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TOTAL MARKS

NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2022

AGRICULTURAL SCIENCES

EXAMINATION NUMBER

Time: 3 hours 300 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of 40 pages. Please check that your question paper is complete.
2. Read the questions carefully.
3. **Answer ALL the questions on the question paper and hand it in at the end of the examination. Remember to write your examination number in the space provided.**
4. This question paper consists of **THREE** sections, namely **SECTION A**, **B** and **C**.
5. ALL SIX questions must be answered in the spaces provided on the question paper.
6. Use the marks awarded for each question as an indication of the detail required.
7. Non-programmable calculators may be used.
8. Show all your calculations, including formulae and units, where applicable.
9. It is in your own interest to write legibly and to present your work neatly.
10. Two blank pages (pages 39 and 40) are included at the end of the paper. If you run out of space for a question, use these pages. Clearly indicate the number of your answer should you use this extra space.

FOR MARKERS' USE ONLY

Question	1	2	3	4	5	6	**Total**
Marks	80	50	50	50	50	20	**300**
Obtained							

SECTION A

QUESTION 1

1.1 **DIAGRAM A** and **DIAGRAM B** below represent sexual reproduction in plants. Match the letter (A–G) from the diagrams that represent each of the following:

DIAGRAM A

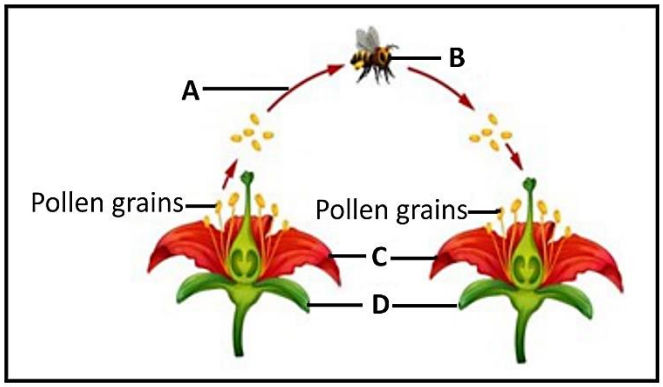
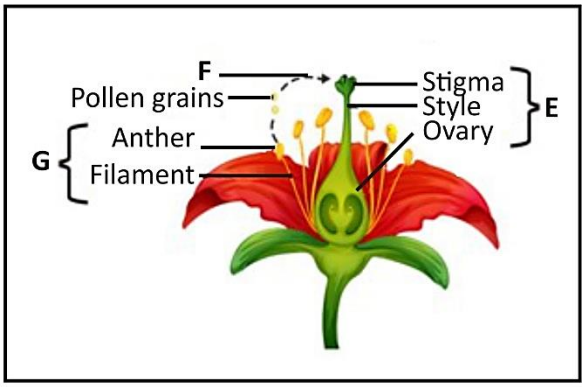


DIAGRAM B



1.1.1 Male reproductive part of a flower

_____

(2)

1.1.2 Indicates cross pollination

_____

(2)

1.1.3 Agent of pollination

_____

(2)

1.1.4 Protects the flower while still in the bud

_____

(2)

1.1.5 Attracts insects to the flower

_____

(2)

1.1.6 Female reproductive organ of flower

_____

(2)

1.2 Change the UNDERLINED WORD(S) in each of the following statements to make the statements TRUE. Write only the correct word(s) in the spaces provided.

1.2.1 The part of the sperm cell that facilitates penetration into the ovum is called the mid-piece.

_____

(2)

1.2.2 Grading is the provision of standard specifications that will give uniformity to a group of products.

_____

(2)

1.2.3 The gestation period in dairy cattle refers to the period between two lactations.

_____

(2)

1.2.4 The reappearance of a characteristic after its apparent absence for a few generations is known as epistasis.

_____

(2)

1.2.5 Parthenocarpy involves weakening, opening, or otherwise altering the coat of a seed to encourage germination.

_____

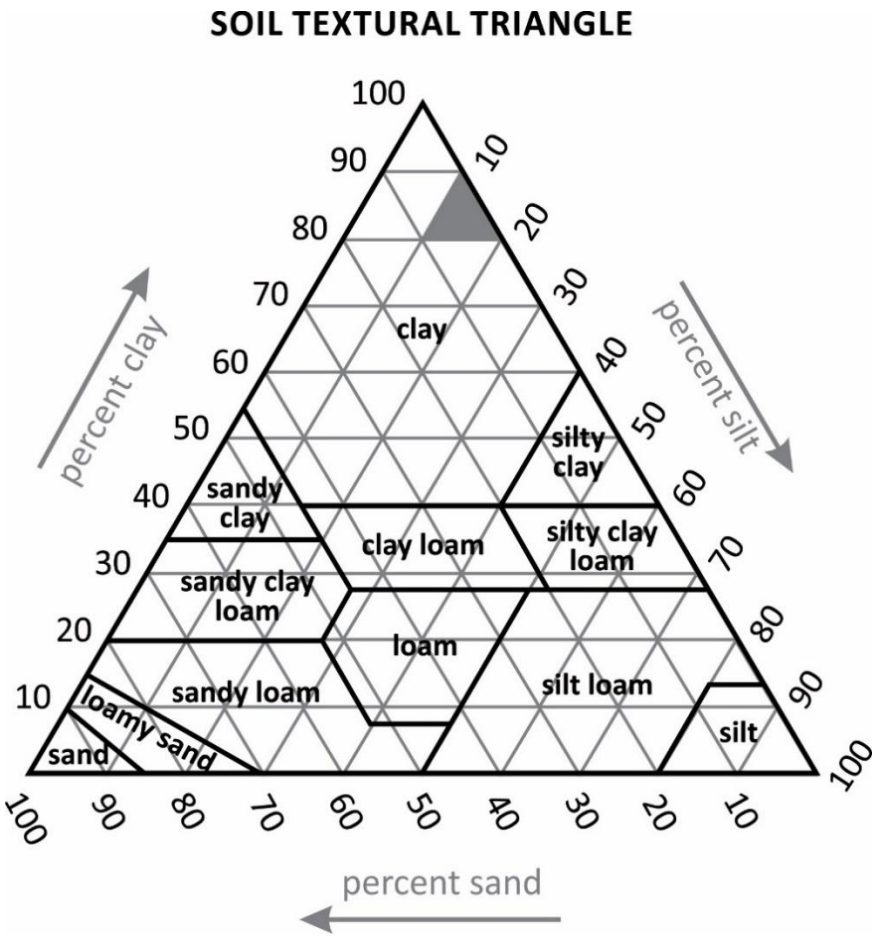
(2)

1.2.6 Heredity is the study of how characteristics are passed from parents to offspring.

_____

(2)

1.3 A natural system approach to soil classification involves grouping soils by their properties such as soil texture and structure, their behaviour or their genesis.



Use the soil textural triangle to complete the table below by supplying labels for letters A to F.

	Soil sample	Soil sample particles			Texture Name
		% Clay	% Sand	% Silt	
1.3.1	**2**	60	30	**A**	Clay
1.3.2	**3**	**B**	40	40	Loam
1.3.3	**4**	10	85	5	**C**
1.3.4	**5**	45	10	45	**D**
1.3.5	**6**	5	35	**E**	Silty loam
1.3.6	**7**	40	50	10	**F**

1.3.1 A _____ 1.3.4 D _____

1.3.2 B _____ 1.3.5 E _____

1.3.3 C _____ 1.3.6 F _____

(12)

1.4 Give the correct term for each of the following descriptions. Write only the term in the spaces provided.

1.4.1 The yellowish and fatty milky fluid that comes from the udder of cows the first few days after giving birth, before true milk appears.

_____

(2)

1.4.2 The transfer of genetic characteristics from generation to generation.

_____

(2)

1.4.3 A condition that occurs in male animals where testes remain in the abdominal cavity and do not descend into the scrotum.

_____

(2)

1.4.4 Risk management strategy by farmers to ensure a secure market and price by entering into future contracts.

_____

(2)

1.4.5 The male animal shows interest in the female, but is unable to service and fertilise the female.

_____

(2)

1.4.6 The management practices to reduce the risks of introducing and spreading pests or diseases on the farm.

_____

(2)

1.5 Each of the following questions has an image and two labels, i and ii. Indicate with a cross in the relevant block whether the image relates to **only i**, **only ii**, **i and ii** or **neither i nor ii**.

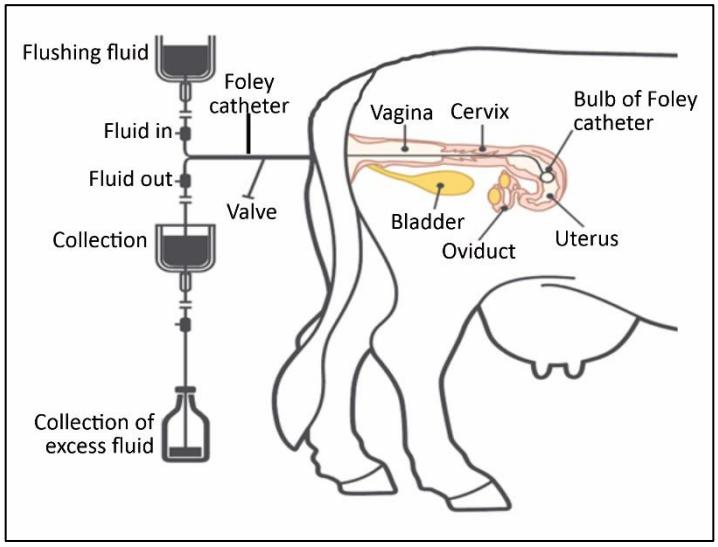
1.5.1

(i) soil surveys
(ii) soil mapping

A only (i) ☐
B only (ii) ☐
C (i) and (ii) ☐
D neither (i) nor (ii) ☐

(2)

1.5.2

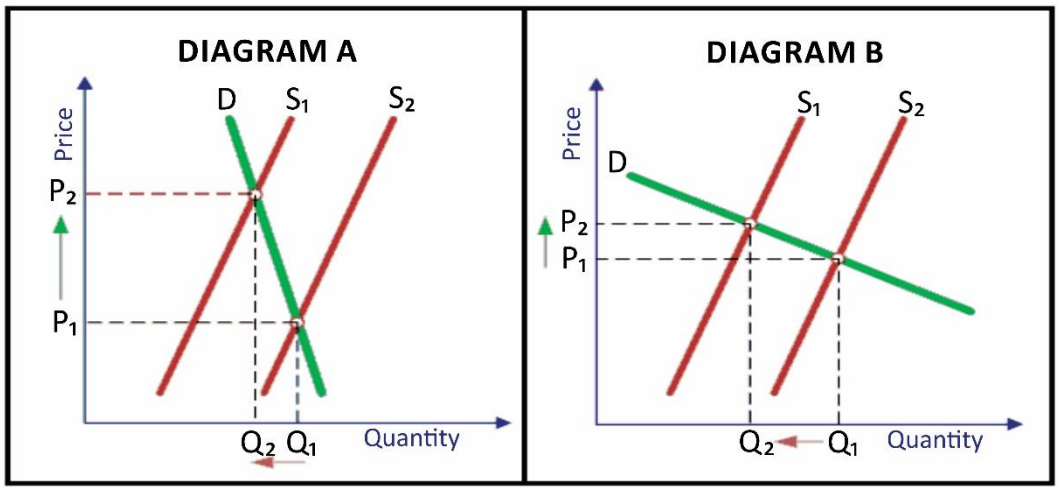


(i) Nuclear transfer
(ii) Embryo transfer

A only (i) ☐
B only (ii) ☐
C (i) and (ii) ☐
D neither (i) nor (ii) ☐

(2)

1.5.3

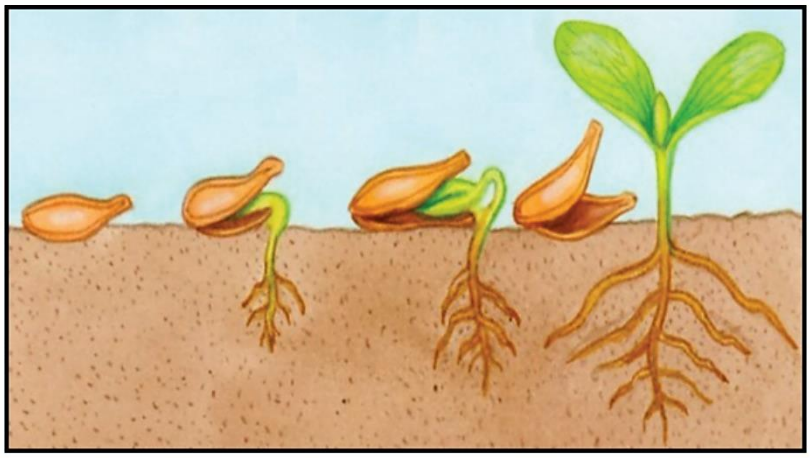


(i) Diagram A inelastic demand and Diagram B elastic demand
(ii) Diagram A elastic demand and Diagram B inelastic demand

A only (i) ☐
B only (ii) ☐
C (i) and (ii) ☐
D neither (i) nor (ii) ☐

(2)

1.5.4

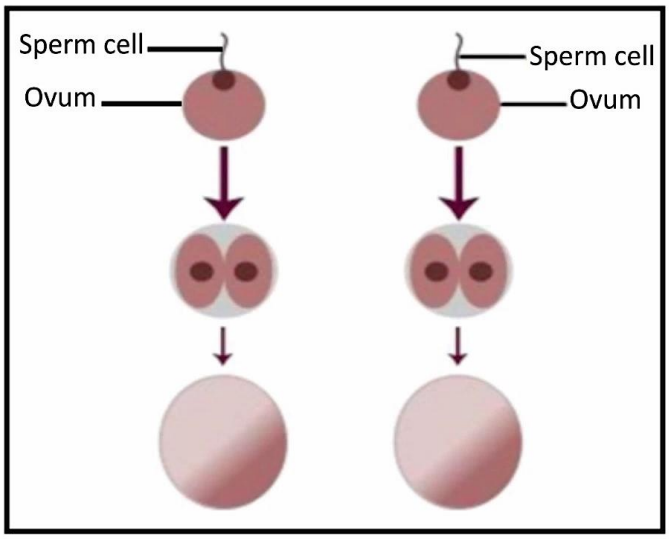


(i) Pollination process
(ii) Fertilisation process

A only (i) ☐
B only (ii) ☐
C (i) and (ii) ☐
D neither (i) nor (ii) ☐

(2)

1.5.5



(i) Fraternal (Dizygotic)
(ii) Identical (Monozygotic)

A only (i)

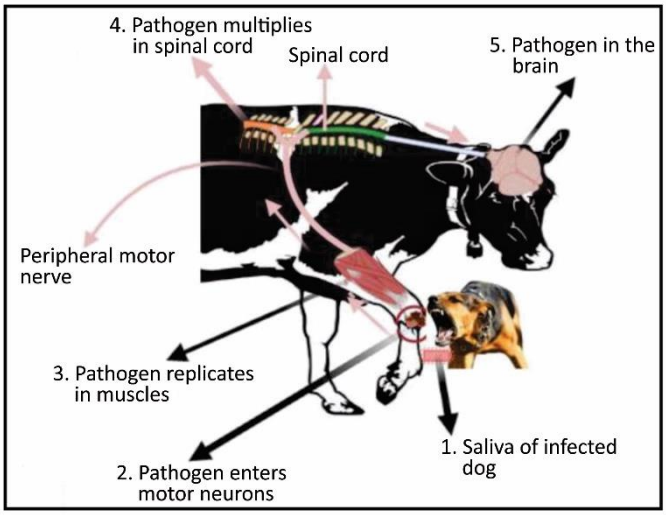
B only (ii)

C (i) and (ii)

D neither (i) nor (ii)

(2)

1.5.6



(i) Foot and Mouth Disease
(ii) Rabies disease

A only (i)

B only (ii)

C (i) and (ii)

D neither (i) nor (ii)

(2)

1.6 Four options, A to D, are provided as possible answers to the following questions. Make a cross (X) in the block next to the correct answer. NO marks will be awarded if more than one option is marked.

1.6.1 What is a soil horizon?

A	A factor influencing how soil is formed	☐
B	A layer of soil	☐
C	An organism found within the soil	☐
D	A technique used to map soils	☐

(2)

1.6.2 Which of the following is NOT a threat commonly faced by soils?

A	Percolation	☐
B	Soil erosion	☐
C	Deforestation	☐
D	Climate change	☐

(2)

1.6.3 Subcutaneous injections are given …

A	in the muscle.	☐
B	orally.	☐
C	in the ear.	☐
D	under the skin.	☐

(2)

1.6.4 The blastocyst consists of two layers of cells. The layer responsible for nutrition of the developing embryo is called the …

A	trophoblast.	☐
B	mesoderm.	☐
C	embryoblast.	☐
D	ectoderm.	☐

(2)

1.6.5 Choose the correct combination of statements that apply to the blue tick:

(i) Transmits diseases such as anaplasmosis and heartwater
(ii) Represents endoparasites
(iii) Example of one-host ticks
(iv) Remains on one host during larval and nymphal stages

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

(2)

1.6.6 One of the following is an example of a primary female reproductive organ:

A Uterus ☐
B Vagina ☐
C Testis ☐
D Ovaries ☐

(2)

1.6.7 Those traits in which there is a sharp distinction between phenotypes, such as black and white or polled and horned in livestock.

A Quantitative ☐
B Continuous ☐
C Qualitative ☐
D Variation ☐

(2)

1.6.8 A market where cattle are sold by public bidding with the animals going to the highest bidder is known as a …

A contract market. ☐
B auction market. ☐
C electronic market. ☐
D internet market. ☐

(2)

1.6.9 The degree to which the crossbred offspring outperforms its parent purebreds is known as …

A	hybrid vigour.	☐
B	Rocio condition.	☐
C	high performance.	☐
D	phenotype.	☐

(2)

1.6.10 A breeder wants to compare values to select between two cultivars. Considering the formula, P = G + E, what must that breeder do to ensure the correct cultivar is selected?

A	Change the growing environment so each cultivar has the same phenotype.	☐
B	Minimise the differences between growing environments for each cultivar.	☐
C	Grow one cultivar one year and the other cultivar the next year and then compare.	☐
D	Only compare cultivars that are very similar genetically.	☐

(2)

80 marks

SECTION B

QUESTION 2

2.1

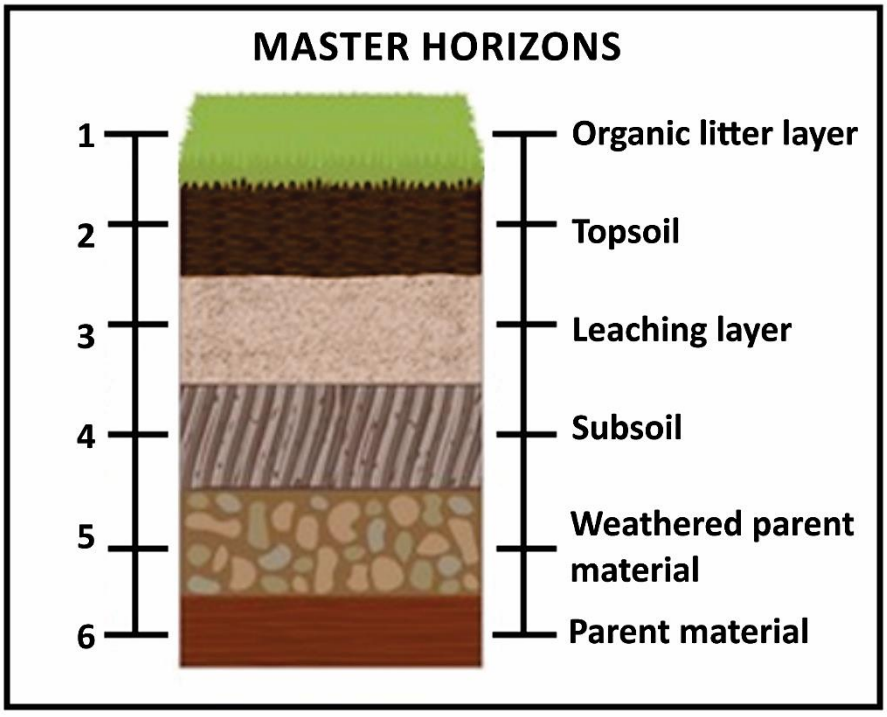
Soil erosion and land degradation: the global risks

Soils develop horizons due to the combined process of organic matter deposition, decomposition, illuviation of clays, oxides and other mobile compounds downward with the wetting front. In moist environments free salts are leached completely out of the profile, but they accumulate in desert soils.

The total land area of the world exceeds 13 billion hectares, but less than half of it can be used for agriculture, including grazing. The world's potential arable land is estimated at 3031 million hectares or 22% of the total land area. Soil is one of the main resources that the farmer can utilise for production and it needs special care. Soil surveys and the resultant soil mapping are aimed at utilising soil for the production purpose for which it is most suited.

Soil is classified according to a hierarchy of classes. A soil classification system has been developed to provide scientists and resource managers with generalised data about the nature of soil found in a particular location.

[*Extracted from by Rattan Lal, Advances in soil science, 129–172*, 1990]



2.1.1 Name the vertical cross section showing the master horizons above.

_____

_____

(2)

2.1.2 Indicate THREE aims of soil surveys in the agriculture industry.

(3)

2.1.3 Identify the master horizons **1** to **6** depicted in the structure on page 12.

(6)

2.1.4 What are the TWO main categories of the binomial soil classification systems in South Africa?

(2)

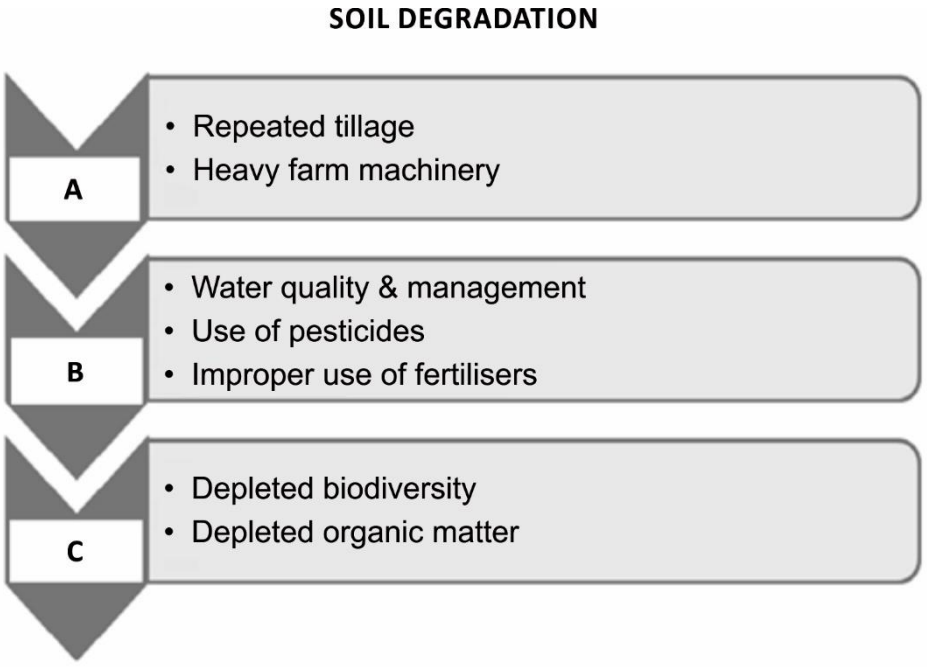
2.1.5 Give TWO reasons for classifying soils in agriculture.

(4)

2.1.6 Explain the soil survey process in agriculture with steps that need to be followed during soil surveying.

(6)

2.2



2.2.1 Identify the types of soil degradation indicated by **A**, **B** and **C** above.

(3)

2.2.2 Define *soil degradation*.

(2)

2.2.3 Explain how soil degradation can be a threat to agricultural productivity.

(6)

2.3

A farmer uses technology that enables her to move from blanket fertilisation to applying only the fertiliser required for a specific area. It also allows the farmer to compare harvest information and identify poor spots in lands. The farmer uses new information and communication technologies (NICT), such as GPS and GIS.

2.3.1 Identify the farming system depicted in the scenario above.

(1)

2.3.2 Identify a piece of equipment that plays a central role in the farming system in the scenario above.

(1)

2.3.3 Give THREE basic principle aims of the farming system identified in Question 2.3.1.

(6)

2.3.4 What do the acronyms below stand for?

(a) GPS

(2)

(b) GIS

(2)

2.3.5 Explain the purpose of farmers using the following special equipment on their tractors.

(a) GPS

(2)

(b) GIS

(2)

[50]

QUESTION 3

3.1 Agricultural marketing comprises all activities involved in the supply of farm inputs to the farmers and the movement of agricultural products from the farms to the consumers.

There are many options open to both commercial and subsistence farmers wishing to market agricultural products. Emerging farmers use different types of marketing channels to market their produce. Each marketing channel has associated costs such as transportation costs, profits and prices of produce. Before choosing a marketing channel a farmer has to consider these costs. The farmer's choice of marketing channel can pose problems and result in lower earnings. In general, the income of the farmer can be determined by the choice of marketing channel used.

An investigation was conducted using a sample of farmers who claimed to be using more than one marketing channel. They were allowed to choose more than one answer from the questionnaire used. Therefore, the percentages in the table are expected not to add up to 100% as one answer was chosen more than once from the questionnaire. The results were treated separately and are presented separately in the table below.

Marketing channels	Distribution (%)
Word of mouth	52
Spot markets	44
Farm gate sales	14
Local traders	62
Urban consumers	20
Rural consumers	45

[*Adapted South African Journal of Agricultural Extension: volume.44 no.1, Pretoria 2016*]

3.1.1 Identify the type of marketing system depicted in the picture above.

(2)

3.1.2 State THREE visible reasons shown in the picture to support your answer to Question 3.1.1.

(3)

3.1.3 Draw a bar graph representing the marketing channels and distribution according to the results of the investigation shown in the table above.

(10)

3.1.4 Tabulate THREE differences between marketing and selling.

Marketing	Selling

(6)

3.1.5 A good marketing strategy involves paying much attention to the marketing mix. Name the four Ps of marketing.

(4)

3.1.6 Give THREE approaches to marketing that the farmer can adopt to market a product.

(3)

3.2 Complete the table below by writing down ONLY the missing information for **A**, **B**, **C** and **D**.

DISEASE	PATHOGEN	SYMPTOMS	TYPE OF ANIMAL
A	Virus	Blisters on the muzzle and tongue	All farm animals
Tuberculosis (TB)	**B**	Affects respiratory tract with coughing and high rate of respiration	All farm animals
C	Protozoan	Rupture of the cells of intestinal lining, diarrhoea and watery faeces with traces of blood and intestinal mucosa	Most farm animals
Ringworm	**D**	A round wound with a scabby surface forms	All farm animals

A _____

B _____

C _____

D _____

(4)

3.3 Use the following scenario to answer the questions that follow:

The disease is caused by a virus. It is spread to sheep, cattle and goats by mosquitos and it causes abortion and death of the farm animals. People can get the disease if they handle blood, tissues or other body fluids of infected animals. The disease does not spread from person to person. By law, if a farmer suspects that some animals are infected, authorities should be alerted immediately.

3.3.1 Name the disease described in the scenario above.

_____

(2)

3.3.2 Identify the following from the scenario above:

(a) Vector

_____

(1)

(b) Pathogen

_____

(1)

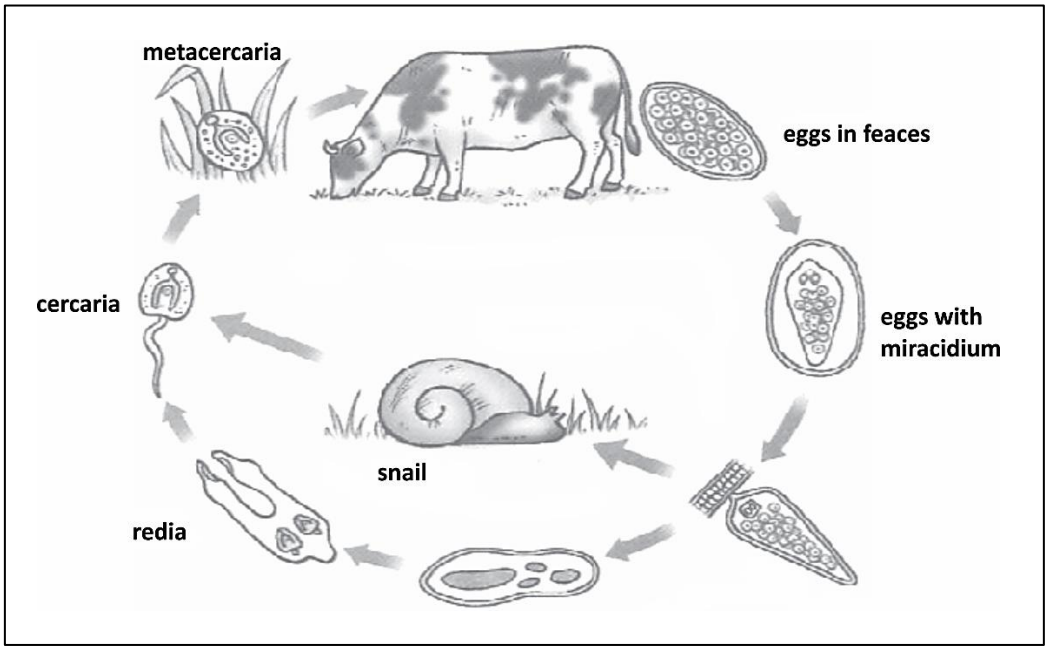
3.3.3 Extract from the scenario on page 20 a sentence indicating that the disease is a notifiable disease.

(2)

3.3.4 Suggest THREE economic implications of animal diseases to the farmer.

(3)

3.4 Life cycle of a parasite.



3.4.1 Identify the main group of internal parasites represented in the schematic representation above.

(2)

3.4.2 Name the intermediate host in the schematic representation above.

_____

_____

(2)

3.4.3 Give TWO other main groups of internal parasites not mentioned in Question 3.4.1

_____

_____

(2)

3.4.4 Suggest THREE pasture management measures to control the parasite indicated in Question 3.4 on page 21.

_____

_____

_____

_____

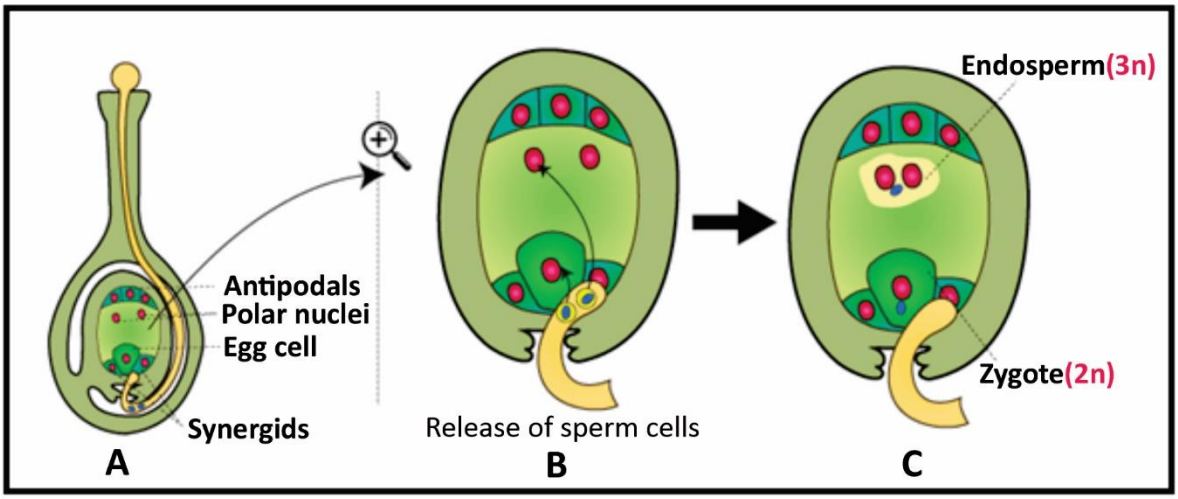
_____

_____

(3)
[50]

QUESTION 4

4.1 The diagram below shows a reproductive process. Study the diagram and use it to answer the questions that follow:



4.1.1 Identify the reproductive process represented by C.

(2)

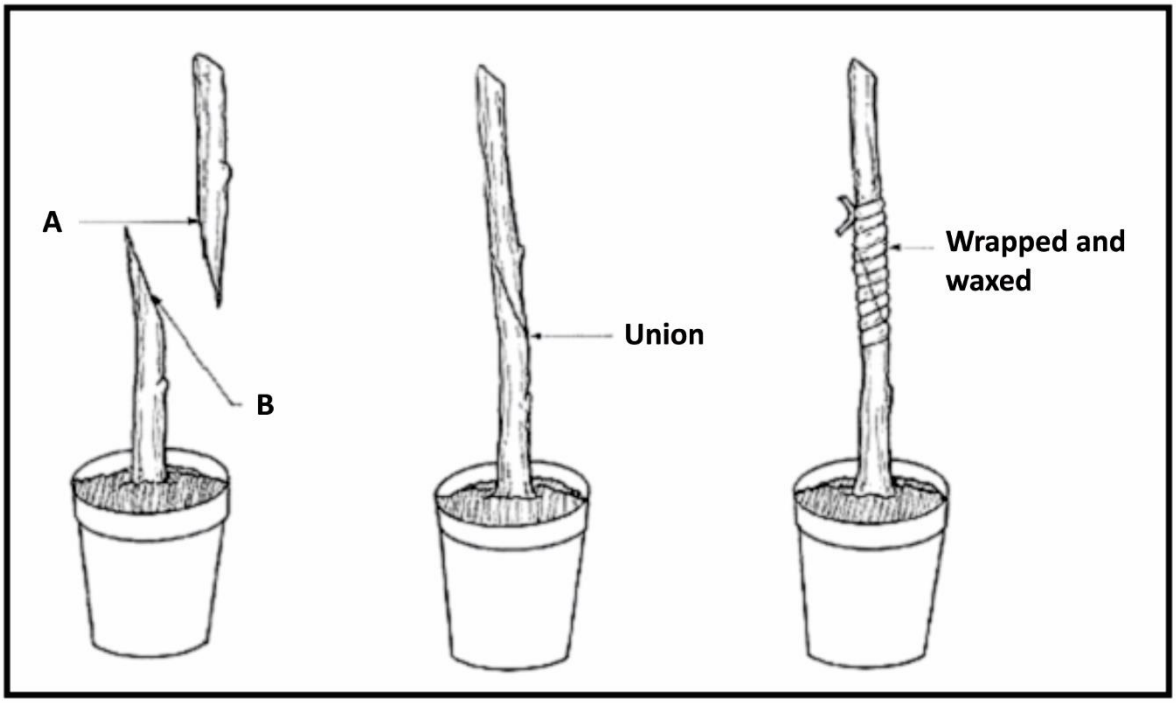
4.1.2 Define the reproductive process identified in Question 4.1.1.

(2)

4.1.3 Distinguish between vegetative and stimulative parthenocarpy.

(2)

4.2 The diagram below shows a method of artificial plant propagation.



4.2.1 Identify the type of plant propagation illustrated above.

_____

(1)

4.2.2 Provide labels for **A** and **B** in the diagram above.

A _____

B _____

(2)

4.2.3 Give TWO advantages of the plant propagation method illustrated above.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

4.2.4 List TWO examples of fruit trees propagated in South Africa using the method above.

_____

_____

(2)

4.3 The table below shows the supply and demand of apples at different prices.

Price/2,5 kg (rand)	Quantity demanded per week	Quantity supplied per week
8	1 000	400
10	900	500
12	800	600
14	700	700
16	600	800
18	500	900
20	400	1 000

4.3.1 Use the information in the table above to draw a line graph of both supply and demand on the same set of axes.

(8)

4.3.2 Determine the equilibrium price from the table above.

(2)

4.4

In some cases, blossom drop in plants is normal. For instance, male flowers naturally drop from vegetable plants after a few days. Many vegetables, like squash, begin producing male flowers as much as two weeks before the first female flower blooms. That being said, healthy blossoms can suddenly drop from plants due to inadequate pollination, environmental factors, low soil fertility and thrips.

4.4.1 Name the phenomenon described in the passage above.

(2)

4.4.2 From the passage above, deduce a biological cause of the phenomenon.

(1)

4.4.3 State TWO climatic factors that can lead to the phenomenon named in Question 4.4.1 above.

(2)

4.5

When a farmer employs a new worker, a contract must be drawn up. The terms and conditions of the contract must comply with labour legislation. Some of the items to be included in the contract are:

- Dispute between employer and employee
- Wages/Salaries
- Conditions for termination of service
- Affiliation to trade unions and right to strike
- Supply of protective clothing
- Provision of training to employees

4.5.1 Choose ONE statement from the list above which is addressed by the following:

(a) Occupational Health and Safety Act (Act 85 of 1993)

_____

(1)

(b) Basic Conditions of Employment Act (Act 75 of 1997)

_____

(1)

(c) Labour Relations Act (Act 66 of 1995)

_____

(1)

4.5.2 State TWO benefits of the Unemployment Insurance Fund for farm workers.

_____

_____

_____

_____

(2)

4.6

A farmer obtained a loan of R2 million from a bank. This loan was used to build a dam and install an irrigation system for a fifty-hectare maize field. The farmer also purchased three bakkies, each worth R165 000, and 50 beef cattle using his inheritance from his parents.

Use the information above to complete the table below.

TYPE OF CAPITAL	EXAMPLE	SOURCE OF CAPITAL

(6)

4.7

	RY	Ry	rY	ry
RY	1	RRYy	RrYY	RrYy
Ry	RRYy	RRyy	RrYy	Rryy
rY	RrYY	RrYy	rrYY	rrYy
ry	RrYy	Rryy	rrYy	2

4.7.1 Name the type of cross indicated in the Punnett square above.

_____

(1)

4.7.2 Provide the genotype for offspring 1 and offspring 2.

_____

_____

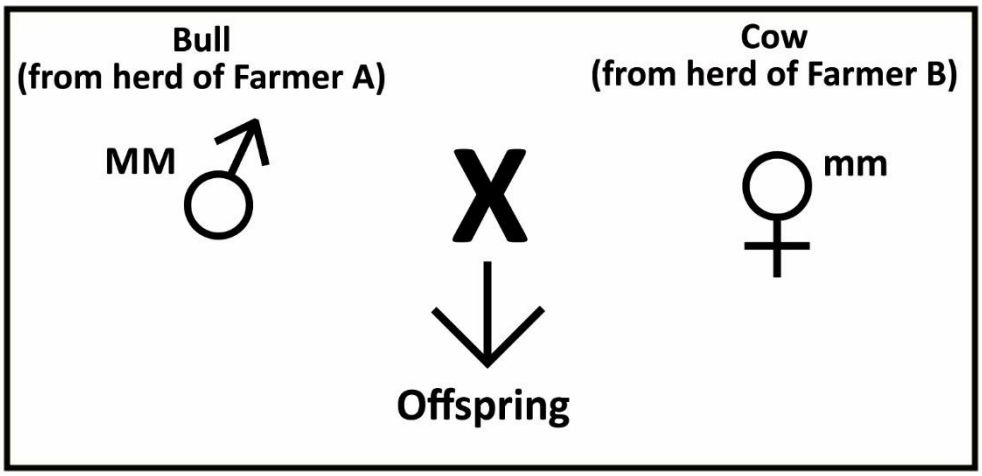
(2)

4.7.3 Indicate the phenotypic ratio of the cross above.

_____

(2)

4.8 The illustration below shows an animal breeding method with cattle from two farmers (A and B). Farmer A has a commercial Hereford herd while Farmer B is a Sussex stud breeder.



4.8.1 Identify the breeding method depicted above.

_____

(2)

4.8.2 State TWO benefits that this breeding method will have for Farmer B.

_____

_____

_____

_____

(2)
[50]

QUESTION 5

5.1

Financial records for ABC Farm business, 31 March 2021			
ASSETS		**LIABILITIES**	
Current Assets	962 000	Current Liabilities	469 000
Medium-term Assets	1 234 000	Medium-term Liabilities	116 000
Long-term Assets	2 654 000	Long-term Liabilities	450 000
TOTAL ASSETS	**A**	**TOTAL LIABILITIES**	**B**

5.1.1 Identify the financial record above.

_____

(2)

5.1.2 Explain the purpose of the financial record shown above.

_____

_____

(2)

5.1.3 Provide the values for **A** and **B**.

A _____

B _____

(4)

5.1.4 Calculate the net worth of ABC Farm Business. Show ALL your calculations including the formula.

_____

_____

_____

_____

_____

_____

(3)

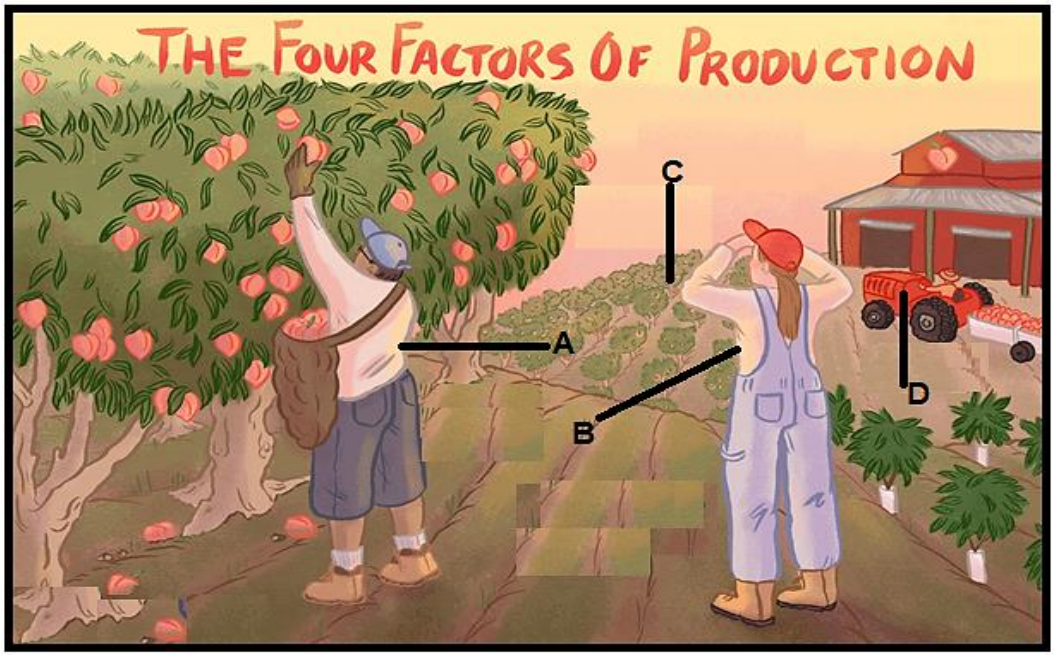
5.1.5 Determine the percentage of current assets to the value of total assets.

_____

_____

(2)

5.2



5.2.1 Classify the factors of production labelled **A**, **B**, **C** and **D** shown in the image above.

A _____

B _____

C _____

D _____

(4)

5.2.2 Name TWO economic functions of the production factor labelled **C**.

_____

_____

(2)

5.2.3 Indicate TWO problems associated with the production factor labelled **A** in agriculture.

_____

_____

(2)

5.2.4 State TWO problems associated with the production factor labelled **D**.

_____

_____

(2)

5.3 Complete the following table.

	Organ / process / condition	**Bull**	**Cow**
5.3.1	Organ where gametes are produced		
5.3.2	Name of the gamete produced		
5.3.3	The process by which gametes are formed		

(6)

5.4

Artificial insemination is one of the important processes performed in female animals to increase the herd economically and rapidly.

Below are the steps that are involved before and during artificial insemination:

- Semen dilution
- Placing semen into the reproductive tract of a cow
- Semen examination
- Heat detection
- Semen harvesting

5.4.1 Rearrange these steps in their chronological order to ensure successful artificial insemination.

_____

_____

_____

_____

_____

(5)

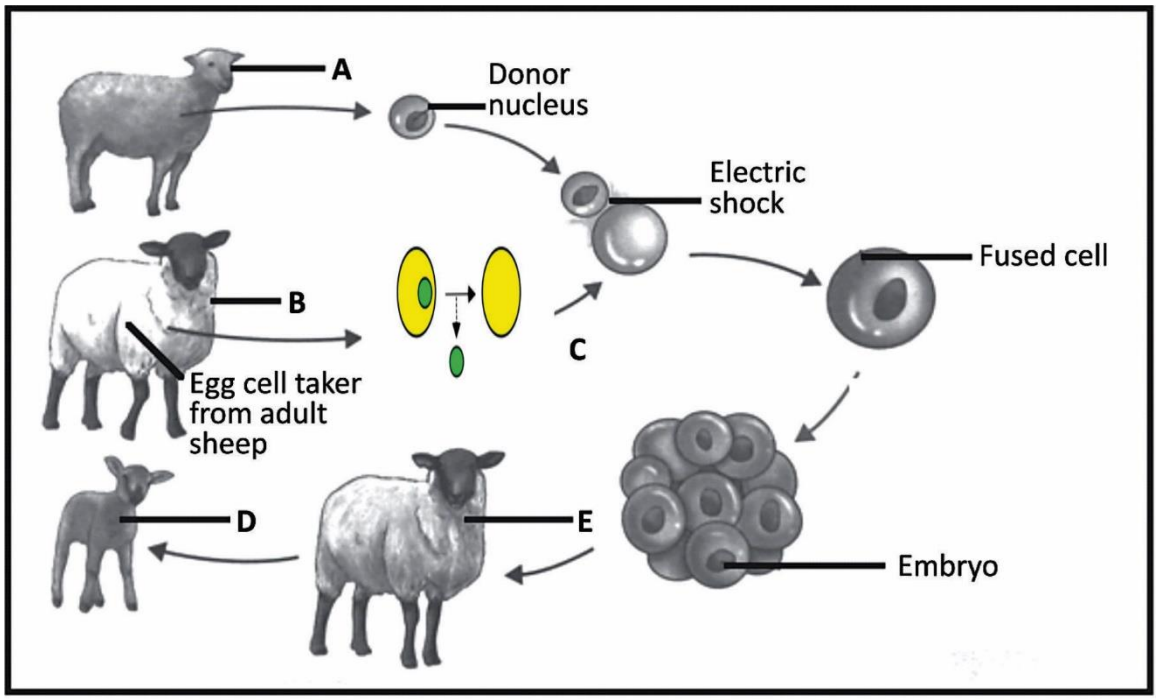
5.4.2 Suggest TWO economic benefits of artificial insemination for the farmer.

_____

_____

(2)

5.5 The diagram below illustrates a reproductive process that can be used in animals.



5.5.1 Identify the process illustrated above.

_____

(1)

5.5.2 Indicate the letter representing the sheep that will be genetically identical to the sheep labelled **D**.

_____

(1)

5.5.3 Write the letter of the sheep that will serve as a surrogate.

_____

(1)

5.5.4 Give the name of the process labelled **C**.

_____

(1)

5.5.5 Name TWO aims of the process illustrated above.

_____

_____

_____

_____

(2)

5.6 5.6.1 Parturition is a complicated process and can be problematic especially if presentation of the calf is not correct. Indicate the form of presentation represented by the statements below.

(a) Foetus lies on its abdomen with forefeet stretching towards the pelvis and the head resting on it.

_____

(2)

(b) Rear part of the foetus lies towards the cervix resulting in hind legs appearing first.

_____

(2)

5.6.2 Give the term for 'difficult birth'.

_____

(2)

5.6.3 Name TWO problems other than presentation that may cause difficult birth.

_____

_____

(2)
[50]

200 marks

SECTION C

QUESTION 6

For centuries farmers and plant breeders have laboured to improve the quality of crop plants. A variety of biotechnology techniques are used in agricultural production to accomplish this. One of the most widespread techniques used is genetically modified crops (GMOs).

Discuss biotechnology in agriculture under the following sub-headings:

- The concept of biotechnology (3)
- The characteristics of genetically modified crops (5)
- Examples of genetically modified crops in South Africa (2)
- The advantages of genetically modified crops (5)
- The disadvantages of genetically modified crops (5)

20 marks

Total: 300 marks

ADDITIONAL SPACE TO ANSWER QUESTIONS. REMEMBER TO CLEARLY INDICATE AT THE QUESTION THAT YOU USED THE ADDITIONAL SPACE TO ENSURE THAT ALL THE ANSWERS ARE MARKED.

