group to ensure results are valid. Minimum recommended number/group is 15.

(ii) Outline a 'duty of care' obligation that the producer would have toward the farm employees involved in this trial. (2 marks)

Description	Marks
Outlines a 'duty of care' obligation	2
States briefly some information about 'duty of care'	1
Total	**2**

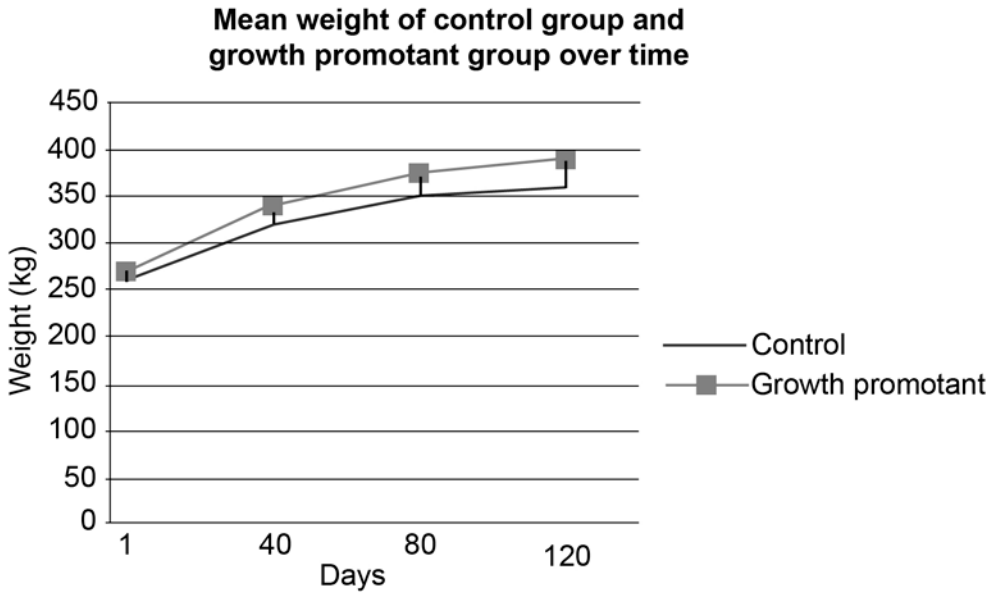
Answers could include, but are not limited to the following:

- ensure all facilities are well maintained – ongoing safety checks, maintenance
- all workers are appropriately inducted and trained in the required tasks
- workers have access and use necessary PPE.

(c) (i) Graph the mean weights collected for the animals in the Control group and Growth promotant group over the period of the trial. (5 marks)

Description	Marks
Graph title	1
x – axis, title and units	1
y – axis, title and units	1
Control group labelled and plotted as a line graph	1
GP group labelled and plotted as a line graph	1
Total	**5**

Answers could include, but are not limited to the following:



(ii) Provide evidence from your data analysis that either supports or rejects your hypothesis in part (a). (2 marks)

Description	Marks
Provides relevant data that supports/rejects hypotheses	1
States if evidence supports/rejects hypothesis	1
Total	**2**

Answers could include, but are not limited to the following:

- GP group had a higher growth rate throughout the trial – total average +20 kg/animal.

Question 22 (continued)

(d) List a feed additive commonly used in animal production systems and outline how it can improve production. (3 marks)

Description	Marks
Lists a feed additive	1
Outlines clearly how the feed additive improves production	2
States briefly some information about how the feed additive improves production	1
Total	**3**

Answers could include, but are not limited to the following:

- antibiotics: disease prevention
- coccidiostats: control parasites
- Xanthophyll: makes egg yolks yellow
- yeast, fungi, direct fed microbials
- buffers: HCO_3, etc., prevent rumen acidosis
- antioxidants: prevents feed from getting rancid
- flavoring agents: makes feed taste better – improves feed intake
- mineral/vitamin supplements – assist in balancing rations, feed utilisation, digestion
- urea/molasses – protein supplement increase pasture intake.

Question 23 **(15 marks)**

(a) (i) Use the information above to calculate: (4 marks)

- Gross margins **A**
- Gross margins **B**
- Gross margin/hectare **C**
- Gross margin/hectare **D**

Description	Marks
A = $90 000	1
B = $140 750	1
C = $90/ha	1
D = $148/ha	1
Total	**4**

(ii) Discuss a reason for the differences in enterprise gross margins in part (a)(i). (3 marks)

Description	Marks
Identifies a valid reason	1
Discusses clearly a valid reason	2
States briefly a valid reason	1
Total	**3**

Answers could include, but are not limited to the following:

Difference in GM of top 20% producers contributed to
- higher income from sales (+$5/hd)
- better stocking rates (+ 2 DSE) better utilisation of pasture (less supplementary costs)
- higher enterprise gross margin returns (Total + $50/ha)
- slightly smaller farming area (-500 ha) but more profitable/efficient

Reason differences in profit as top 20% of operators:
- optimise production whilst producing it at a lower cost
- have higher stocking rates as well as spending less on supplementary feeding – implies better pasture management/utilisation
- also higher stocking rate with better per hectare production (sale weight and price) with more spent on pastures but less per head on supplementary feeding – 'better management'
- management system linked to livestock demands – aligns with pasture growth curve to optimise pasture utilisation
- optimise sale returns through meeting market specification for premium returns – condition score and weight
- ensure genetics, animal health and flock structure to coincide with optimal returns.

Question 23 (continued)

(b) Describe a short-term strategy and a long-term strategy a producer could implement to improve the financial performance of an enterprise. (4 marks)

Description	Marks
Two marks for each strategy. Maximum four marks.	
Describes clearly a valid strategy	2
States briefly a valid strategy	1
Total	**4**

Answers could include, but are not limited to the following:

Short-term strategies:

- identify areas of inefficiency/productivity shortfalls
- benchmark performance against other producers
- compare enterprise budget with actual results and re-evaluate where necessary
- implement enterprise plan for productivity improvements – explore options through possibility either altering enterprise focus or mix, investment in infrastructure/new technologies / genetic improvements, etc.
- focus on improving management capabilities – technical assistance, further training, investigate current research, keep up to date current trends, market reports, issues, etc.
- improve financial management of enterprise – professional assistance/ training
- identify performance drivers and implement changes to present husbandry and business management processes and practices that will improve enterprise financial results

Long-term strategies:

- restructuring of enterprise – capital investment in infrastructure/new technologies
- implement plans for productivity gains – soil improvement, improved pastures, meeting market specifications
- implement recommended improvements in enterprise practices – breeding systems, genetics, nutrition, animal health, etc.
- conduct and analyse market research – identify long term international market trends.

(c) State a source of market information and explain its importance in the management of an enterprise. (4 marks)

Description	Marks
States a source	1
Explains clearly the importance of the source	3
Outlines the importance of the source	2
States briefly some information about the source	1
Total	**4**

Answers could include, but are not limited to the following:

Source market information:
Current market information – fulfils the immediate commercial needs of producers/ traders
Historical market information – useful planning tool for producers/policy makers

- market sales reports – historical/current
- product feedback reports
- price schedules/market specifications
- market forecasts
- market research data/analysis
- technical advisers/consultants

Importance in the management of an enterprise:

- efficient market information has positive benefits to producers, traders and policy makers
- market price signals send important feedback from consumes to producers on quantities and quality required. Supply and demand principles
- ready access to immediate and accurate information on prices and quantities required is critical in reducing the risk of financial loss on a market transaction – selling in the correct market place and/or at the market price
- information on prices over a longer period (i.e. season) can enable producers to contemplate viability of suppling to market when there is a shortfall in production (e.g. feedlotting)
- availability of information on market conditions within the marketing chain can assist in maximising returns. This information could allow for the analysing of returns and costs associated with different selling options – farm gate, saleyard, consignment to wholesaler, directly to retailers and/or consumers
- accurate and immediate market knowledge often implies market power.

Question 24 **(15 marks)**

(a) Define metabolism and outline its importance in the digestive process. (4 marks)

Description	Marks
Defines metabolism clearly	2
States briefly some information about metabolism	1
Outlines clearly the importance of metabolism	2
States briefly some information about the importance of metabolism	1
Total	**4**

Answers could include, but are not limited to the following:

Metabolism refers to the changes that the absorbed products of digestion (nutrients) undergo during their utilisation by the body. It is the process that makes energy available for cellular processes.

Importance:

- all animals require energy to grow and reproduce, maintain body structures and to adapt to their environment
- nutrients may be degraded by tissues of the body to obtain energy to maintain vital functions, and to accomplish work (eating, walking, ruminating, etc.). Nutrients also may be used as precursors for the synthesis of tissues (muscle, fat) and in the case of a dairy cows the synthesis of milk.

(b) Describe **two** benefits of a microbial system in the digestion of feed. (4 marks)

Description	Marks
Two marks for each benefit. Maximum four marks.	
Describes clearly a valid benefit	2
States briefly a valid benefit	1
Total	**4**

Answers could include, but are not limited to the following:

- microbial system can utilise a greater variety of food sources. The microbes in the rumen and reticulum allow ruminants to metabolise fibrous feed and non-protein nitrogen (ammonia, urea).
- microbial system can utilise both forages (low energy feed) and concentrates (usually high energy feed digested feed for further breakdown)
- gastric systems need pre-formed amino acids in their diets
- microbial system can utilise many other nitrogen sources because they are able to synthesize amino acids and protein from non-protein nitrogen sources
- in the microbial system when a diet is low in nitrogen, large amounts of urea returns to the rumen where it can be used by the microbes. In non-ruminants, urea is lost in the urine
- microbial systems can breakdown feeds high in cellulose through fermentation process.

(c) Discuss how a sudden change in protein levels in a ration affects the microbial system. (3 marks)

Description	Marks
Discusses clearly the impact on the microbial system	3
Outlines the impact on the microbial system	2
States briefly some information about the microbial system	1
Total	**3**

Answers could include, but are not limited to the following:

Sudden diet changes:
- impacts on the microbial balance of rumen
- lactic acid fermenters are slow growing
- can't keep up so pH is not restored
- low pH kills microbes
- animal often dies of lactic acidosis/grain poisoning/bloat
- loss of production as microbes adjust to new diet
- impacts on the lining of the rumen impacting on efficiency of feed digestion/ absorption.

(d) Describe **two** strategies for managing animal feed requirements to meet market specifications. (4 marks)

Description	Marks
Two marks for each strategy. Maximum four marks.	
Describes a strategy for managing feed requirements	2
States briefly a strategy for managing feed requirements	1
Total	**4**

Answers could include, but are not limited to the following:

Initial introduction:
- gradual introduction of animals to ration to avoid acidosis
- ensure animals have access to roughage as well as high protein diet
- when feeding grain ensure a good quality source of hay or silage is always available and that it makes up at least 20% of the ration (unless feeding a complete ration where the roughage and grain are mixed)
- monitor your herd or flock for signs of scouring, depression, lethargy and lameness, which will indicate that the amount of grain being fed is being increased too fast
- buffer*s* added to the diet that help to maintain a stable rumen, and promote feed digestion and bacterial growth
- check pulpy kidney vaccinations are up to date and vaccinate if necessary before grain feeding
- have animals at correct weight and condition score before commencing high protein ration. Usually aim to finish cattle within 90 days on feedlot
- feed analysis to ensure protein levels of ration are within the necessary boundaries for the class of animal being finished.

Question 25 **(12 marks)**

(a) (i) Justify the selection of the animal you believe best meets the producer's breeding goal. (3 marks)

Description	Marks
Selects animal L1	1
Justifies clearly the selection of L1	2
States briefly some information about the selection of L1	1
Total	**3**

Answers could include, but are not limited to the following:

Reason for selecting L1:
- significant difference in birth weight BV (+6 difference) suggesting high risk of birthing issues if using animal L2
- significant difference in milk BV (+7 difference) would suit replacement female breeders by improving maternal traits
- has same estimated weight gain BV but difference in other two breeding values mean this is the best choice.

(ii) Calculate the increase in profit of the selected animal based on a liveweight market price of $3.30 per kilogram. Show **all** workings. (2 marks)

Description	Marks
BV Est weight gain = +30 kg +30/2 = 15 kg weight gain	1
Extra income: 15 kg x $3.30/kg = $49.50/animal	1
Total	**2**

(b) (i) Name a breeding goal and state **two** ways in which a producer could assess progress toward it. (3 marks)

Description	Marks
Names a breeding goal	1
One mark for each assessment. Maximum of two marks.	1–2
Total	**3**

Answers could include, but are not limited to the following:

Breeding goal:
- decrease spread between offspring
- change age and weight at first mating
- interval between offspring (calving/lambing)
- age and weight at first mating
- increase marking %
- increase conception rates (AI success rate, ET program, natural mating)

Assess progress by:
- financial analysis/comparisons – benchmarking production within district/ industry. Return per breeding animal
- production records – improvements in performance
- improvement in progeny breeding values.

(ii) Describe **two** management practices that may have a negative impact on the progress towards a breeding goal. (4 marks)

Description	Marks
Two marks for each management practice. Maximum four marks.	
Describes a valid negative impact	2
States briefly some information about a negative impact	1
Total	**4**

Answers could include, but are not limited to the following:

- herd health – buying from non-reputable sources, no vaccination program
- nutritional management – no correct feeding regimes for males and females through production system, not maintaining correct condition score, no raising plain of nutrition leading up to mating, poor pasture
- genetic principles – not selecting appropriate traits to meet breeding goals, heritability of chosen traits
- not aligning breeding goals to meeting market specifications – no market awareness, not selecting traits that assist in meeting specified targets.

Question 26 (12 marks)

(a) (i) Outline how the evidence in the above graph either supports or disproves the belief that climate change is occurring in Australia. (2 marks)

Description	Marks
States that the evidence supports/disproves climate change	1
Indicates how data supports/disproves belief.	1
Total	**2**

Answers could include, but are not limited to the following:

Evidence supports climate change, graph indicates:

- Australia's climate has warmed from 1910–2010. Clearly indicated by the temperature increasing trend over this period
- increase in temperature has been especially prevalent from the 1950's onwards.

(ii) Outline what scientists believe is a cause of climate change. (2 marks)

Description	Marks
Outlines the cause of climate change	2
States briefly some information about climate change	1
Total	**2**

Answers could include, but are not limited to the following:

- the increase of the greenhouse effect (warming) is a result of the atmosphere trapping heat radiated from the Earth toward space. Certain gases such as carbon dioxide, methane, nitrous oxide block heat from escaping
- burning of fossil fuels for energy producing CO_2 – a main greenhouse gas
- deforestation – burning of vegetation converts stored carbon back to CO_2
- methane production via the process of fermentation in rumen animals and effluent management
- nitrous oxide production – dung, urine, fertiliser application.

(iii) Describe **two** impacts on animal production systems that might result from climate change. (4 marks)

Description	Marks
Two marks for each impact. Maximum four marks.	
Describes the impact to animal production systems	2
States briefly the impact to animal production systems	1
Total	**4**

Answers could include, but are not limited to the following:

- higher temperatures can cause heat stress in livestock – negative impact on production, animal welfare issues
- extended dry periods/drought – feed and water shortages, animal health welfare issues, supplementary feeding, interruptions to production cycle
- probable faster adaptation of disease pathogens to the warmer environment and more efficient and larger populations of pest insects – loss of production, increasing cost of control
- extremes in weather conditions (heat waves, frosts, droughts, floods) impacting on pastures and timing of farming operations
- changing weather patterns as a direct result of changing sea temperatures
- loss of biodiversity – possible population increase in pests/weeds, greater reliance on chemical control measures.

(b) Outline both a short-term strategy and a long-term strategy to manage an impact identified in part (a)(iii). (4 marks)

Description	Marks
Two marks for each strategy. Maximum four marks.	
Outlines a valid strategy	2
States briefly a valid strategy	1
Total	**4**

Answers could include, but are not limited to the following:

Short-term strategies:

- adopt animal management practices that limit the impact of heat stress – low stress handling techniques, stock access to water and shade, shelter over yards, cooling systems in intensive production systems techniques
- develop plans for short term financial sustainability whilst also ensuring sufficient funds allocated to improving resources to address climate changes
- seek professional assistance/advice on dealing with impacts – government agencies, farm advisors, company technical advisors
- implement a relevant supplementary feeding program

Long-term strategies

- genetic selection for more heat tolerant breeds/pasture plant varieties – more emphasis placed on animals/plants ability to perform at higher temperatures.
- improve water resource management – increase water catchment/storage, improve irrigation efficiency, sow pasture water tolerant species
- improved fodder conservation strategies – feed deficiencies during season likely to be more frequent. Greater emphasis on purchasing feed and/or fodder conservation will become an important farm management requirement
- implement planning for resources development to address climate changes – planting shelter belts, improving water storage (dams, soaks, bores, etc.)

Section Three: Extended answer **30% (40 Marks)**

Question 27 **(20 marks)**

This compulsory question must refer to **one** animal enterprise you studied during the year.

Animal enterprise: _____ (No marks allocated)

Marketable product: _____ (No marks allocated)

(a) Name a quality assurance program relevant to your enterprise. Describe, using **two** examples, how this program assists in meeting market expectations (5 marks)

Description	Marks
Names a QA program	1
Two marks for each example. Maximum four marks.	
Describes how the QA program assists in meeting market expectations	2
States briefly some information about the QA program and basically relates these to market expectations	1
Total	**5**

Answers could include, but are not limited to the following:

QA programs:
- Meat Standards Australia (MSA)
- Livestock Production Assurance (LPA)
- Cattlecare
- Egg Corp Assured (ECA)
- Australian Pork Industry Quality Assurance Program (APIQ)

Compliance	Market expectations
Recording of chemical use (type, application rates	Food safety – free from chemical residual
Adherence to chemical withholding periods	Food safety – free from chemical residual
Livestock traceability – NLIS tags, NVDs	Food safety – disease free status
Animal handling – low stress	Food quality – influences eating quality
Animal transport – number hours off feed and water, hours from yards to slaughter	Food quality – influences eating quality
Quarantine and biosecurity	Food safety – disease free status
Third party auditors QA compliance	Consumer confidence
Animal Welfare – animal stocking rates, housing	Consumer expectations
Nutrition – feeding regime	All of above

(b) Name a new technology and explain how it could be used to improve your enterprise's production performance. List **two** factors that determine its effectiveness. (6 marks)

Description	Marks
Lists a new technology	1
Explains clearly how technology maximises production	3
Outlines how technology maximises production	2
States briefly some information about how technology maximises production	1
Lists two factors that determine effectiveness	2
States one factor that determines effectiveness	1
Total	**6**

Answers could include, but are not limited to the following:

New technology	How the new technology improves production performance
Laptops, internet capabilities, tablets, smartphones, GPS, high resolution cameras, communication capabilities, etc.	immediate access to information/ knowledge to assist with decision making process
Electronic productivity monitoring	Identification of higher performing animals, assists in breeding management – selection/culling
Electronic weighing/drafting	Easier identification/management of animals to meet market specifications
Electronic identification	Allows for easier traceability, compliance with NLIS, coincides with productivity monitoring
Breeding technologies – embryo transfer, AI, gene marking	Improvement in genetic gain
Satellite technology – pastures from space	Improvements in pasture management leading to increased pasture utilisation.
Precision farming techniques	Decrease in amount of wastage of resources – less overspraying of pastures.

Factors determining effectiveness:

- technical skills of producer thus influencing ability to utilise technology. Influenced by access to suitable training, age dynamics, technical support, etc.
- reliability of technology – internet availability and speed a concern in many rural areas
- additional cost associated with technology *vs* traditional methods, i.e. ET program *vs* natural mating.

Question 27 (continued)

(c) Discuss how your enterprise management practices consider these sustainability requirements:

- social
- economic
- environmental. (9 marks)

Description	Marks
Three marks for each sustainability criteria. Maximum nine marks.	
Discusses clearly how management practice meets sustainability criteria	3
Outlines how management practice meets sustainability criteria	2
States briefly some information about how management practice meets sustainability criteria	1
Total	**9**

Answers could include, but are not limited to the following:

Social:
- adhering to OHS requirements – safety induction, workplace training, system of hazard identification and risk assessment, established workplace protocols/policies
- developing good community relationships – education activities, sharing of facilities, involvement in fundraising activities, neighborhood watch
- meeting social responsibilities – stewardship of land, adopting practices that minimise long term impact on natural resources, food safety requirements (WHP), legal responsibilities (infectious disease reporting, NLIS, land clearing)

Economic:
- farm planning – profitability analysis of enterprises, gross margin budgeting – predicting prices, quantities produced and variable costs, establishing short and long term goals, ongoing monitoring of financial performance
- efficient use of resources – management practices, conflicting outcomes between education goals *vs* maximizing enterprise profit
- researching and meeting market requirements – breed selection, nutritional and health management, breeding program
- adopting best practice in all aspect of production – animal handling, health management, housing

Environmental:
- fencing of remnant vegetation to protect from grazing pressure
- planting of trees in laneways, shelter belts assists in decreasing land degradation issues and providing shelter for livestock
- application, storage and disposal of chemicals ensuring no contamination of natural resources
- management practices implemented that ensure soil not exposed to erosion – stocking rates, farm layout, fencing to contours
- management of animal waste – runoff from feedlots doesn't enter waterways, fly control
- pest control practices – feral animal control measures.

Question 28 (20 marks)

The reliance on chemicals and the issue of pesticide resistance are major concerns for the livestock industry.

(a) Explain:

- how pesticide resistance occurs and outline **two** management strategies that can be implemented to avoid this issue.
- the economic principles of controlling pest populations and how they can be applied. (10 marks)

(b) Compare the effectiveness of **two** different pest control methods. For **one** control method, outline its potential impact on a natural ecosystem. (10 marks)

(a)

- **pest resistance**

Description	Marks
Explains comprehensively how pesticide resistance occurs	3
Outlines clearly how pesticide resistance occurs	2
States briefly some information about pesticide resistance	1
One mark per management strategy. Maximum two marks.	1–2
Total	**5**

Answers could include, but are not limited to the following:

Pesticide resistance is the ability of a pest to develop a tolerance to the applied pesticide. This resistance usually develops by genetic mutation and selection. This mutation is either through a change in:

- the processes in the pest that make it immune to the pesticide
- where the pesticide can no longer enter the pest
- the behaviour of the pest so it avoids the pesticide

Management strategies:

- only apply pesticides when required
- use pesticides from different resistance management groups
- monitoring to make sure pesticides are applied at the most effective time
- using the recommended application rate
- if applicable apply pesticide to ensure an even coverage so animal receives the proper pesticide dose
- using selective pesticides
- using pesticides that break down quickly
- if the pesticide doesn't work, do not re-treat with a pesticide in the same group
- use integrated pest management strategies
- routinely monitor pests
- use reasonable treatment thresholds
- always quarantining introduced livestock and treating them with a quarantine drench
- using drenches strategically as part of an overall parasite control program
- reading labels thoroughly before use and following the directions for dose rates
- using grazing management to reduce exposure of young livestock to heavily contaminated pasture.

Question 28 (continued)

(a) continued

- **economic principles**

Description	Marks
Explains comprehensively the economic principles	4
Explains clearly the economic principles	3
Outlines some information about economic principles	2
States a fact about economic principles	1
States how the economic principles can be applied	1
Total	**5**

Answers could include, but are not limited to the following:

The economic principles of pest control:

- implement control measure/s when the pest is causing a financial loss to the producer. The control program is only implemented if the cost of control is less than the damage caused by the pest (pest causing economic injury)

Requires an understanding of:

- Economic Threshold (ET) – the level at which the population of a pest is at a point at which control measures need to be implemented
- Economic Injury Level (EIL) – the amount of pest injury which will justify the cost of control.

Reduces pesticide resistance:

- only applying chemicals at appropriate time, avoid over use.

(b) Effectiveness of control methods

Description	Marks
Four marks for each pest control method. Maximum eight marks.	
Discusses clearly multiple advantages and disadvantages	4
Discusses multiple advantages or disadvantages	3
Outlines an advantage and disadvantage	2
States an advantage or disadvantage	1
Outlines clearly the impact on a natural ecosystem	2
States briefly the impact on a natural ecosystem	1
Total	**10**

Answers could include, but are not limited to the following:

Pest control methods	Advantages	Disadvantages
Chemical control (insecticides, fungicides, drenches)	• effective and instant control of pests • millions of dollars directed into research for effective pest control • select most effective control – systemic *vs* contact *vs* fumicide • treatment required to gain access to specific markets – vaccination scabby mouth (export market) • increases productivity	• over or incorrect use can cause resistance • possible impact on environment other beneficial creatures • safety concerns to user – poisoning • residual issues

Pest control methods	Advantages	Disadvantages
Cultural or physical control (timing of operations, vaccination programs, grazing management)	• lessons impact on the environment from chemical usage • decreases reliance on chemicals • very effective component of a IPM program • improves enterprise profitability	• can't adequately control pest due to rapid increase in population numbers – change in weather conditions or infected animals entering property • relies on managerial ability of producer • conflicting demands for labour resources • more labour intensive
Genetic improvement (breeding of animals resilient to pest infestation)	• lessons impact on the environment from chemical usage • decreases reliance on chemicals • improves enterprise profitability	• difficult to align genetic gain in pest resilience with productivity traits • funding availability for research and development
Biological/environment (deliberate release of natural predators	• lessons impact on the environment from chemical usage • decreases reliance on chemicals • reduction of pest numbers – traps • improves enterprise profitability	• requires years of development, testing and control measures • risks of impacting on natural ecosystem
Pest control method	**Potential impact on conservation of natural ecosystem**	
Chemical control (insecticides, fungicides, drenches)	• possible high negative impact on conservation • reduction of biodiversity • residual effects of certain chemicals on the environment and other beneficial creatures • chemical contamination of non-target organisms	
Cultural or physical control (timing of operations, vaccination programs, grazing management)	• lower impact on conservation • lessons the impact on the environment from chemical usage • may result in destruction of habitat for natural predators	
Genetic improvement (breeding of animals resilient to pest infestation)	• lower impact on conservation • lessons impact on the environment from chemical usage	
Biological/environment (deliberate release of natural predators	• possible high negative impact on conservation • released insect may overcome natural populations and become a pest itself	
	Question total	**20**

Question 29 (20 marks)

To be successful, a producer must monitor production practices to meet market trends as well as being competitive in major markets.

(a) Examples of market trends include leaner meat, guaranteed eating quality and food safety assurance. From these examples, select **one** and explain why the market trend has occurred and how producers use their management practices to meet the trend. (5 marks)

(b) Explain:

- the importance of the global economy for the Australian livestock industry using an example
- how maintaining a comparative advantage and quarantine laws assist in achieving success in international markets. Include examples of each. (15 marks)

(a) Market trend

Description	Marks
Provides a reason for trend	1
Explains clearly a number of changes in practices to meet a market trend	4
Explains clearly one change in a practice to meet market trend	3
Outlines a number of changes in practices to meet a market trend	2
States briefly one change in a practice to meet market trend	1
Total	**5**

Answers could include, but are not limited to the following:

Market trend	Producers' management practices
Leaner meat • consumers are becoming more health conscious • health promotions that highlight negative aspects of consuming excess fat	• regular monitoring of animal condition score • adoption of new technologies – fat scanning, automatic weighing drafting systems, using BV's for growth and fat • breeding programs – breed selection, breeding systems (crossbreeding) • nutritional management – ration formulation, grazing management, finisher diets
Eating quality guarantees • consumers are insisting on having guarantees on eating quality of meat they purchase	• participation in QA programs • use of low stress handling techniques • animal selection – temperament considerations, carcass feedback, use of genetic information • government/industry initiated educational programs • product labelling – MSA
Food safety assurance • consumers what guarantees/confidence in the products they purchase are safe	• participation in QA programs • adherence to WHP • traceability requirements – NLIS • on farm biosecurity – vaccination programs, quarantine practices • meeting recognised Australian Industry standards • practice of feeding animals safe food products in their diets

(b)	
• **International markets**	
Description	**Marks**
Explains comprehensively the importance of international markets	4
Explains clearly the importance of international markets	3
Outlines the importance of international markets	2
States a fact about international markets	1
Includes example	1
Total	**5**

Answers could include, but are not limited to the following:

Importance:
- approximately two thirds of agricultural animal production is exported
- provides valuable source of foreign investment
- very important employment provider
- integral to Australia's GDP

Usually achieved through industry and/or governments involvement:
- department enforces regulatory framework to ensure commodity is
  - fit for human consumption (disease free)
  - accurately described and labeled
  - fully traceable
- all goods under this legislation must be registered and be provided with a license prior to export. This includes a number of protocols that must be allowed
- providing market development assistance via Austrade and the Export Finance and Insurance Corporation
- maintaining our overseas diplomatic network of agriculture and trade specialists
- develop free trade agreements (FTAs) – international treaties that reduce barriers to trade and investment. This assists the Agriculture industry via:
  - improving access to markets
  - improving competitive position for our exports – tariff reductions
  - increase industries productivity and profitability.

Examples of Australia FTAs:
- ASEAN-Australia-New Zealand FTA
- China-Australia FTA
- Japan-Australia Economic Partnership Agreement
- Australia-United States FTA
- Singapore-Australia FTP
- Korea-Australia FTA

Question 29 (continued)

(b) continued

- **Comparative advantage and quarantine laws**

Description	Marks
Five marks for each factor. Maximum ten marks.	
Explains clearly a factor with multiple examples	5
Explains clearly a factor with an example	4
Outlines a factor with multiple examples	3
States a fact about a factor with an example	2
States a fact about a factor	1
Total	**10**

Answers could include, but are not limited to the following:

Maintaining a comparative advantage:

- level of government protection and financial assistance provided to the industry
  - Australia has low tariff levels (1.2%) – this has contributed to a very competitive and productive agricultural sector
  - Australian farmers provide high quality products to international markets without high levels of financial support, protection
- relative availability of resources used for production of agricultural commodities
  - Australia has the most arable land per capita of any country
- market proximity
  - fast and efficient transport systems enable the delivering of high quality animal products in the shortest possible time to Asian markets
- improved farming systems
  - sheep and cattle farmers have introduced improved pastures, rotational grazing and grain finishing to improve livestock productivity
- technical and management skills
  - Australian farmers are highly skilled producers of food and fibre, and exceptionally good business managers

Quarantine laws:

- Australia is well positioned to take advantage of growing world consumer demand for clean and safe quality food
- compliance with the National Livestock Identification System
- largely reliant on being free from exotic diseases and pests
  - maintained by our strict quarantine laws. Overseen by the Australian Quarantine and Inspection Service (AQIS)
  - Australia is one of the most pest and disease-free agricultural production areas in the world. Strict quarantine requirements ensure this status is maintained
- adherence to quality assurance schemes
- effective biosecurity management from farm gate to the consumer.

Question total	**20**

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