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

ANIMAL PRODUCTION SYSTEMS

ATAR course examination 2019

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.

2019/62782

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

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

Section Two: Short answer **50% (84 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.

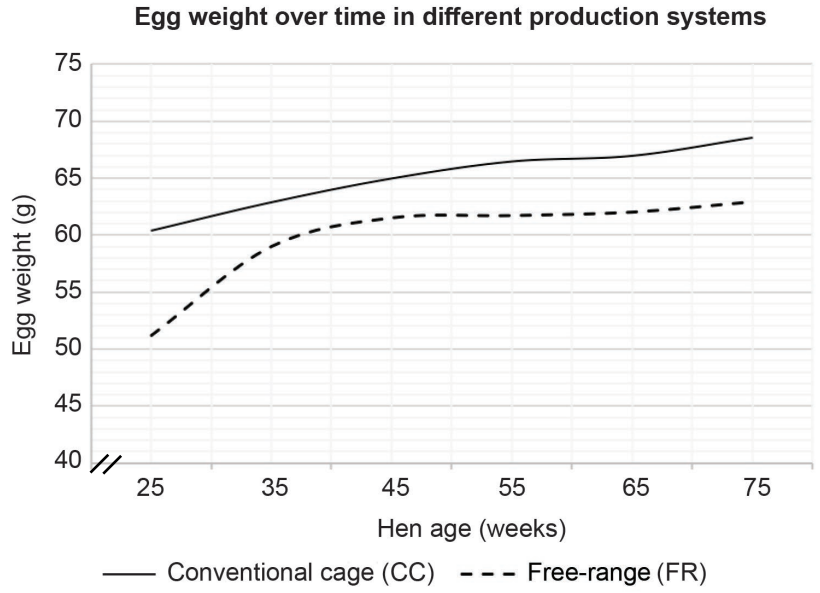
Question 21 **(18 marks)**

(a) Comment on how well this investigation meets **two** different requirements of good experimental design. (4 marks)

Description	Marks
For each of **two** requirements	
Comments on how well this investigation meets requirements of good experimental design	2
States a requirement of good experimental design	1
Subtotal	**2**
Total	**4**
Answers could include: • replication – study would need to be repeated under the same conditions • randomisation – no mention as to whether hens were randomly allocated into groups • standardisation – possible differences in diet, influence of climate, parasites, predators, stress, etc. between two groups not accounted for, genetic differences between individual birds, an equal number of hens in each of the two experimental groups • large group size – improves reliability of results.	
Accept other relevant answers.	

(b) Draw a line graph on the grid below to show how egg weight changes with hen age for each production system. (5 marks)

Description	Marks
Graph title with independent and dependent variable	1
X-axis, title and units	1
Y-axis, title and units	1
Groups labelled	1
Accuracy of plotted graph	1
Total	**5**



Question 21 (continued)

(c) What are **two** possible conclusions that can be drawn from the data obtained in this study? (2 marks)

Description	Marks
Provides two conclusions from the data	2
Provides a conclusion from the data	1
Total	**2**
Answers could include: • egg weights were greater in conventional cage (CC) group than free-range (FR) group at all ages • by 75 weeks, CC eggs were still increasing in weight, whereas FR egg weights had started to plateau.	
Accept other relevant answers.	

(d) Comment on the significance of the standard errors for this data and suggest **one** way in which standard errors could be improved. (3 marks)

Description	Marks
Comments on the significance of standard errors for this data	2
States a general comment on the significance of standard errors for this data	1
Suggests how standard errors could be improved	1
Total	**3**
Answers could include: Significance of standard errors: • low standard errors in this investigation indicate that calculated means are a good reflection of wider population (i.e. reliable) • standard errors are quite variable for free-range group – indicating less reliability. Ways that standard errors could be improved: • increasing group/sample size for each production system • limiting the environmental factors that may be influencing the reliability of data (e.g. disease, weather).	
Accept other relevant answers.	

(e) To meet consumer preferences, a caged egg producer is considering diversifying into a free-range system. Explain the key economic factors that should be considered when diversifying into a new production system. (4 marks)

Description	Marks
Explains the key economic factors that should be considered when diversifying into a new production system	4
Describes the key economic factors that should be considered when diversifying into a new production system	3
Outlines the key economic factors that should be considered when diversifying into a new production system	2
Makes a general statement about economic factors	1
Total	**4**

Answers could include:

- difference in income between two types of enterprise systems
- variable costs, gross margins for each enterprise system
- if increase in costs outweighs increase in income, then change will be less profitable
- set-up costs of infrastructure required (e.g. land, fencing, equipment, training, etc.)
- income must be sufficient to ensure set up costs are met, any loan repayments met
- marketing options for products of new system – to ensure sufficient demand, level of competition, etc.
- level of expertise needed to diversify into new enterprise.

Accept other relevant answers.

Question 22 **(15 marks)**

(a) (i) Select **two** of the hormones listed in the dot points above and complete the table below. Identify the site of production of each hormone and the role each plays in natural breeding behaviour and reproductive processes. (6 marks)

Description	Marks
For each of **two** hormones	
Identifies the role of the hormone in natural breeding behaviour	1
Identifies the role of the hormone in reproductive processes	1
Subtotal	**4**
States site of production of each hormone	1
Subtotal	**2**
Total	**6**

Answers could include:

Hormone	Site of production	Natural breeding behaviour	Reproductive processes
Oestrogen	• produced in ovaries	• oestrus behaviour	• development of the sexual organs – growth of uterus • stimulates release of luteinising hormone (for ovulation) • thickening of cervical mucus
Progesterone	• produced by corpus luteum (ovaries) and placenta (in pregnancy)	• failure to show oestrus behaviour	• development of uterine walls, thickening of uterine lining • inhibition of follicle development and ovulation
Oxytocin	• produced by pituitary gland	• maternal bond behaviour	• stimulates milk let-down • uterine contractions during parturition
Testosterone	• produced by testes	• libido (promotion and development of sexual behaviour)	• development of the male sexual organs and secondary sex characteristics • formation and maturation of sperm (spermatogenesis)

Accept other relevant answers.

(ii) Explain how **one** of the four hormones listed in the dot points above can be used to manipulate breeding cycles in livestock. (4 marks)

Description	Marks
Explains how the selected hormone can be used to manipulate breeding cycles in livestock	4
Describes how the selected hormone can be used to manipulate breeding cycles in livestock	3
Outlines how the selected hormone can be used to manipulate breeding cycles in livestock	2
Makes a general comment relating a named hormone to breeding cycle manipulation	1
Total	**4**
Answers could include: • progesterone – used to synchronise oestrus by inhibiting ovulation, removal of progesterone implant initiates oestrus cycle • oestrogen – injections can be used to initiate heat cycle, oestrus behaviour and ensure ovulation, usually following treatment with progesterone • testosterone – injections used to prepare teaser males, initiates breeding behaviour, presence of male can initiate oestrus cycle especially in seasonally polyoestrus livestock such as sheep.	
Accept other relevant answers.	

(b) Name a breeding technology and explain how the management of an animal's endocrine system is critical to its success. (5 marks)

Description	Marks
Names a breeding technology	1
Explains how management of an animal's endocrine system is critical to the success of stated breeding technology	4
Describes how management of an animal's endocrine system affects the success of stated breeding technology	3
Outlines how management of an animal's endocrine system affects the success of stated breeding technology	2
Identifies a way that management of an animal's endocrine system affects the success of stated breeding technology	1
Subtotal	**4**
Total	**5**
Answers could include: • breeding technologies could include: artificial insemination, oestrus synchronisation, embryo transfer • timing of hormonal treatments is vital, e.g. reduction of progesterone levels via removal of implant (CDIR etc.) followed by prostaglandin injection to induce oestrus, ensuring oestrus and artificial insemination occur close together for best chance of conception • oestrus synchronisation – for surrogate dam in embryo transfer program, so implantation of embryo in surrogate's uterus will be successful, uterus lining sufficiently developed.	
Accept other relevant answers.	

Question 23 **(16 marks)**

(a) Calculate the gross margins for 2011. Write your answers in boxes **A** and **B**. (2 marks)

Description	Marks
Correctly calculates gross margin 2011	1
Correctly calculates gross margin/cow 2011	1
Total	**2**
Answers could include: A = ($) 311 280 B = ($) 1383	

(b) Explain using examples, the impact of drought on the following components of an enterprise's gross margin:
- total income
- variable costs. (8 marks)

Description	Marks
Total income	
Explains using examples, the impact of drought on total income	4
Explains the impact of drought on total income	3
Describes the impact of drought on total income	2
Makes a brief statement about the impact of drought on total income	1
Subtotal	**4**
Variable costs	
Explains using examples, the impact of drought on variable costs	4
Explains the impact of drought on variable costs	3
Describes the impact of drought on variable costs	2
Makes a brief statement about the impact of drought on variable costs	1
Subtotal	**4**
Total	**8**
Answers could include: Total income: • reduced price for sale of livestock, as many producers will destock during drought to reduce feed requirements, so supply of stock may exceed demand and price per animal falls • reduction in income from milk sales due to reduced milk yield/quality, possibly due to reduced feed quality/quantity, heat stress, etc. Variable costs: • increase in amount of supplementary feed required, as reduced pasture growth means more feed must be brought in • increased feed costs as reduced grain production/supply and increased demand from livestock producers • increased irrigation costs, reduced supply/allocation of water, expense of carting in water from outside region • increased freight costs, feed and water being brought in from further away, more animals transported to sale yards/abattoirs, increased demand for freight by many producers destocking or buying in feed.	
Accept other relevant answers.	

(c) Describe **two** strategies that could be adopted by a producer to mitigate the effects of future drought on economic sustainability. (6 marks)

Description	Marks
For each of **two** strategies	
Describes a strategy for mitigating the effects of drought on economic sustainability	3
Outlines a strategy for mitigating the effects of drought on economic sustainability	2
Makes a general statement about mitigating the effects of drought	1
Subtotal	**3**
Total	**6**
Answers could include: • 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, reducing need to buy in water during drought thus reducing costs • select types of pasture plant better adapted to dry conditions, shorter growing season, genetically modified or native pastures, perennial pastures rather than annual ones, thus reducing supplementary feed costs • manage animal condition to prepare them for dry weather, ensure adequate water supply and adjust the timing of certain operations to reduce stress, thus mitigating potential loss of condition, improving survival rate and reducing need to destock, thus ensuring animals are not sold at a loss/low price • stockpile feed to use during dry periods, investigate alternative feed sources such as silage, thus saving money on buying in feed when prices are high and reducing variable costs.	
Accept other relevant answers.	

Question 24 **(22 marks)**

(a) Compare the process of carbohydrate digestion in the microbial and gastric digestive systems. (4 marks)

Description	Marks
Compares the process of carbohydrate digestion in microbial and gastric digestive systems	4
Describes some key differences between the process of carbohydrate digestion in the two systems	3
Outlines some differences between the two systems	2
Makes a general comment about carbohydrate digestion	1
Total	**4**

Answers could include:

Microbial system	Gastric system
carbohydrate digestion occurs in rumen and small intestine	carbohydrate digestion largely confined to small intestine
digestion of cellulose to simple sugars occurs in microbial digestive system	digestion of cellulose in gastric system is very limited
due to secretion of enzymes (cellulases) by large population of rumen microbes	relatively small number of microbes in large intestine
rumen microbes utilise some simple sugars and convert to volatile fatty acids	no volatile fatty acid production
which are utilised by rumen microbes and absorbed through rumen wall	no absorption of carbohydrates or their products until food reaches small intestine
volatile fatty acids carried to liver and converted to glucose	simple sugars converted to glucose or glycogen

Note:
- in both systems carbohydrates, such as starch, are digested into simple sugars in the small intestine, by secretion of carbohydrases (e.g. amylase, maltase, etc.)
- in both systems, products of carbohydrate digestion are absorbed through the wall of the small intestine.

Accept other relevant answers.

(b) Explain **two** differences between livestock feed rations for animals with gastric digestive systems compared to those with microbial digestive systems. (8 marks)

Description	Marks
For each of **two** differences	
Explains a difference between feed rations, relating this to action of each type of digestive system	4
Describes a difference between feed rations related to different digestive systems	3
Outlines a difference between feed rations	2
Identifies a difference between feed rations	1
Subtotal	**4**
Total	**8**
Answers could include: Gastric systems require: Lower proportion of fibre/roughages which are high in cellulose: • most gastric digestive systems have limited ability to breakdown cellulose compared to microbial systems • as they lack rumen and rumen microbes. Higher proportion of concentrates: • little/no fermentation of cellulose as a carbohydrate source • so must obtain energy from starch-rich food (e.g. grains) • do not have same risk of acidosis from high grain content unlike microbial digestive systems. Higher protein content: • as no rumen microbes to digest as a protein source • so must obtain all protein requirements via diet • no benefit from artificially increasing nitrogen content.	
Accept other relevant answers.	

(c) (i) Why is the digestible energy requirement of a weaner piglet ration greater than that for grower piglets? Justify your answer. (3 marks)

Description	Marks
Justifies why the digestible energy requirement of a weaner piglet ration is greater than that for a grower piglet	3
Outlines a reason why the digestible energy requirement of a weaner piglet ration is greater than that for a grower piglet	2
Makes a statement about the different energy needs of weaner and grower piglets	1
Total	**3**
Answers could include: • weaners are smaller than growers so daily voluntary feed intake is lower • energy needs are equal/higher due to greater heat loss of smaller animals • more energy per kilogram of feed consumed is required to meet energy needs in a smaller ration • in the faster growth stage feed is used more efficiently.	
Accept other relevant answers.	

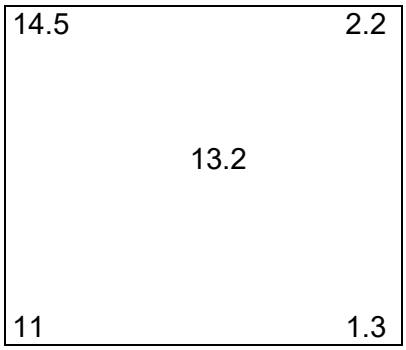
Question 24(c) (continued)

(ii) Use a Pearson square to determine an appropriate feed ration for Finisher pigs. The available feeds are wheat (14.5 MJ/kg DM) and barley (11 MJ/kg DM). Show your working and express the ration as the percentage of each grain. (3 marks)

Description	Marks
Calculates correct percentage for proportions of each grain in ration	3
Shows correct working for proportion of each grain in ration	2
Sets out Pearson square correctly	1
Total	**3**

Answers could include:

wheat



barley

percentage wheat = 2.2 / 3.5 × 100 = 63%

percentage barley = 1.3 / 3.5 × 100 = 37%

(d) Explain why sheep can be fed a lower protein diet than pigs while maintaining health and productivity. (4 marks)

Description	Marks
Explains the difference in protein utilisation in terms of microbial and gastric digestion	4
Describes how protein is utilised within microbial and gastric digestive systems	3
Outlines differences in the two digestive systems relevant to protein utilisation	2
Makes a statement about protein utilisation in livestock	1
Total	**4**

Answers could include:

- sheep have microbial/ruminant digestive system whereas pigs are monogastric
- pigs access protein in diet which is digested and absorbed as amino acids – these are used for synthesis of required proteins in body
- in addition to dietary protein, sheep access some protein via digestion of rumen microbes
- rumen microbes can utilise low-quality dietary protein and non-protein nitrogen to manufacture microbial proteins
- so, if sheep diet contains sufficient nitrogen, protein needs can be met despite lower dietary protein levels than pigs.

Accept other relevant answers.

Question 25 **(13 marks)**

(a) Explain the importance of EBV accuracy when selecting an animal to meet breeding goals successfully. (4 marks)

Description	Marks
Explains the importance of EBV accuracy in meeting breeding goals successfully	4
Describes the importance of EBV accuracy in meeting breeding goals successfully	3
Outlines the importance of EBV accuracy in a breeding program	2
States a fact about EBV accuracy	1
Total	**4**
Answers could include: • accuracy indicates the confidence level of the EBV (i.e. the likelihood of the trait being passed on to offspring) • also refers to the chance that an individual animal's EBV will change over time • high accuracy is desirable to ensure that selection traits are passed to progeny and breeding objectives are met • high accuracy will ensure that a selected sire will reliably pass on these traits in the future – important if sire/semen from that sire is to be repeatedly used over successive generations of a breeding program.	
Accept other relevant answers.	

Question 25 (continued)

(b) Outline how the following factors affect an animal's EBV:
- trait heritability
- sample size tested
- progeny testing. (6 marks)

Description	Marks
Trait heritability	
Outlines the effect of trait heritability on accuracy of EBVs	2
States a fact about heritability and accuracy of EBVs	1
Subtotal	**2**
Sample size tested	
Outlines the effect of sample size on accuracy of EBVs	2
States a fact about sample size and accuracy of EBVs	1
Subtotal	**2**
Progeny testing	
Outlines the effect of progeny testing on accuracy of EBVs	2
States a fact about progeny testing and accuracy of EBVs	1
Subtotal	**2**
Total	**6**

Answers could include:

Trait heritability:
- a trait with a low heritability is less likely to be passed on to progeny, while a high heritability tells us the trait is more likely to be present in progeny
- so the higher the heritability, the greater the reliability of EBVs.

Sample size tested:
- how much performance information is available about the animal and its close relatives – especially the number of progeny that have been analysed
- more animals tested = greater accuracy.

Progeny testing:
- progeny testing takes into account likelihood of trait to be passed on (heritability)
- progeny testing must involve animals kept under the same environmental conditions for valid genetic data
- performance data only looks at an individual animal and expression of trait may be affected by environmental factors as well as genetics.

Accept other relevant answers.

(c) Demonstrate, with an example, how an understanding of EBVs assists producers with their artificial insemination (AI) programs. (3 marks)

Description	Marks
Demonstrates, with an example, how EBVs can assist in artificial insemination programs	3
Outlines how EBVs can be used within an artificial insemination program	2
States a fact about artificial insemination	1
Total	**3**

Answers could include:

- selecting genetic material (semen) based on:
  - targeted EBVs that meet breeding objectives (e.g. improve overall birth weights)
  - accuracy of EBVs must be considered
- artificial insemination enables semen from multiple sires to be used, selection depending on genetic/physiological performance of females (e.g. lower birthweight EBV for young females to reduce birthing problems)
- accessing genetic material from interstate/overseas using EBVs as selection criteria.

Accept other relevant answers.

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

Question 26 **(20 marks)**

(a) Using examples, discuss how on-farm practices meet the requirements of a stated quality assurance program. (6 marks)

Description	Marks
States a quality assurance program	1
Subtotal	**1**
Using examples, discuss how on-farm practices meet quality assurance requirements	5
Using examples, explains how on-farm practices meet quality assurance requirements	4
Using examples, describes how on-farm practices meet quality assurance requirements	3
Using examples, outlines how on-farm practices meet quality assurance requirements	2
Using an example, identifies how on-farm practices meet quality assurance requirements	1
Subtotal	**5**
Total	**6**

Answers could include:
Quality assurance programs such as:

Meat Standards Australia (MSA):
- a beef, lamb and sheepmeat eating quality program
- red meat products have an MSA label that guarantees the grade and provides a recommended method of cooking
- MSA compliance covers aspects such as:
  - handling of animals (i.e. low stress handling techniques)
  - number of days on feed
  - preparation for dispatch of livestock (i.e. transporting animals from the same mob)
  - consignment to MSA approved abattoir and appropriate slaughter of livestock
- research has been conducted to determine the impact that factors such as livestock management practices have on eating quality.

Livestock Production Assurance (LPA):
- A simple on-farm food safety program is LPA, which helps producers to evidence the claims that are made on the National Vendor Declaration waybills. It also helps to manage on-farm risks effectively
- LPA focuses on food safety management, which considers five key elements or areas of compliance:
  - property risk assessment
  - safe and responsible animal treatments
  - stock foods, fodder crops, grain and pasture treatments
  - preparation for dispatch of livestock
  - livestock transactions and movements.

Hazard Analyses and Critical Control Point (HACCP) – milk:
- quality assurance food safety plan that evaluates and addresses potential physical, biological and chemical hazards in the dairy enterprise
- quality assurance program requires compliance in such areas as food safety, animal welfare, chemical contamination and environmental contamination.

Australian Wool Exchange (AWEX): • wool classer registered with AWEX • shearing managed to minimise contamination • wool classed to national standards, wool specification completed accurately to provide brokers with correct information about each bale. Organic/biodynamic produce assurance schemes: • accreditation from the Biological Farmers Association • outlines guidelines members must adhere to meet compliance requirements.
Accept other relevant answers.

(b) Describe **two** factors that can cause variations in a marketable animal product. Explain the strategies that can be applied to minimise these product variations. (8 marks)

Description	Marks
For each of **two** factors	
Describes a factor causing product variation	2
Identifies a factor causing product variation	1
Subtotal	**4**
For the strategies to minimise product variation	
Explains at least two strategies to minimise product variation	4
Describes at least two strategies to minimise product variation	3
Outlines at least two strategies to minimise product variation	2
Identifies at least one strategy to minimise product variation	1
Subtotal	**4**
Total	**8**

Answers could include:
Factors causing product variations:

Breed:
- breed or genetics of the animals used – some breeds are more suitable than others in avoiding product quality/quantity (e.g. temperament differences, suitability to climatic conditions)
- certain breeds are more tolerant of certain climatic conditions (e.g. Bos).

Weather:
- including temperature, humidity
- product variation due to animals not receiving constant access to quality water, heat stress.

Nutrition:
- maintaining adequate glycogen levels will help to deliver the required level of pH. If glycogen falls below a threshold concentration, can potentially cause dark cutting
- changes in diet and water supply that are sudden can be stressful for livestock
- differences with feed system used (e.g. feedlot vs pasture)
- management skills of producer (e.g. ration formulation, feeding plan for different classes of animals)
- differences in eating quality that can be influenced by nutritional management include pH levels, marbling, ossification, fat colour and depth.

Handling and transport:
- differences in handling techniques can impact greatly on stress levels thus potentially impacting on the quality of the end product
- differences in handling facilities. Poor facilities subject animals to potential bruising and injury
- management differences in the way producers handle animal stress during transportation

Question 26(b) (continued)

- producers not understanding the roles and responsibilities that exist in addition to standards and guidelines relating to the transport of livestock
- demographic differences – distances to market.

Strategies to minimise product variations:

Breed:
- research market returns for different weight and ages – vealer vs yearling, pork vs bacon, prime lamb and broiler optimum weights. Select suitable breed to meet these returns
- meeting market specifications – weight, fat, meat colour, micron, age
- timing of mating to meet production goals – designated market/s, nutritional management, enterprise management, weather factors.

Weather:
- minimise exposure to weather extremes – availability of shade/shelter
- adequate ventilation is required for enclosed animal enterprises such as poultry, provision of adequate shade
- timing of husbandry activities to minimise the potential impact of adverse weather conditions (e.g. timing of shearing).

Nutrition:
- changes in diet should be planned carefully and gradually introduced. Major changes in diet and/or water supply should not be made in conjunction with other husbandry procedures that might be stressful
- to ensure high glycogen levels, producers must have feeding and finishing systems that are well planned, helping to produce animals of good condition that are actively gaining weight
- animal's condition should be monitored regularly and the animal sold once it can meet market specifications.

Handling and transport:
- low stress handling techniques should be adopted
- livestock should be handled gently with a minimum of noise
- animal handling should be kept to the minimum level that is necessary for the management of health and productivity
- animal handling facilities should be designed so that the risk of injury is minimised
- where possible, handling facilities should be designed to take advantage of natural animal behaviours
- ensuring livestock handlers are competent. The application of optimal instead of excessive pressure can be achieved by using the 'flight zone' to advantage
- avoid undertaking activities likely to cause stress just before animals are loaded, including crutching, drenching, dipping and/or dehorning
- only livestock that are considered fit to travel should be presented
- animals that should not be transported include those that are sick, blind, injured, heavily pregnant, lame, weak or emaciated, or those that can no longer keep up with the mob
- livestock should be yarded prior to loading, overnight if possible, which allows them to settle
- for loading and travel, livestock should be segregated appropriately
- livestock should be held off feed and water, if possible, for 8–12 hours before they are transported.

Accept other relevant answers.

(c) Describe how a new technology could improve the efficiency of an animal production system. Outline **one** factor that would need to be considered when introducing this technology. (6 marks)

Description	Marks
States a new technology	1
Subtotal	**1**
For how the new technology could assist the enterprise	
Describes how the new technology could assist the animal production system to improve its efficiency	3
Outlines how the new technology could assist the animal production system to improve its efficiency	2
States how the new technology could assist the animal production system to improve its efficiency	1
Subtotal	**3**
For the production change required	
Outlines a factor to be considered when introducing the new technology	2
States a factor to be considered when introducing the new technology	1
Subtotal	**2**
Total	**6**

Answers could include:
Examples of new technology:
- automotive equipment
- drone technology
- breeding technologies – artificial insemination and embryo transfer, gene marking
- precision farming techniques
- soil and crop sensors
- mobile computers – internet accessibility
- drought resistant variety
- x-ray and 3D digital imaging for accurately measuring live animals.

Improvements in efficiency:
- efficiency is commonly expressed as the ratio of selected inputs to outputs. That is, a desirable new technology would reduce the cost of inputs whilst still maintaining or increasing outputs
- technology can improve economic efficiency by increasing income and/or reducing costs
- availability of information from computer apps and networks will facilitate better decision-making capabilities via improved diagnostic capabilities, updated market information, sourcing cost efficient inputs, etc.
- a new technology can enhance the producer's ability to accurately meet market specifications (e.g. scanning, animal EBV's, breeding technologies).

Factors to be considered:
- upskilling of employer/employees – training workshops, inductions, liaison with technical staff, occupational safety and health for new equipment
- changes to property infrastructure (e.g. automated dairy – may require restructuring of internal fencing)
- alteration of existing on-farm practices to fulfil the necessary requirements of the new technology – data collection and management.

Accept other relevant answers.

Question 27 **(20 marks)**

(a) Explain the economic, social and environmental issues related to the use of pesticides to control parasites in livestock effectively. (12 marks)

Description	Marks
For the economic, social and environmental issues	
Explains the issues related to the use of pesticides to control parasites effectively	4
Describes the issues related to the use of pesticides to control parasites effectively	3
Outlines the issues related to the use of pesticides to control parasites effectively	2
Identifies an issue related to the use of pesticides to control parasites effectively	1
Subtotal	**4**
Total	**12**

Answers could include:

Economic:

- drenches are expensive to purchase
- cost of treatment must be less than potential economic cost of damage
- loss of production because of pesticide resistance
- establish economic injury level of pest via monitoring populations/effects
- targeted use (e.g. selective drenching of most susceptible animals can save money)
- full dose must be given to avoid problematic levels of pesticide resistance
- using drenches as part of an integrated pest management program (i.e. lowers cost, with less money having to be spent on chemicals).

Social:

- education of producers on effective use of drenches to reduce resistance risk, types and combinations of drenches, resistance status on their farm
- safety precautions for humans handling drench, personal protective equipment (PPE), etc.
- observe withholding periods to ensure consumer safety
- consumer concern regarding use of chemicals in livestock production, market requirements
- using drenches as part of an integrated pest management program (i.e. less exposure to chemicals for farm workers).

Environmental:

- timing of pesticide use must consider climate and season, which in turn affect pest populations (e.g. wet, warm conditions for worms, avoid summer drenching)
- pesticide resistance – may render some chemicals ineffective, tests can be performed to determine a farm's resistance status
- using pesticides as part of an integrated pest management program – reduces reliance on chemicals, lowers risk of pesticide resistance, thus maintains effectiveness of control
- storage and disposal of products
- using drenches as part of an integrated pest management program (i.e. reducing the amount of chemicals that are used and using narrow spectrum and non-residual chemicals).

Accept other relevant answers.

(b) Outline how pesticide resistance develops. Describe **two** on-farm strategies that could be implemented to reduce this threat. (8 marks)

Description	Marks
Outlines how pesticide resistance develops	2
States a fact about how pesticide resistance develops	1
Subtotal	**2**
For each of **two** strategies	
Describes a strategy that could be implemented on-farm	3
Outlines a strategy that could be implemented on-farm	2
States a potential strategy that could be implemented on-farm	1
Subtotal	**6**
Total	**8**

Answers could include:

Outline of pesticide resistance:

- pesticide resistance – when a population/strain of pest organisms cannot be killed/inactivated by a certain group of pesticides
- a small proportion of any pest population has natural resistance, overuse/misuse of a specific pesticide can repeatedly select for resistant pests by only killing non-resistant individuals
- misuse includes repeatedly using drenches from the same pesticide group each year, under-dosing, drenching at inappropriate times
- proportion of resistant pests increases to a level whereby chemical control is not effective in reducing pest numbers.

Strategies to mitigate effects could include:

- utilisation of non-chemical methods to control pests as part of an integrated pest management program – including cultural and biological control methods
- selecting for pest resistance in livestock breeding programs
- use of combination drenches, containing multiple chemical groups, to target both resistant and non-resistant pests
- vaccination of livestock – employing animal's own immune system to recognise and destroy/inactivate pest organisms.

Accept other relevant answers.

Question 28 **(20 marks)**

(a) Using examples, compare the function of feed additives and growth promotants in livestock. Explain how these improve enterprise efficiency and profitability. (11 marks)

Description	Marks
Compares the function of each stated example in animal production	5–6
Describes the function of the stated examples	3–4
States a specific example of a feed additive and growth promotant	1–2
Subtotal	**6**
Explains how enterprise efficiency and profitability can be improved	4–5
Describes how enterprise efficiency and profitability can be improved	2–3
Makes a general statement about effects on enterprise efficiency or profitability	1
Subtotal	**5**
Total	**11**

Answers could include:
Examples of feed additives:
- antibiotics
- coccidiostats
- probiotics
- vitamin/mineral premixes.

Examples of growth promotants:
- antibiotics
- oestrogen
- testosterone
- synthetic androgens.

Function:
- feed additives functions include: reducing disease risk, altering rumen microflora to reduce waste, improve efficiency of digestion/metabolism of feed, correcting vitamin/mineral deficiencies
- antibiotic growth promotant functions involve altering rumen microflora to reduce waste, improve efficiency of digestion/metabolism of feed
- hormonal growth promotant functions accelerate animal's metabolic processes, leading to faster growth rates.

Effects on efficiency and profitability:
- increased growth and production levels due to better use of feed and reduced losses due to nutrient deficiencies/health issues/waste (e.g. methane emissions)
- with little change in feed requirements
- inputs generate more outputs = increased efficiency
- increased income with costs maintained/reduced = greater profit
- also possible reduction in health issues = reduced costs of treatment/lost production
- although cost of additive/implant and its application must be taken into consideration.

Accept other relevant answers.

(b) Discuss the potential marketing issues associated with using growth promotants in planning sustainable production systems. Describe the legal requirements relating to the use of these growth promotants. (9 marks)

Description	Marks
Discusses the potential marketing issues and relates to enterprise sustainability	4–5
Outlines some potential marketing issues	2–3
Make a general statement about potential marketing issues	1
Subtotal	**5**
Comprehensively describes legal requirements	3–4
Outlines a few legal requirements	2
Makes a general statement about legal requirements	1
Subtotal	**4**
Total	**9**

Answers could include:

Potential marketing issues:

- hormonal growth promotants not permitted by certain markets (e.g. EU and some domestic markets)
- concerns regarding increased risk of antibiotic resistance, including in potential human pathogens
- potential reduction in eating quality/reduced marbling in some meat cuts from hormonal growth promotant-treated animals.

Legal requirements:

- feed containing growth promotants must meet Australian stockfeed regulations and standards
- must be registered by the Australian Pesticides and Veterinary Medicines Authority (APVMA)
- withholding periods for medications and hormonal growth promotants
- follow specific instructions for application/use
- record keeping of hormonal growth promotant purchase and use, producers must sign APVMA declaration, identification of treated animals with ear mark, treatment details stated on National Vendors Declaration
- feed containing growth promotants – record batch, date, where stored, which animals were given growth promotants
- ruminant feed cannot contain any restricted animal material (RAM) constituents prohibited in Australia – antibiotics, hormones, meat meal, etc.

Accept other relevant answers.

ACKNOWLEDGEMENTS

Question 21(b) Egg weight over time in different production system graph provided by courtesy of a member of examining panel

Question 26(a) Information about LPA requirements under answers could include adapted from: Meat and Livestock Australia. (2017). *Livestock production assurance: approved guidebook.* Retrieved October, 2019, from www.mla.com.au/globalassets/mla-corporate/meat-safety-and-traceability/documents/livestock-production-assurance/lpa_guidebook_jan2018.pdf

Question 26(b) Information under answers could include adapted from: Meat and Livestock Australia. (n.d.) *Eating quality*. Retrieved November, 2019, from www.mla.com.au/Research-and-development/Feeding-finishing-nutrition/Eating-quality

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