



AGRICULTURAL SCIENCES: PAPER I

Time: 2½ hours

150 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of 12 pages including an Answer Sheet. 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 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. Start each question on a NEW page.
 6. Number your answers correctly according to the numbering system used in this question paper.
 7. Non-programmable calculators may be used.
 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. 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	B	C	D
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- 1.1.1 One of the following groups of chemicals is responsible for the regulation of animal reproductive systems.

- A Enzymes
- B Hormones
- C Amino acids
- D Steroids

- 1.1.2 The fate of energy in the diet of an animal can be shown as follows:

Gross Energy → X Energy → Metabolic Energy → Y Energy

What are the types of energy at X and Y respectively?

	X	Y
A	Net	Total
B	Total	Digestible
C	Digestible	Net
D	Digestible	Total

- 1.1.3 The growth rate (kg/day) for each animal in a pen of steers is shown in the table below:

2.7	2.1	1.7	2.0	1.8	2.5	2.5	1.7	2.0
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What is the mean growth rate for the pen of steers?

- A 1,90 kg/day
- B 2,00 kg/day
- C 2,11 kg/day
- D 2,38 kg/day

- 1.1.4 A farmer is planning the lambing season for a flock of ewes. The average gestation period for a sheep is 147 days.

If the first lambs are to be born at the end of July, the rams need to be joined with ewes that are cycling no later than the beginning of ...

- A January.
- B February.
- C March.
- D April.

- 1.1.5 Ruminant animals can achieve high growth rates on a diet containing only low quality protein.

The feature of rumen microbes that allows this to occur is the ability to ...

- A digest cellulose.
- B synthesise amino acids.
- C produce B group vitamins.
- D synthesise volatile fatty acids.

- 1.1.6 One of the following is a method used regularly in cattle to control ticks.

- A Vaccinating
- B Drenching
- C Dosing
- D Dipping

- 1.1.7 A disadvantage associated with artificial insemination in livestock breeding.

- A It may lead to an increase in inbreeding.
- B It may lead to an increase in sexually transmitted diseases.
- C It may reduce the range of male genotypes available to a farmer.
- D It may reduce the number of offspring sired by genetically superior animals.

- 1.1.8 A reason for farmers to increase the quality and quantity of food available to female animals prior to placing them with male animals for mating.

- A To increase the length of the oestrus cycle.
- B To increase milk production during lactation.
- C To increase the chance of survival of an offspring.
- D To increase the rate of ovulation in their breeding stock.

- 1.1.9 This is a major difference between the digestive processes in ruminant and monogastric animals.

- A Monogastric animals do not require roughage in their diets.
- B Ruminant animals are able to synthesise some B group vitamins.
- C Monogastric animals use their own enzymes in the process of digestion.
- D Ruminant animals are able to convert some amino acids into other amino acids.

- 1.1.10 One of the following is the most likely consequence for farm animals under conditions of sustained high temperatures.

- A Early onset of puberty.
- B Reduced fertility in male animals.
- C Increased birth weights of offspring.
- D Increased ovulation rates in female animals.

(20)

1.2 In the table below, a description and **TWO** possible answers are given. Decide 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 B Bone meal	An example of a concentrate that is rich in protein.

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 Treatment B Vaccination	The action taken once an animal is showing symptoms of illness.
1.2.2	A Oestrogen B Progesterone	A hormone involved in regulating the female reproductive system.
1.2.3	A Parasite B Pathogen	The name given to organisms that cause disease.
1.2.4	A Sheep B Cattle	The ruminant animals most affected by wire worm.
1.2.5	A Proventriculus B Duodenum	Mechanical digestion takes place in this part of a chicken.

(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 hormone responsible for the maintenance of pregnancy.
- 1.3.2 The vitamin sometimes referred to as the sunshine vitamin as it is produced by the body when time is spent in the sun.
- 1.3.3 The type of production where a large number of animals are kept in a relatively small area and pushed to produce as much as possible.
- 1.3.4 The index of the quality of a protein in animal feed.
- 1.3.5 The structure in a hindgut fermenter where fermentation of fibre takes place.

(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 **Artificial insemination** is the procedure during which an embryo is placed into the uterus of a surrogate female.
- 1.4.2 A crush or handling facility with a long **straight** passage is the ideal design for ease of cattle movement.
- 1.4.3 **Metabolic** energy is the energy used to maintain the animal.
- 1.4.4 A **parasitic** relationship is mutually beneficial to both species involved.
- 1.4.5 Mastitis is an infection in the **digestive** system of a cow.

(5)

45 marks

SECTION B**QUESTION 2 ANIMAL NUTRITION**

This question must be answered in your Answer Book.

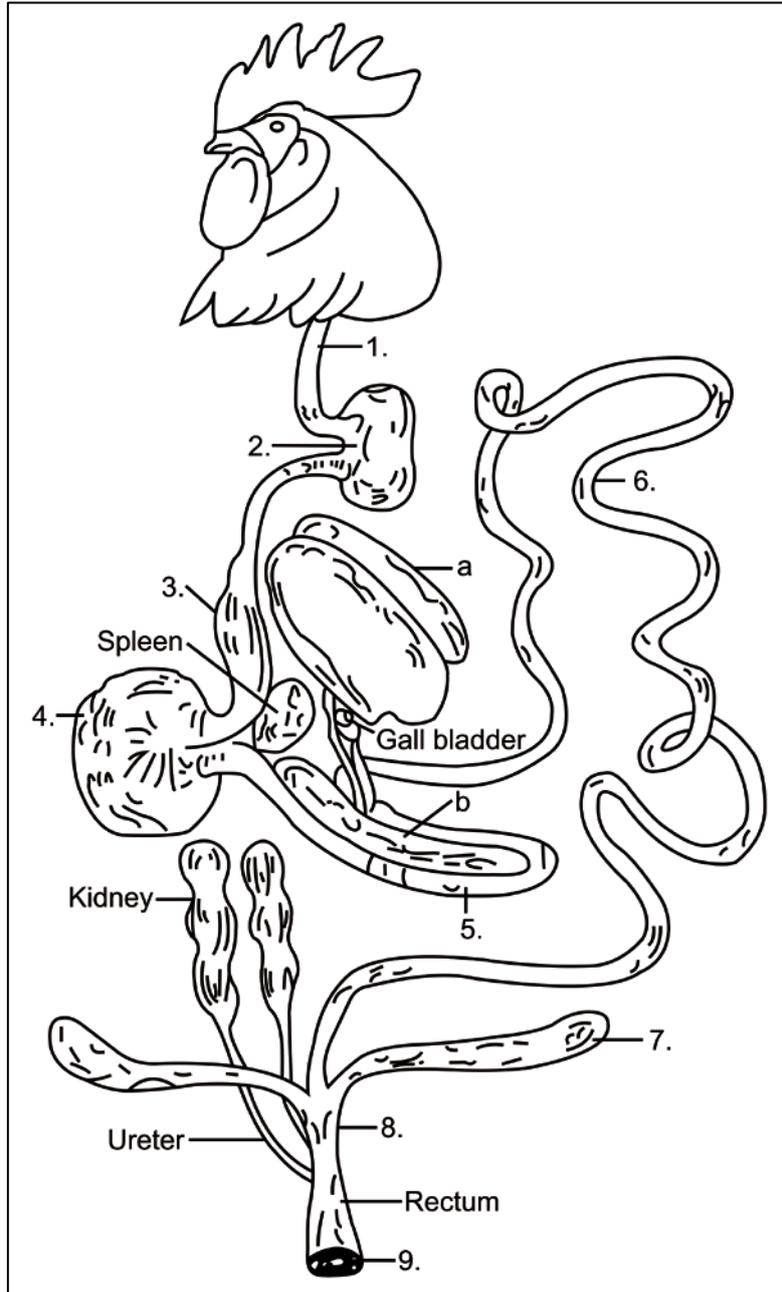
2.1 The table below represents the nutritional information of selected feeds.

Feed	Crude Protein %	Crude Fibre %	Metabolisable energy MJ/kg
Lucerne pasture	22,5	25,8	9,4
Veld grass	7,0	36,0	8,0
Lucerne hay	14,1	30,1	7,5
Groundnut hay	9,2	24,1	8,7
Milk powder	33,5	0,0	12,0
Maize meal	8,9	2,0	12,0
Blood meal	82,2	0,0	9,1
Fish meal	60,9	0,0	10,6
Sorghum grain	11,0	1,7	12,2

- 2.1.1 Identify **TWO** feeds listed above that are the best examples of protein-rich concentrates. (2)
- 2.1.2 Explain the reason for monogastric animals not being able to utilise and digest normal pasture grass. (2)
- 2.1.3 Indicate a feed from the table above that has the lowest crude-fibre content. Give a reason for the very low crude-fibre content by referring to the type of feed. (2)
- 2.1.4 Explain a possible reason for the high metabolisable energy in sorghum grain. (2)
- 2.1.5 Suggest a feed that will be the most suitable for production of muscle. Give a reason for your answer. (2)
- 2.1.6 The farmer wants to fatten some lambs using a ration with a crude protein of 14%. The farmer currently has maize meal and lucerne hay available.

Use the Pearson Square method to calculate how much maize meal and lucerne hay should be mixed together in order to meet the requirements mentioned above. (5)

2.2 Refer to the diagram below of the alimentary canal of a fowl and answer the questions that follow:



2.2.1 Identify the parts of the digestive tract numbered 1 to 9. (9)

2.2.2 Organ b plays an important role in the digestion of a chicken.

(a) Identify the organ labelled b. (1)

(b) Mention the function of organ b in digestion. (1)

- 2.3 The information below pertains to the feeding of Voermol Maxiwol Concentrate. Referring to this information, answer the questions that follow.

Mixing instructions (kg)				
	Maintenance Lick	Licks for producing animals on different types of grazing		
		1	2	3
Voermol Maxiwol Concentrate	400	150	200	250
Maize meal/whole grain	–	300	250	200
Salt	100	50	50	50
Total	500	500	500	500
Composition of lick (g/kg)				
Crude Protein (min)	280	153	180	205
Urea (max)	48	18	24	30
Calcium (max)	9,76	4,6	5,8	7,1
Phosphorus (min)	2,88	2,8	2,8	3,1
% Protein derived from NPN	58	39,8	45,1	49,5
Recommended intake (g/sheep/day)				
Dry sheep	125–200	250–300	250–300	250–300
Growing sheep	–	250–500	250–500	250–500
Late pregnancy	–	250–350	250–350	250–350
Lactating ewes	–	350–500	350–500	350–500
Flush feeding of ewes	–	300–400	300–400	300–400

[Extracted from: *Voermol Product Guide*, 13th Edition, page 50]

- 2.3.1 Explain why the late pregnant animals have a lower recommended intake than the growing, lactating, and flushing ewes. Use information from the table provided to support your answer. (3)
- 2.3.2 Evaluate each of the feeding systems mentioned below and select the most suitable lick from the table provided above. Give a reason for your choice.
- (a) Animals grazing mixed Karoo veld, which consists of grasses and Karoo shrubs. (2)
- (b) Animals grazing on cultivated pastures made up of a mixture of Rye grass, Kikuyu and Clover. (2)
- (c) Animals grazing on a dry veld or dry crop residues. (2)

[35]

QUESTION 3 ANIMAL PRODUCTION, PROTECTION AND CONTROL

Start this question on a NEW page.

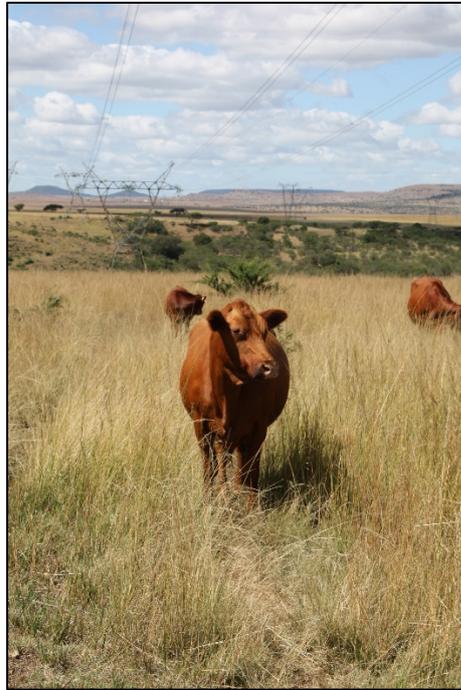
3.1 Study the pictures of farm animals shown below and answer the questions that follow.

A



[Photograph by examiner, 2012]

B



[Photograph by examiner, 2011]

- 3.1.1 Identify which of the pictures above (A or B) represents intensive animal production and which picture represents extensive animal production. (2)
- 3.1.2 Give **THREE** key characteristics of an extensive production system. (3)
- 3.1.3 Looking at the current drought situation in the country, name the production system which will be the most affected and provide a reason. (3)
- 3.1.4 Suggest **FOUR** strategies the farm in scenario B could use to help cope with water shortages. (4)
- 3.1.5 Give **THREE** important behaviours a farmer would look for when assessing the health of the cattle seen in B. (3)
- 3.1.6 List **FIVE** ways in which disease spread can be controlled or prevented in Picture A. (5)
- 3.1.7 Referring to the production system in Picture B, explain the difference between vaccination, dipping and dosing. (3)

- 3.2 Temperature within a piggery has a direct influence on feed and water intake of pigs. The table below shows the number of times per day, on average, that the pigs visited the water and feed troughs at various temperatures in a piggery.

Temperature in the piggery (°C)	Visits to the water trough (per day per pig)	Visits to the feed trough (per day per pig)
10	1	9
18	3	7
22	4	6
30	6	4
38	10	2
42	14	1

Refer to the table above and answer the questions that follow.

- 3.2.1 Using a bar graph, plot the number of visits per pig to the water and feed troughs at different temperatures. (6)
- 3.2.2 Identify the temperature range at which you would advise the farmer to keep the piggery. Give two reasons to support your answer. (3)
- 3.2.3 Describe **THREE** ways in which a pig farmer goes about controlling random breeding in the piggery. (3)

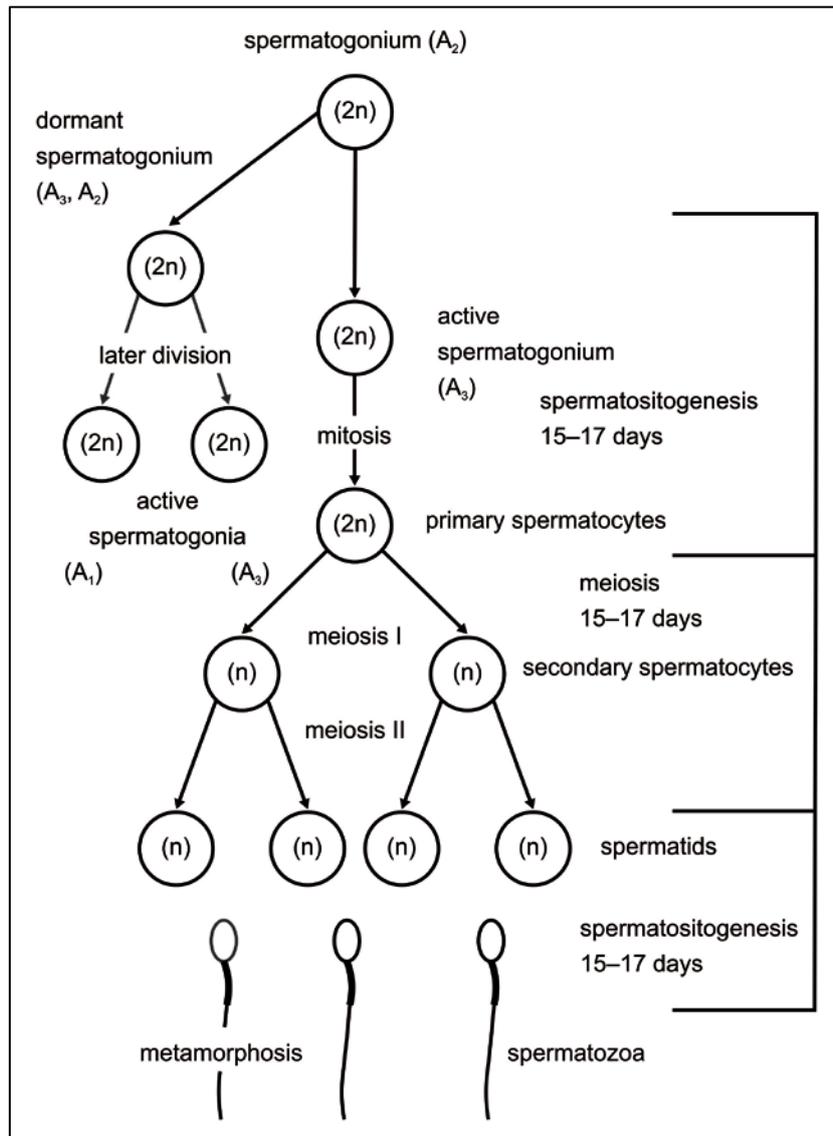
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QUESTION 4 ANIMAL REPRODUCTION

Start this question on a NEW page.

- 4.1 Artificial insemination is becoming more popular in the beef and dairy industry in South Africa.
- 4.1.1 Explain why dairy farmers would rather practise artificial insemination than purchase a bull. (5)
- 4.1.2 Give **THREE** important factors that need to be controlled when handling semen. (3)
- 4.1.3 Describe **FOUR** signs of oestrus in cattle. (4)
- 4.1.4 Should the cow be chased back to the grazing camp immediately after being inseminated? Give a reason for your answer. (3)

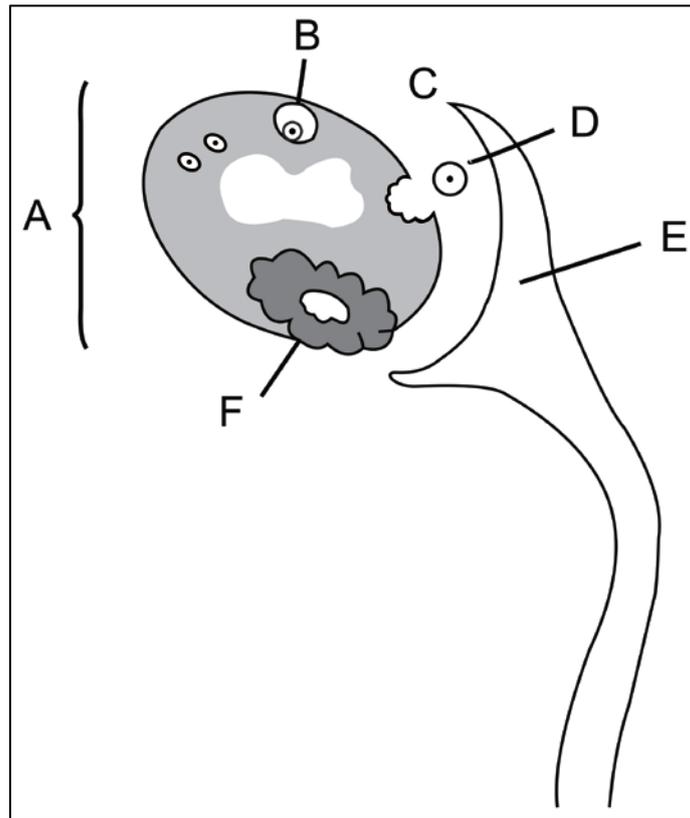
4.2 The diagram below illustrates the process of spermatogenesis.



[Diagram by examiner, 2016]

- 4.2.1 Briefly describe the process of *spermatogenesis*. (4)
- 4.2.2 Explain the role of meiosis in the spermatogenesis process. (2)
- 4.2.3 Name **TWO** congenital defects that may disturb the spermatogenesis process. (2)

4.3 Refer to the diagram below of a portion of the female reproductive tract of a mammal and answer the questions that follow:



[Image by examiner, 2016]

- 4.3.1 Name structures A, B, D, E and F (5)
- 4.3.2 Identify the process taking place at C. (1)
- 4.3.3 Supply the name of the hormones associated with each of the following functions:
- (a) Stimulating the development of structure B. (1)
 - (b) Stimulating process C. (1)
 - (c) Characterises the visible signs of oestrus. (1)
 - (d) Secreted by structure F. (1)
- 4.3.4 Describe how structure E is adapted to successfully capture structure D. (2)

[35]

105 marks

Total: 150 marks