



AGRICULTURAL SCIENCES: PAPER I

Time: 2½ hours

150 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of 12 pages and an Answer Sheet of 2 pages (i–ii). Please ensure that your examination number is completed in the space provided on the Answer Sheet and that it is handed in with your Answer Book 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. Read the questions carefully.
 6. Start **EACH** question on a **NEW** page.
 7. Number your answers correctly according to the numbering system used in this question paper.
 8. Use the total marks that can be awarded for each of Questions 1, 2, 3 and 4 as an indication of the detail required.
 9. Non-programmable calculators may be used.
 10. 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	X	A	B	C	D
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- 1.1.1 One of the following is the correct order of the various structures in the digestive tract of a chicken.
- A Proventriculus; Crop; Duodenum; Gizzard
 B Crop; Proventriculus; Gizzard; Duodenum
 C Crop; Duodenum; Gizzard; Proventriculus
 D Proventriculus; Crop; Gizzard; Duodenum
- 1.1.2 The two devices used to synchronise ewes in a breeding program.
- (i) Oestrogen sponge
 (ii) Progesterone sponge
 (iii) FSH implant
 (iv) CIDR™
- A (i) and (ii)
 B (i) and (iii)
 C (ii) and (iii)
 D (ii) and (iv)
- 1.1.3 A large number of animals in a small area is a good example of ...
- A an intensive production system.
 B a semi-intensive production system.
 C an extensive production system.
 D a semi-extensive production system
- 1.1.4 Coprophagy or ingesting of faeces is practised by ...
- A ruminants.
 B hind-gut fermenters.
 C chickens.
 D monogastrics.

1.1.5 A steer enters the feedlot at 224 kg and after being fed for 110 days, the steer leaves the feedlot at 532 kg. The average daily gain of this steer is ...

- A 1,7 kg per day.
- B 2,0 kg per day.
- C 2,8 kg per day.
- D 3,0 kg per day.

1.1.6 The average gestation period of a ewe is ...

- A 147 days.
- B 152 days.
- C 156 days.
- D 160 days.

1.1.7 Artificial insemination has become the norm in the dairy industry of South Africa largely for the following reasons:

- (i) Availability of international genetics
- (ii) Crossbreeding purposes
- (iii) Rapid genetic progress
- (iv) Prevention of inbreeding

- A (ii) and (iii)
- B (i), (ii) and (iii)
- C (i), (ii) and (iv)
- D All of the above

1.1.8 Vaccination in cattle is a method commonly used to ...

- A treat illness.
- B prevent disease.
- C control ticks.
- D control internal parasites.

1.1.9 Chewing the cud by animals with complex stomachs is also known as ...

- A regurgitation.
- B peristalsis.
- C rumination.
- D none of the above.

1.1.10 Eragrostis hay in animal feeds is a source of ...

- A roughage.
- B carbohydrate.
- C energy.
- D protein.

(20)

1.2 In the table below, a description and **TWO** possible answers are given. Decide whether the description in **COLUMN Y** relates to **A only**, **B only**, **both A and B**, or **none** of the answers in **COLUMN X** 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 X	COLUMN Y
	1.2.6	A Maize meal B Bone meal	An example of a concentrate that is rich in protein.

ANSWER	1.2.6	A only	B only	A and B	None
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	COLUMN X	COLUMN Y
1.2.1	A Light-tight house B Open-sided house	A form of poultry house that is environmentally controlled.
1.2.2	A Infundibulum B Cervix	The portion of the reproductive tract that catches the ovum.
1.2.3	A Metabolic energy B Net energy	The portion of gross energy that is used for work, growth and fattening.
1.2.4	A Mechanical B Chemical	The type of digestion carried out by bacteria in the rumen.
1.2.5	A Redwater B Gall sickness	A disease caused by high worm infestation in sheep.

(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 structure that develops on the ovary after ovulation at the position of the burst follicle.
- 1.3.2 The type of organism that causes foot-and-mouth disease in cattle.
- 1.3.3 The portion of the reproductive tract of the hen where the shell is formed around the egg.
- 1.3.4 Roughage with a high moisture content that is mostly used as a feed source for dairy cattle.
- 1.3.5 The collective name for finger-like projections in the rumen of farm animals.

(10)

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 **Metoestrus (Metestrus)** is the longest period of the oestrus cycle that allows for the development of the corpus luteum.

1.4.2 A **maintenance** ration is used for work, growth and fattening.

1.4.3 **Mixing** involves the management practice and strategy that controls the introduction and spreading of diseases through contact.

1.4.4 **Toxins** are chemicals produced in the animal body to provide protection from diseases.

1.4.5 **Calcium** is an essential mineral nutrient for the synthesis of vitamin B₁₂ by rumen micro-organisms.

(5)

45 marks

SECTION B**QUESTION 2 ANIMAL NUTRITION**

Answer this question in your Answer Book.

2.1 The table below represents the nutritional information of Voermol's Dundee lick.

MIXING INSTRUCTIONS (kg)						
	Maintenance Lick			Production		
	1	2	3	4	5	
Voermol Dundee Lick Concentrate	400	250	300	200	250	
Voermol HPC 36	–	–	50	100	–	
Voermol Rumevite 12P	–	–	50	50	50	
Maize Meal	–	100	100	400	550	
Salt	250	150	250	150	150	
Total	650	500	750	900	1 000	
COMPOSITION (g/kg)						
Crude Protein (min)	505	427	363	260	251	
Urea (max)	167	136	109	60	68	
Calcium (max)	3	3	19	15	14	
Phosphorus (min)	1,2	1,5	9,6	9	7,8	
Energy (MJ ME/kg)	–	–	–	7,8	7,9	
% Protein derived from NPN	95,3	91,5	86	66,9	77,7	
RECOMMENDED INTAKE (g/animal/day)						
Cattle	300–470	355–470	450–600	1 550–1 750	1 520–1 750	

Refer to the above and answer the following questions.

- 2.1.1 The THREE maintenance licks in the table above should be fed with large amounts of roughage. Provide reasons to support this statement. (8)
- 2.1.2 Name the maintenance lick you would recommend for lactating dairy cows. Give a reason to support your answer. (3)
- 2.1.3 Among the THREE maintenance licks, recommend the one you would feed to animals on poorer quality grazing. Give a reason to support your answer. (4)

2.2 A researcher at an animal research station made the following observations:

Observation 1:
 A dairy cow took in 25 kg of a fodder with a moisture content of 12%. This cow then excreted 10 kg of manure with a moisture content of 25%.

Observation 2:
 The dairy cow needed a concentrate with a digestible protein (DP) content of 18% (feed requirement for this dairy cow). Two feeds are available, Feed A (with a DP value of 24%) and Feed B (with a DP value of 6%).

2.2.1 Calculate the digestibility coefficient of the fodder in Observation 1 above. Show ALL your calculations. (5)

2.2.2 Use the Pearson square to calculate the ratio in which Feed A and Feed B need to be mixed to get to the required DP value as indicated in Observation 2 above. (5)

2.3 The table below gives the nutritional information of selected feeds.

Feed	Crude Protein (%)	TDN (%)
Lucerne hay	25	62
Maize meal	9,5	80
Silage	7,5	75

2.3.1 Calculate the nutritive ratio (NR) for lucerne hay. Show ALL your calculations. (3)

2.3.2 Classify the scale of NR value of lucerne hay calculated in the previous question. (1)

2.3.3 Justify the suitability of lucerne hay for the fattening of matured animals by referring to the data above. (2)

2.4 State TWO functions of each of the following vitamins:

2.4.1 Vitamin A (2)

2.4.2 Vitamin D (2)

[35]

QUESTION 3 ANIMAL PRODUCTION, PROTECTION AND CONTROL

Start this question on a NEW page.

- 3.1 Foot-and-mouth disease is one of the major diseases affecting the South African animal product export market. The outbreak of this disease costs the agricultural sector millions of rands. As such, the disease is very closely monitored and controlled by farmers and government alike.
- 3.1.1 Describe TWO control measures to prevent the spread of this disease. (2)
- 3.1.2 Indicate THREE main types of livestock affected by foot-and-mouth disease. (3)
- 3.1.3 Describe THREE symptoms of foot-and-mouth disease. (3)

3.2 Refer to the photographs below and answer the questions that follow.



[Photograph by examiner, 2009]



[Photograph by examiner, 2009]

- 3.2.1 Identify the production system seen in the pictures above. (1)
- 3.2.2 Identify THREE biosecurity measures used by this farmer. (3)
- 3.2.3 Classify the labour intensity of the operation illustrated in the photographs. Justify your answer by making reference to the pictures above. (3)
- 3.2.4 The photographs shown above were taken later in the production cycle of these chickens.
 - (a) Looking at the house in the photographs above, suggest a potential problem the farmer may have experienced early in the production cycle. (1)
 - (b) Provide a solution which the farmer used to overcome this problem. (1)

3.3

Research into some of South Africa's indigenous sheep breeds has revealed that the sheep have lean meat, with fat concentrated in certain parts of the body. This has adapted the breeds to the harsh South African conditions with the localised fat helping the sheep to regulate their body temperature in hot climatic conditions.

In more modern breeds however selection has taken place for a more even fat distribution. This has led to an improvement in the carcass quality of some of the modern breeds.

The table below represents the change in body fat concentration in the hindquarter of mutton sheep in South Africa in the last 50 years.

Year	Body fat concentration (Hindquarter) (g/100 g)
1960	30
1970	25
1980	20
1990	15
2000	10
2010	5

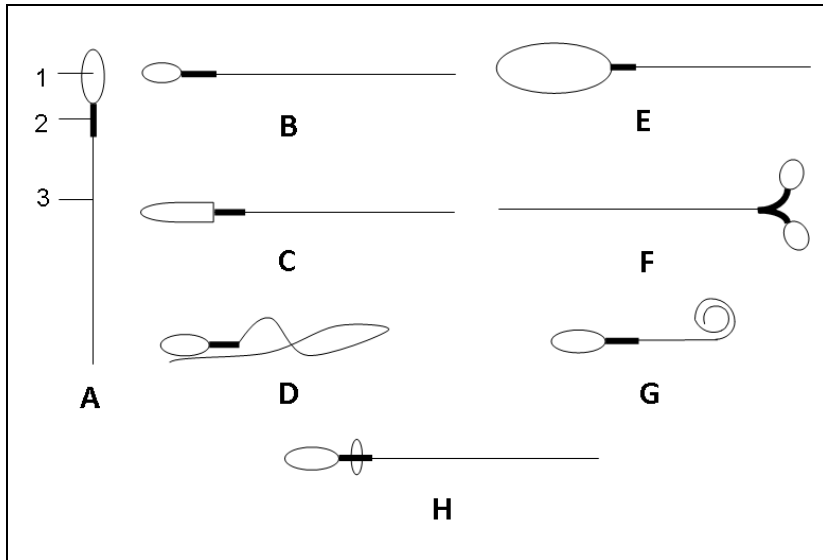
- 3.3.1 (a) Name TWO breeds of sheep that are indigenous to South Africa. (2)
- (b) Name TWO modern breeds of sheep that contain indigenous sheep genetics. (2)
- 3.3.2 Explain TWO reasons why animal breeders aim to produce meat with more even fat distribution. (2)
- 3.3.3 Draw a line graph of the total fat content measured over the 50-year period using the table above. (6)
- 3.3.4 Describe the trend in fat distribution over the 50-year period evident from the graph. (2)
- 3.4 Describe FOUR attributes that a well-designed cattle-handling facility should have. (4)

[35]

QUESTION 4 ANIMAL REPRODUCTION

Start this question on a NEW page.

4.1 The diagrams below indicate morphological abnormalities of sperm cells that play an important role in normal animal reproduction.



4.1.1 Identify the part labelled **2** in structure **A**. (1)

4.1.2 Select the normal structure of a sperm cell from **A** to **H**. (1)

4.1.3 Give the number of the section of the sperm that would be responsible for the following:

(a) Movement (1)

(b) Carrier of genetic information (1)

4.1.4 Name the organ where the structures illustrated in the diagram above are formed. (1)

4.2 Describe FIVE signs of oestrus in cattle. (5)

4.3 Copy the following table into your Answer Book and fill in the blanks. Testosterone has been done for you as an example.

Hormone	Where it is produced	Function	Where is feedback to
Testosterone	Testes	– Development of testes and penis – Sperm production – Secondary sexual characteristics	Pituitary gland
Follicle-Stimulating Hormone			
Progesterone			

(8)

4.4 Discuss the effect the following would have on a bull's fertility.

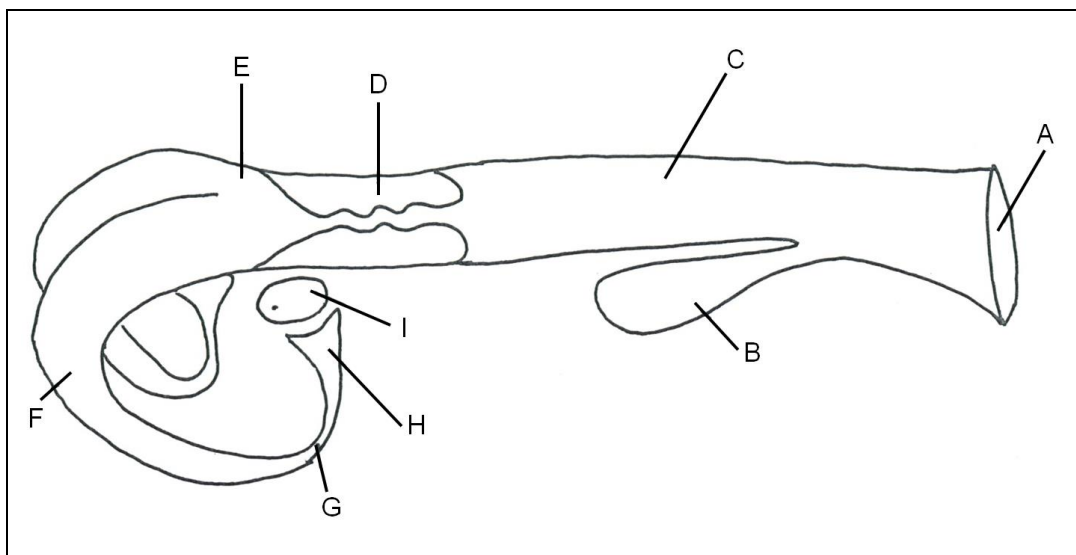
4.4.1 Heat stress (2)

4.4.2 The use of a burdizzo (2)

4.4.3 Poor nutrition (2)

4.4.4 A bull—cow ratio of 1 : 60 (2)

4.5 Label the parts of the bovine reproductive tract in the diagram below. In your Answer Book list the letters and give the name next to each.



(9)
[35]

105 marks

Total: 150 marks