



AGRICULTURAL SCIENCES: PAPER I

Time: 2½ hours

150 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of 14 pages and an Answer Sheet of 2 pages (i – ii). Please ensure that your examination number is filled in in the spaces provided on the Answer Sheet and that it is handed in with your Answer Booklet at the end of the examination.
 2. This question paper is made up of two sections, namely **SECTION A** and **SECTION B**.
 3. This question paper consists of four questions.
 4. Question 1 must be answered on the Answer Sheet provided. Questions 2, 3, and 4 must be answered in your Answer Book.
 5. Start **EACH** question on a **NEW** page.
 6. Number the answers correctly according to the numbering system used in this question paper.
 7. Non-programmable calculators may be used.
 8. Show all your calculations, including formulae, where applicable.
 9. It is in your own interest to write legibly and to present your work neatly.
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SECTION A**QUESTION 1**

Answer the following questions on the ANSWER SHEET provided.

- 1.1 Various options are provided as possible answers to the following questions. Choose the answer and make a cross (X) in the block (A – D) next to the question number (1.1.1 – 1.1.10) on the attached ANSWER SHEET. NO marks will be awarded if more than one cross (X) appears for the answer.

EXAMPLE:

1.1.11	<input checked="" type="checkbox"/>	A	B	C	D
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1.1.1 When designing a deep-litter chicken house, the long sides should face ...

- A East and west.
- B North and south.
- C South.
- D North.

1.1.2 Symbiotic bacteria and protozoa of ruminants occur in the ...

- A omasum.
- B rumen.
- C abomasum.
- D duodenum.

1.1.3 The digestibility of hay is also influenced by the age of the plant. Lucerne hay cut ... will have the lowest digestibility.

- A after the flowering stage
- B during the full flowering stage
- C during the beginning of the flowering stage
- D before the flowering stage

1.1.4 The liver and the pancreas secrete bile and pancreatic juices that are deposited into the ... of the alimentary canal.

- A caecum
- B duodenum
- C colon
- D ileum

1.1.5 ONE of the following is important when working with animals in a crush:

- A Make sudden movements.
- B Use dogs to calm cattle.
- C Be vigilant and aware of safety.
- D Whistle loudly.

1.1.6 In the fowl, the grinding of food by means of small stones in it, is the responsibility of the ...

- A crop
- B proventriculus
- C gizzard
- D caecum

1.1.7 An indication of heat stress in pigs is ...

- A screaming.
- B a higher respiratory rate.
- C shivering.
- D hyperactivity.

1.1.8 The possible advantages of a feedlot in animal production are listed below:

- (i) Stocking rate is increased.
- (ii) Weaning stress on female animals is reduced.
- (iii) Better control over animals.
- (iv) The production output is increased.

The correct combination of valid advantages is ...

- A (i), (ii) and (iii)
- B (i), (ii), and (iv)
- C (i), (iii) and (iv)
- D (ii), (iii) and (iv)

1.1.9 The characteristic that is observed during the microscopic evaluation of quality semen:

- A Volume
- B Colour
- C Density
- D Abnormalities

1.1.10 Which of the following substances are released when roughages are digested by micro-organisms in the rumen?

- (i) Fatty acids
- (ii) Methane
- (iii) Oxygen
- (iv) Cellulose

- A (i) and (ii)
- B (i) and (iii)
- C (ii) and (iv)
- D (i), (ii) and (iii)

(20)

1.2 In the table below, a description and TWO possible answers are given. Indicate whether the description in COLUMN B relates to **A only**, **B only**, **both A and B**, or **none** of the answers in COLUMN A, and make a cross (X) in the appropriate block next to the question number (1.2.1 – 1.2.5) on the attached ANSWER SHEET.

EXAMPLE:

	COLUMN A		COLUMN B
1.2.6	A	maize meal	An example of a concentrate that is rich in protein
	B	bone meal	

ANSWER:

This statement refers to:				
	A only	B only	A and B	None
1.2.6	A	B	C	D

	COLUMN A		COLUMN B
1.2.1	A	Vitamin A	A deficiency of this nutrient can cause parakeratosis.
	B	Vitamin D	
1.2.2	A	Dosing	Chemical methods of controlling internal parasites in farm animals.
	B	Dipping	
1.2.3	A	Fungal disease	Has the greatest economic effect on livestock farming.
	B	Viral disease	
1.2.4	A	Copulation	May be replaced by artificial insemination.
	B	Fertilisation	
1.2.5	A	Abscesses	Symptom of external parasite infection in farm animals.
	B	Skin damage	

(10)

1.3 Give ONE word/term/phrase for each of the following descriptions. Write only the word/term/phrase next to the question number (1.3.1 – 1.3.5) on the attached ANSWER SHEET.

- 1.3.1 The digestive gland in the alimentary canal that secretes both digestive juice and hormones. (2)
- 1.3.2 A relatively small area where a large number of animals are kept and fed for optimal production purposes. (2)
- 1.3.3 A place in the handling facility where cattle are kept during the handling process to avoid injury. (2)
- 1.3.4 The gross energy value of a feed minus the value of energy that is lost in the manure. (2)
- 1.3.5 The vitamin that keeps the mucus membranes in a healthy condition. (2)

- 1.4 Change the **BOLD WORD(S)** in each of the following statements to make the statements TRUE. Write only the correct word(s) next to the question number (1.4.1 – 1.4.5) on the attached ANSWER SHEET.
- 1.4.1 The Drakensberger is more adapted to local environmental conditions because it is an **exotic** breed. (1)
- 1.4.2 The first two compartments of a ruminant stomach are collectively known as a **true stomach**. (1)
- 1.4.3 When animals are moved next to the road **green** flags are used to warn the road users. (1)
- 1.4.4 **Transplantation** is a technique used on female animals to make them come into heat approximately at the same time. (1)
- 1.4.5 The **nitrogen** value is an index of the quality of the protein in a feed. (1)

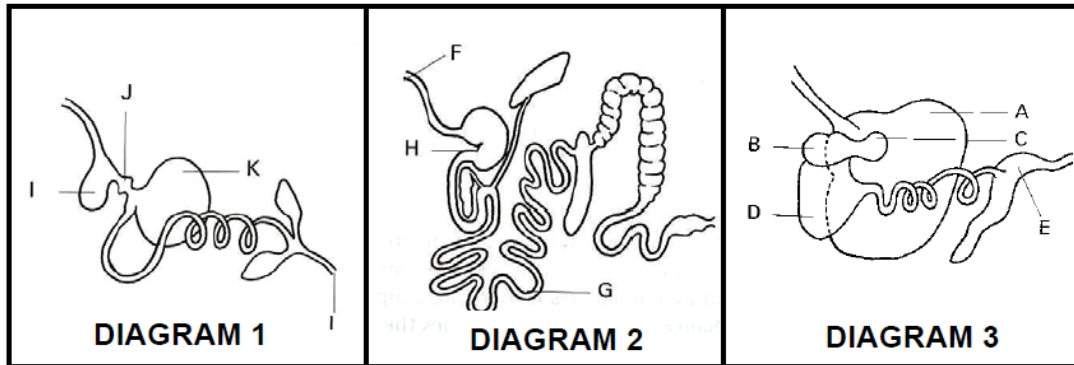
45 marks

SECTION B

QUESTION 2 ANIMAL NUTRITION

Start this question on a NEW page in your ANSWER BOOK.

2.1 The diagrams below indicate the alimentary canals of farm animals.



- 2.1.1 Evaluate DIAGRAM 3 and indicate why this animal would be classified as a ruminant. (2)
- 2.1.2 Identify the diagram above that has the organ in the alimentary canal that normally has small stones that are used for grinding food particles. (1)
- 2.1.3 Name TWO types of micro-organisms that are found in the stomach areas of the ruminant animal (DIAGRAM 3). (2)
- 2.1.4 State TWO conditions that exist in the stomach that provide the ideal living conditions for the micro-organisms in the stomach of this ruminant animal in DIAGRAM 3. (2)
- 2.1.5 A ruminant animal underwent a change in its nutrition after being marketed to a feedlot. The rations of the animals were changed from a roughage percentage of 60% to a roughage percentage of 40%.

Describe THREE possible changes in the digestion process because of this change in the rations to increase the production output. (3)

2.2 The table below represents the nutritional information of selected feeds.

FEED	CRUDE PROTEIN %	CRUDE FIBRE %	METABOLISABLE ENERGY (MJ/kg)
Lucerne hay	30,1	40,1	7,4
Maize meal	8,9	2,0	12,0
Silage	7,8	4,2	4,1

2.2.1 Select a feed that is most suitable for each of the following situations:

- (a) A juicy roughage for the stimulation of milk production (1)
- (b) Essential for young growing ruminants (1)
- (c) Needed for fattening pigs (1)

2.2.2 The farmer wants to mix concentrates for a ration for animals with a crude protein requirement of 14%. There is sunflower oilcake meal available with a crude protein content of 38%.

Use the Pearson square method to calculate the ratio in which maize meal and sunflower oilcake meal should be mixed to meet the requirements mentioned above. (5)

2.3 The value of a feed can be determined by calculating the digestibility coefficient. A cow ingested 15 kg of hay with a moisture content of 10% and excreted 4 kg of dry material in the manure.

2.3.1 Calculate the digestibility coefficient of the hay. Show ALL your calculations. (4)

2.3.2 Define the term *digestibility* of a feed. (1)

2.3.3 Explain how the crude fibre content influences the digestibility of a feed. (2)

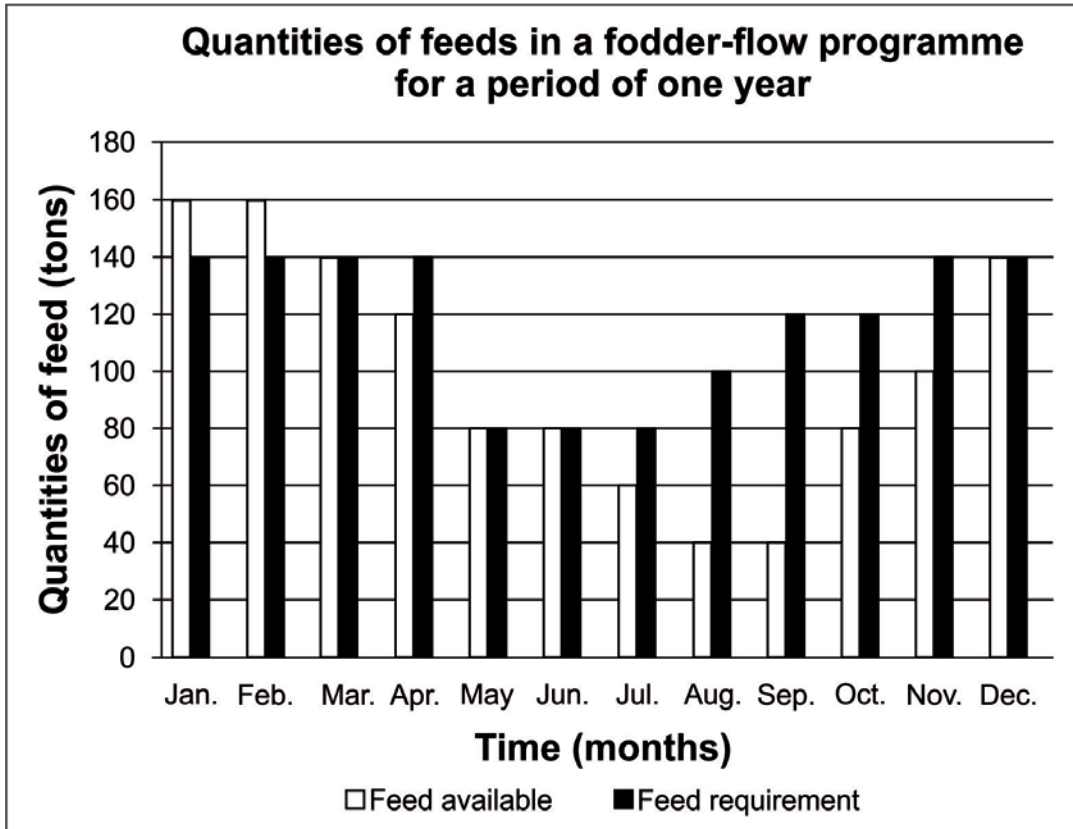
2.4 Name the vitamin or mineral associated with EACH of the following deficiency symptoms:

2.4.1 Deformation and ulceration of the cornea of the eyes. (1)

2.4.2 Muscular dystrophy (stiff-limb disease). (1)

2.4.3 Grazing animals chew dry bones and lick the soil. (1)

2.5 The graph below illustrates a fodder-flow programme. Answer the questions that follow.



- 2.5.1 Deduce, from the bar graph above, the number of months during which there will be more feed available than required by the animals. (1)
 - 2.5.2 Calculate the feed shortage during October in kilograms (kg). (3)
 - 2.5.3 Suggest THREE cost-effective measures for better utilisation of feed that could be applied in January and February. (3)
- [35]**

QUESTION 3 ANIMAL PRODUCTION, PROTECTION AND CONTROL

Start this question on a NEW page.

3.1 The future of the South African dairy industry

In 2007, big supermarkets had very low stocks of dairy products, especially long-life milk. This had been attributed to the general shortage of milk products worldwide, drought, increased demand for dairy products, and low producer prices locally. The data on milk production and average price trends for the years 2009 to 2014 is given below.

YEAR	PRODUCTION ('000 LITRES)	PRICE (CENT/LITRE)
2009	1500	820
2010	1700	840
2011	1900	860
2012	2100	880
2013	2100	840
2014	1900	820

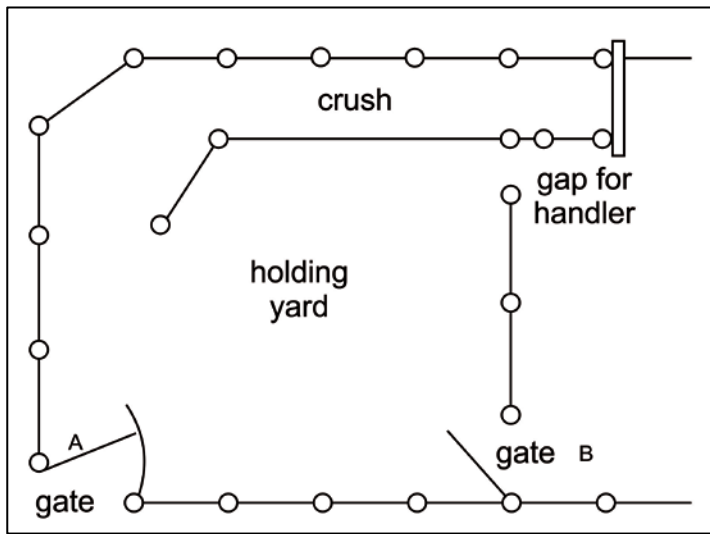
3.1.1 Draw a bar graph to compare milk production and the price of milk during the abovementioned period. (6)

3.1.2 Refer to the milk production data in the table above and provide the milk production tendency during the period from 2009 to 2014. (2)

3.1.3 Suggest TWO factors from the data above that can cause dairy farmers to quit this industry. (2)

3.2 There are different types of abnormal animal behaviour that are often seen in farm animals. Name TWO of these types of behaviour. (2)

3.3 The illustration below represents a handling facility for cattle.



- 3.3.1 State TWO factors that should be considered when designing and building a handling facility like the one in the above diagram. (2)
- 3.3.2 Give TWO reasons for having a crush in a handling facility. (2)
- 3.3.3 Describe FOUR basic principles that need to be implemented when handling cattle in a facility like the one indicated above. (4)
- 3.3.4 State TWO consequences or implications of not following the basic principles mentioned in QUESTION 3.3.3. (2)

3.4 Transporting animals

Losses arising from injury, bruising and death amongst cattle in transit between farms and the abattoir are substantial. It must be avoided for legal, humanitarian and financial reasons. It is important that cattle should be handled as sympathetically as possible to minimise these losses.

- 3.4.1 State THREE basic aspects that should be considered when transporting beef cattle to the abattoir. (3)
- 3.4.2 Name TWO effects that the poor handling of animals may have on the quality of the meat. (2)

- 3.5 The table below indicates some of the indigenous methods used to control diseases and pests in livestock.

INDIGENOUS CONTROL METHOD	FREQUENCY OF USE	PERCENTAGE (%)
Gall smearing	72	93.5
Herbs	67	87.0
Self-diagnosis	70	90.1
Bush burning	37	48.1
Herd isolation	17	22.0
Local concoctions/mixtures	27	35.0

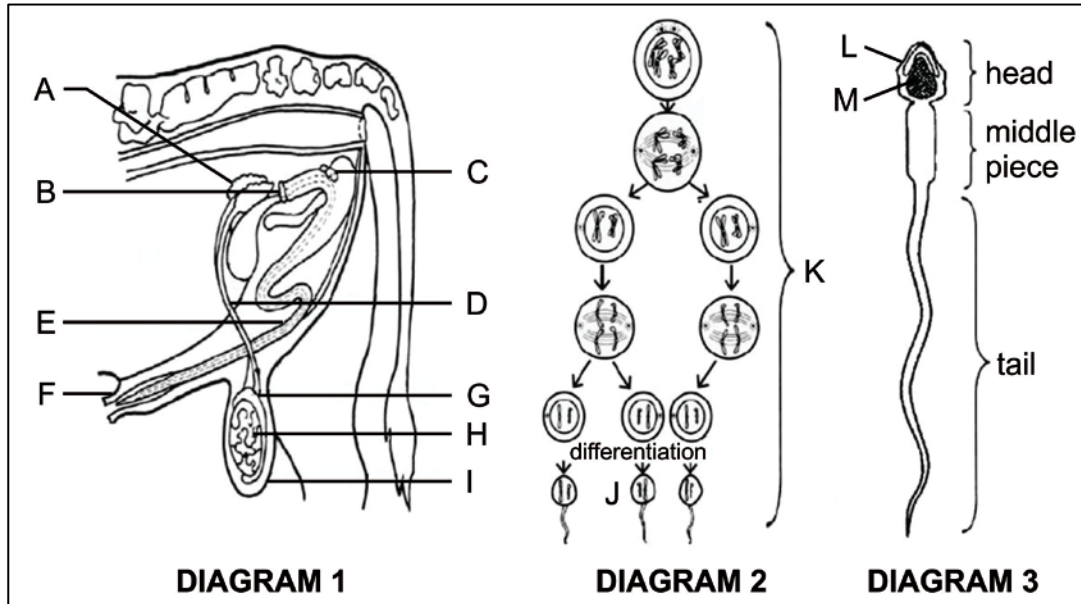
- 3.5.1 Identify an indigenous control method that is comparable to the chemical control of diseases. (1)
- 3.5.2 State the TWO most commonly used methods in controlling pests and diseases by referring to the table above. (2)
- 3.5.3 State TWO ways in which bush burning could control infestations of ticks. (2)
- 3.5.4 Name THREE conventional control measures that a farmer should adopt to restrict infectious diseases. (3)

[35]

QUESTION 4 ANIMAL REPRODUCTION

Start this question on a NEW page.

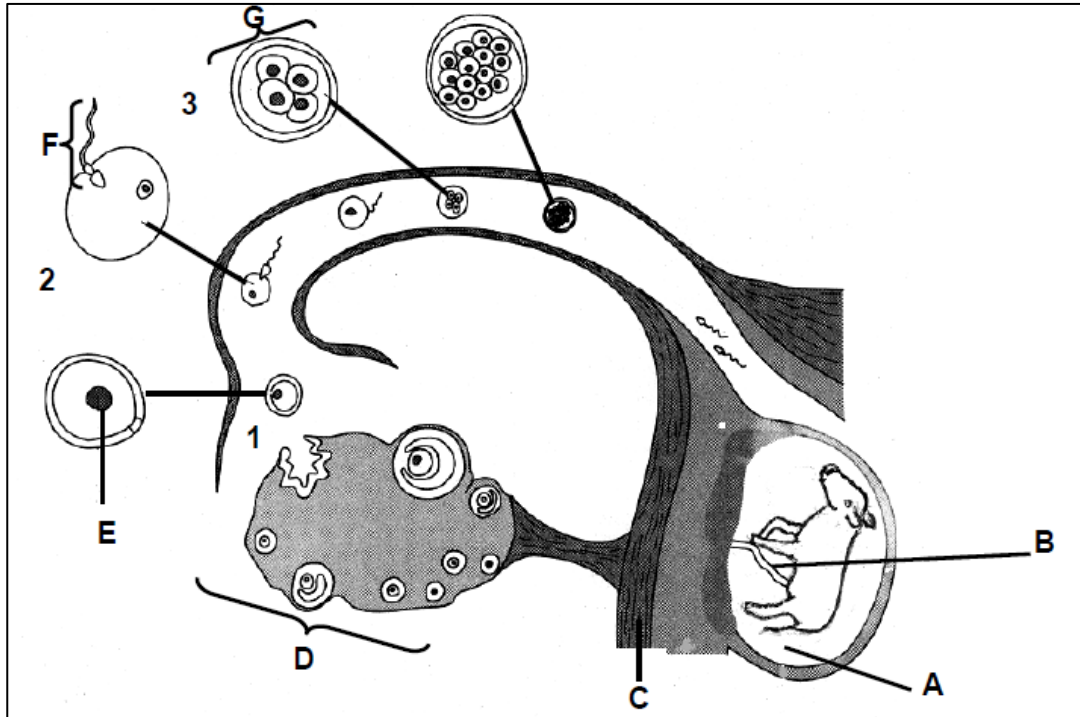
4.1 The diagrams below represent the reproductive organs of a bull, the processes of sperm formation and the development in the sex cells.



- 4.1.1 Name parts **D**, **E**, **F** and **I** in Diagram 1. (4)
- 4.1.2 Identify process **K** in Diagram 2. (1)
- 4.1.3 State ONE function of part **D** (Diagram 1) and ONE function for part **L** (Diagram 3). (2)
- 4.1.4 Describe how congenital defects can influence the process in Diagram 2. (2)
- 4.1.5 Supply a reason why part **H** in Diagram 1 is situated outside the abdominal cavity of a male animal. (1)

4.2 The diagram below illustrates part of the reproductive system of a cow. Take note that structures **E** to **G** and processes **1** to **3** occur in the Fallopian tube and uterus.

Answer the questions that follow.



- 4.2.1 Identify the processes taking place at **1**, **2** and **3** respectively. (3)
- 4.2.2 Name TWO functions of fluid **A**. (2)
- 4.2.3 State the main function of structure **B**. (2)
- 4.2.4 Indicate the hormone responsible for the process taking place at **1**. (1)
- 4.2.5 Describe how structure **F** is adapted to enable it to enter the egg cell. (2)

4.3 The data below represents hormone levels during the oestrus cycle.

DAYS	PROGESTERONE LEVEL CONCENTRATION (mg/ml)	OESTROGEN LEVEL CONCENTRATION (mg/ml)
0	3	2
4	3	2
8	32	2
12	32	2
16	32	2
20	3	30
24	3	2

4.3.1 Draw a line graph to illustrate the levels of progesterone and oestrogen on different days during the oestrus cycle. (6)

4.3.2 Suggest the role of progesterone from day 8 to day 16. (1)

4.3.3 Deduce from the data above the day on which the follicle will be fully developed. (1)

4.3.4 Motivate the answer to Question 4.3.3 by referring to the graph. (1)

4.4 Artificial insemination and heat detection in cattle

Artificial insemination (AI) makes it possible for farmers to impregnate most female animals on the farm. To get the expected results the farmer needs to observe the oestrus cycles of female animals in order to detect heat and readiness for insemination.

4.4.1 Define 'artificial insemination'. (2)

4.4.2 State TWO main requirements for successful artificial insemination of farm animals. (2)

4.4.3 Describe TWO signs of heat that can be seen in cattle. (2)

[35]

105 marks

Total: 150 marks