Please paste the barcoded label here	TOTAL MARKS

NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2023

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 in the answer.
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 Each of the following questions has a sketch and two labels, A and B. Indicate whether the sketch relates to **only A**, **only B**, **A and B** or **neither A nor B**.

1.1.1

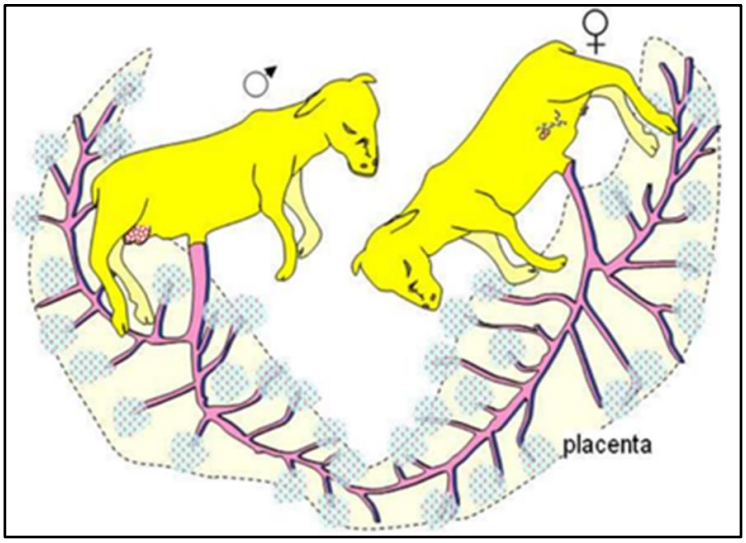
[<https://www.sciencedirect.com/science/article/abs/pii/S0304423814001216>]

A Parthenocarpy
B Scarification

A	only A	☐
B	only B	☐
C	A and B	☐
D	neither A nor B	☐

(2)

1.1.2



[<https://quizlet.com/100979542/bovine-infertility-lec48-flash-cards>]

A Monozygotic twins
B Freemartin twins

A	only A	☐
B	only B	☐
C	A and B	☐
D	neither A nor B	☐

(2)

1.1.3

[The University of Edinburgh: Royal school of veterinary services article, 27 February 2023]

A Parturition
B Dystocia

A	only A	☐
B	only B	☐
C	A and B	☐
D	neither A nor B	☐

(2)

1.1.4

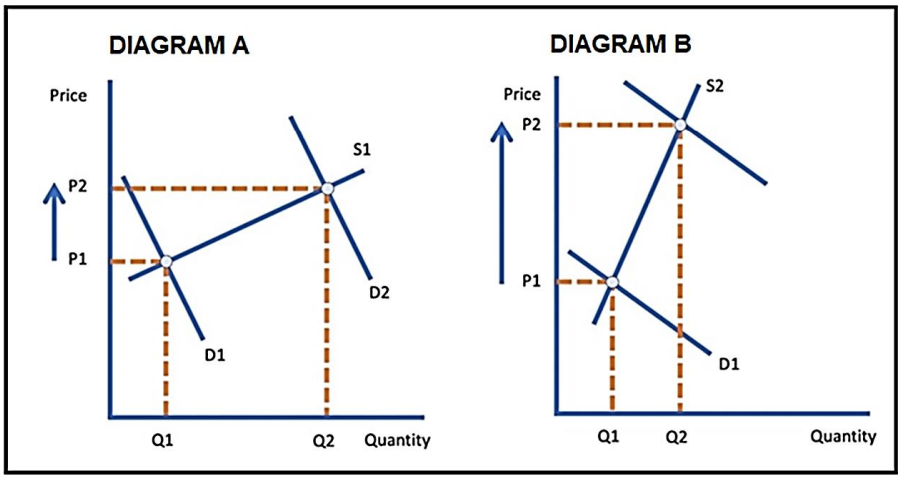
[Extracted from Stock farm magazine January 2023 – Volume 13 no. 1]

A Nasal worm strikes in sheep
B Blowfly strikes in sheep

A	only A	☐
B	only B	☐
C	A and B	☐
D	neither A nor B	☐

(2)

1.1.5



A DIAGRAM A shows elastic supply and DIAGRAM B inelastic supply.
B DIAGRAM A shows inelastic supply and DIAGRAM B elastic supply.

A	only A	☐
B	only B	☐
C	A and B	☐
D	neither A nor B	☐

(2)

1.1.6

A Maize fungus
B Poison bulb

A	only A	☐
B	only B	☐
C	A and B	☐
D	neither A nor B	☐

(2)

1.2 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.

1.2.1 ONE of the following organisms is NOT an external parasite.

A	Ticks	☐
B	Mites	☐
C	Nasal worm	☐
D	Flukes	☐

(2)

1.2.2 The process of developing, organising, and running a new business to generate profit while taking on financial risk.

A	Management	☐
B	Entrepreneurship	☐
C	Hedging	☐
D	Marketing	☐

(2)

1.2.3 The sequence of steps involved in transferring farm produce from the point of production to the point of consumption.

A Marketing chain ☐
B Market development ☐
C Market research ☐
D Marketing mix ☐

(2)

1.2.4 The observable characteristics in an individual resulting from the expression of genes.

A Genotype ☐
B Dominant ☐
C Recessive ☐
D Phenotype ☐

(2)

1.2.5 One of the following is an example of a primary male reproductive organ.

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

(2)

1.2.6 The unusual ability of one parent to pass its genetic characteristics onto its offspring because of homozygosity for numerous dominant genes.

A Prepotency ☐
B Atavism ☐
C Epistasis ☐
D Complete dominance ☐

(2)

1.2.7 The equipment shown in the picture below is used by livestock farmers for …

A enabling the cow to be on oestrus quickly. ☐

B storage of semen. ☐

C collection of semen from the bull. ☐

D detecting whether a cow is on heat. ☐

(2)

1.2.8 The following are aims and principles of soil survey.

(i) Classification of soils into well-defined mapping units.
(ii) Prediction of soils' performance under different management practices.
(iii) Increased soil compaction for poor root growth, plant establishment and increased acidity.
(iv) To find out the best use of soil.

Choose the CORRECT combination.

A (i), (ii) and (iv) ☐

B (ii), (iii) and (iv) ☐

C (i), (iii) and (iv) ☐

D (i), (ii) and (iii) ☐

(2)

1.2.9 Which ONE of the following statements represents an advantage of alien plants?

A	Increased fuel loads and changed fire behaviour, which can lead to soil damage and erosion, thereby adversely affecting water quality.	☐
B	Alteration of the vegetation structure.	☐
C	Mitigation of the effects of climate change by facilitating coastal protection from erosion and favouring carbon sequestration.	☐
D	Affects water availability and damages the quality of soil nutrients.	☐

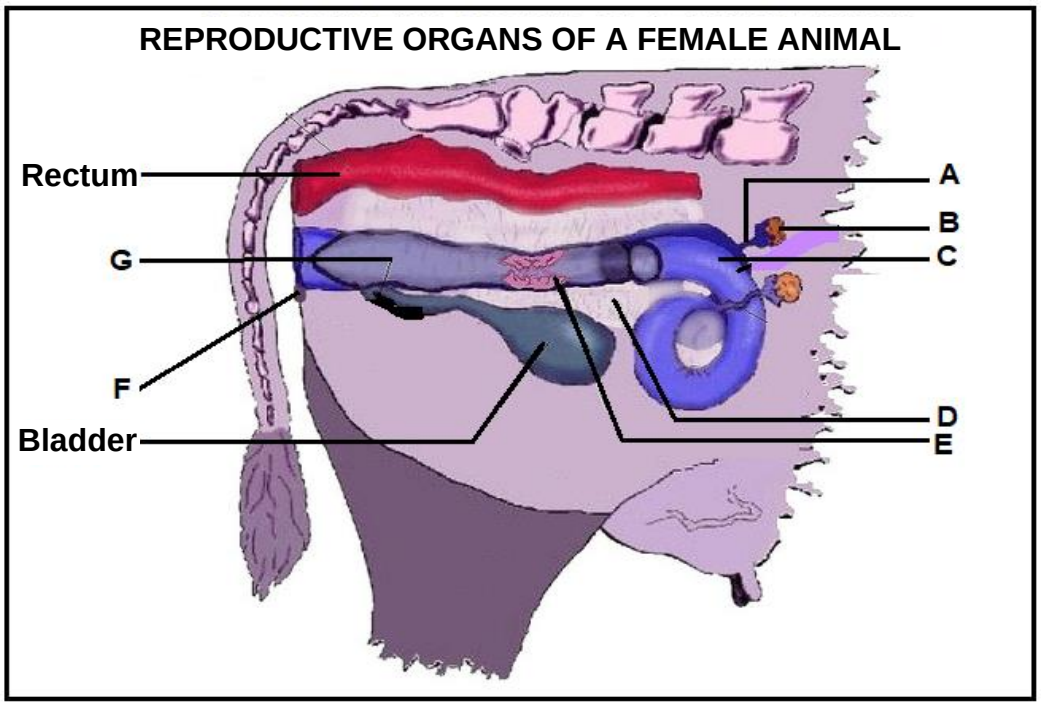
(2)

1.2.10 A heterozygous bull (Bb) was mated with a heterozygous cow (Bb). The expected genotypic ratio in their F1 generation will be …

A	3:1.	☐
B	1:2:1.	☐
C	1:3:1.	☐
D	2:2.	☐

(2)

1.3 The diagram below represents the reproductive system of a cow. Study the descriptions of the reproductive organs listed below the diagram and match each with the correct organ (A–G) from the diagram.



1.3.1 Acts as site of fertilisation and early cell division of the embryo.

_____ (2)

1.3.2 External part of the vagina that swells during oestrus.

_____ (2)

1.3.3 Transportation of sperm cells through to the uterus of the cow.

_____ (2)

1.3.4 Receives penis during mating and acts as birth canal.

_____ (2)

1.3.5 Produces female gametes and the sex hormones oestrogen and progesterone.

_____ (2)

1.3.6 Protects and nourishes the embryo or foetus during pregnancy.

_____ (2)

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

1.4.1 Balling gun is a device with a long nozzle used to release liquid medication directly into the oesophagus of an animal to control internal parasites.

_____

(2)

1.4.2 Sertoli cells are responsible for the production of testosterone in the male reproductive system.

_____

(2)

1.4.3 Genetics is the use of biological systems, living organisms or parts of this to develop or create different products intended to improve human health and society.

_____

(2)

1.4.4 A business strategy where the farmer extends investment by integration of crops and livestock enterprises to reduce risk and make more profit is known as specialisation.

_____

(2)

1.4.5 Primitive farming is the science of improving crop yields and assisting management decisions using high technology sensors and analysis tools.

_____

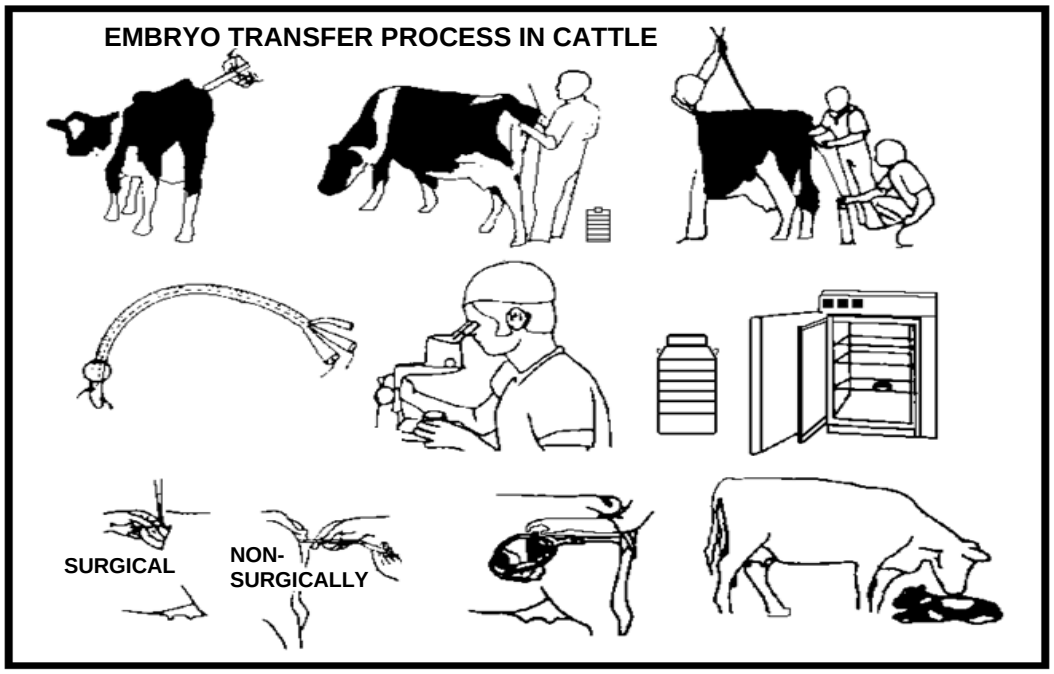
(2)

1.4.6 Budding is the act of placing a portion of one plant (scion) into or on a stem, root, or branch of another (stock) in such a way that a union will be formed and the partners will continue to grow.

_____

(2)

1.5 The illustration below shows embryo transfer in farm animals.



The list below contains stages of embryo transfer as shown in the diagram above.

A The donor cow is treated with multiple hormone injections.
B Evaluation of embryos for successful implantation in the recipient cow.
C The surrogate carries the embryos while they develop until birth.
D During ovulation the donor cow is inseminated with good quality semen.
E The uterus is flushed after seven days to extract embryos.
F Selection of a superior donor cow.

Rearrange the stages of the embryo transfer in Question 1.5 in chronological order. Use LETTERS **(A–F)** only.

1.5.1 _____ (2)

1.5.2 _____ (2)

1.5.3 _____ (2)

1.5.4 _____ (2)

1.5.5 _____ (2)

1.5.6 _____ (2)

1.6 Give the correct term for each of the following descriptions. Write only the term in the space provided.

1.6.1 Number of heartbeats in one minute used to determine the animal's health.

_____

(2)

1.6.2 Fluid released during ejaculation containing sperm cells and secretions of male accessory glands.

_____

(2)

1.6.3 The congenital defect that causes sterility in farm animals due to underdeveloped testis in male or ovaries in female.

_____

(2)

1.6.4 The function of marketing where agricultural products are transformed from its raw state to a more usable form.

_____

(2)

1.6.5 Random change in the structure of genetic composition of a cell, resulting in a variant form that may be transmitted to subsequent generations.

_____

(2)

1.6.6 The process of plant crossbreeding between genetically different parents to produce a hybrid.

_____

(2)

80 marks

SECTION B

QUESTION 2

2.1

Classification of South African soil

The two best known soil classification systems in the world are the World Reference Base (WRB) and the USDA Soil Taxonomy (a system developed in the USA). These two systems may be used to classify soils throughout the world. As these systems do not make provision for the full variety of South African soils, the South African Soil Classification system was developed: According to South African Soil Classification, 5 topsoil horizons and 25 subsoil horizons are recognised as diagnostic (may be used to classify the master horizons in a soil profile). Combinations of the horizons give rise to the recognition of 74 soil types. A few of the most common soil types and their allied soils are used for grain production in South Africa. In order to classify a soil, the master horizons must first be marked out, after which these master horizons are classified into diagnostic horizons. The sequence of diagnostic horizons determines the soil type. Lastly, the soil family is determined.

[Fey, M. 2010. Soils of South Africa. Cambridge University Press, Cape Town, South Africa. Soil Classification Working Group. 1991. Soil Classification – A taxonomic system for South Africa, Department of Agricultural Development, Pretoria]

2.1.1 Name the soil classification system of South Africa.

_____ (2)

2.1.2

Organic O; Humic A; Vertic A; Malanic A and Orthic A

Relate the following statements to the diagnostic topsoil horizons listed in the box above.

(a) A horizon that has undergone humification and eluviation (loss of clay and sesquioxides).

_____ (2)

(b) Horizons (typical turf clay) are formed through inversion as a result of large quantity of 2:1 clays (>30%).

_____ (2)

(c) A topsoil horizon which is enriched with organic material (>10% C) and therefore has a noticeably darker colour.

_____ (2)

(d) The horizon is defined as one which is not classified as one of the other four topsoil horizons, the most common soils (>95%) in South Africa which are used for grain production.

_____ (2)

(e) Horizons are defined according to their dark colour and strong structure.

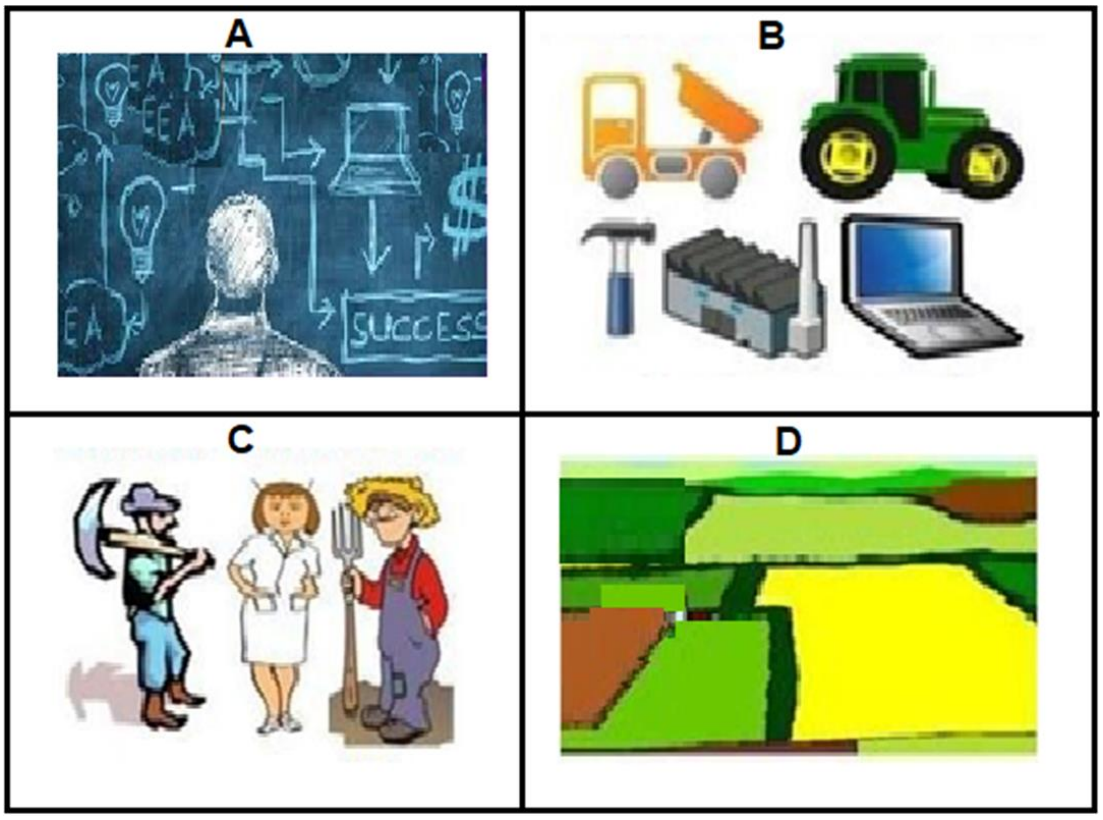
_____ (2)

2.1.3 State TWO reasons for the classification of soils in agriculture.

_____

_____ (2)

2.2



2.2.1 Identify the production factors labelled **A**, **B**, **C** and **D** shown in the image above.

A _____

B _____

C _____

D _____ (4)

2.2.2 Indicate the income that each of the four production factors generate.

(4)

2.2.3 Give TWO problems associated with each of the following production factors:

B

(2)

C

(2)

2.2.4 Name THREE economic characteristics of the production factor labelled **D**.

(3)

2.3

Different types of fruit	Description	Examples
A	A fruit that develops from a single ovary.	E
B	A fruit developing from several ovaries in a single flower.	F
C	A fruit that developed from the ripened ovary and some other parts of the flower.	G
D	A fruit developing from several ovaries in multiple flowers.	H

Complete the table by providing labels for **A** to **H**.

A _____

B _____

C _____

D _____

E _____

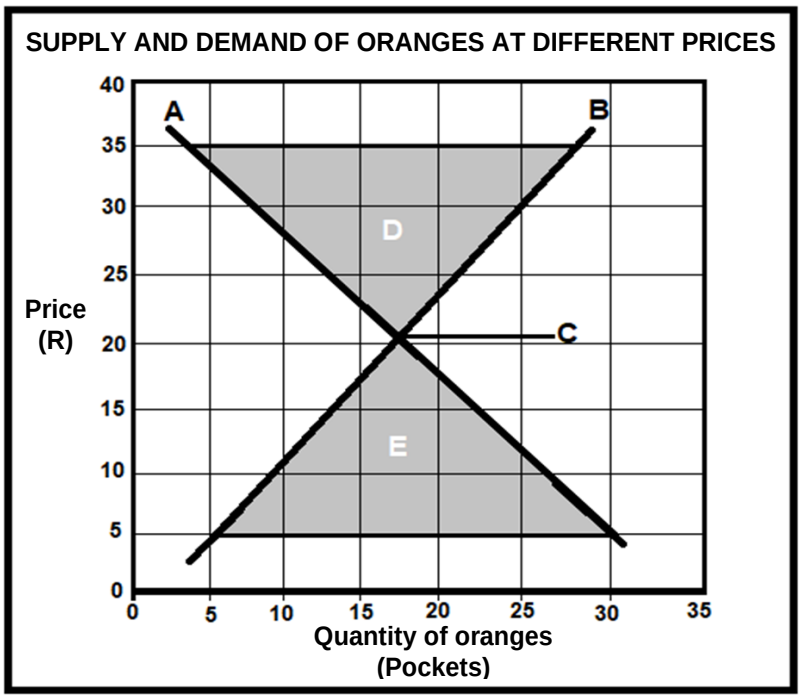
F _____

G _____

H _____

(8)

2.4



2.4.1 Identify curves **A** and **B**.

A _____

B _____

(2)

2.4.2 Give the economic term for point **C**.

_____

(2)

2.4.3 Define the term in Question 2.4.2.

_____

_____

(2)

2.4.4 Identify the grey-shaded areas labelled **D** and **E**.

D _____

E _____

(4)

2.4.5 Explain the relationship between price, demand and supply based on the graph above.

_____

_____

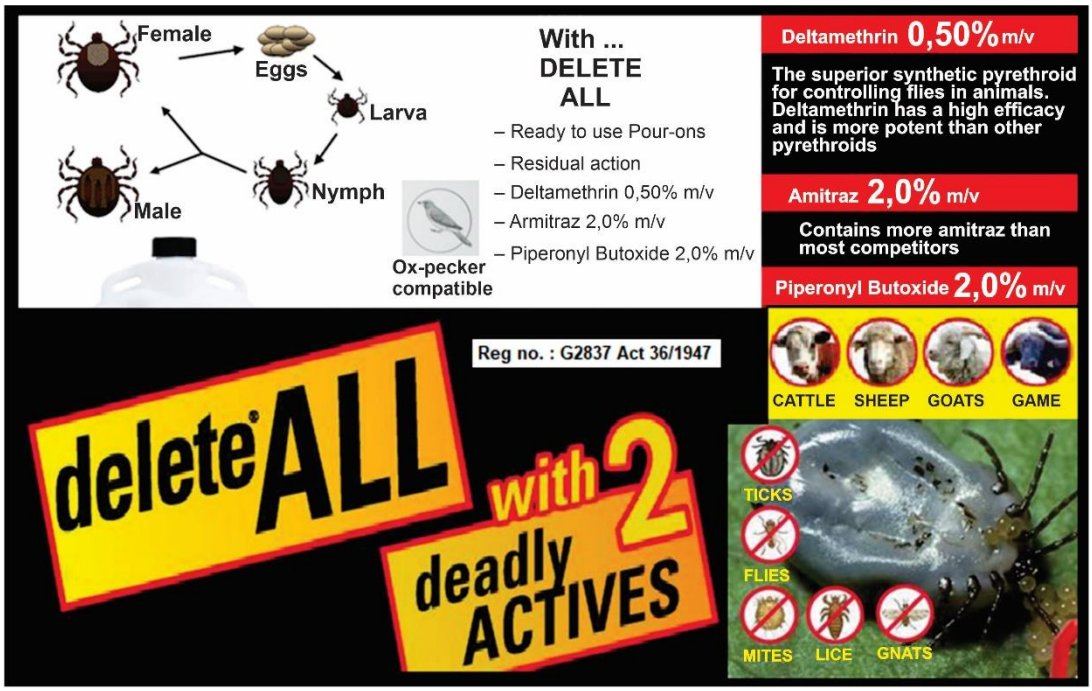
_____

(3)

[50]

QUESTION 3

3.1



[Adapted from Stock farm magazine March 2023 – Volume 13 no. 3]

3.1.1 State the name of the tick treated with the medication above.

_____

(2)

3.1.2 Indicate ONE animal disease transmitted by the tick above.

_____

(2)

3.1.3 The chemical above is considered eco-friendly. Justify this statement by giving TWO reasons from the data given above.

_____

_____

(2)

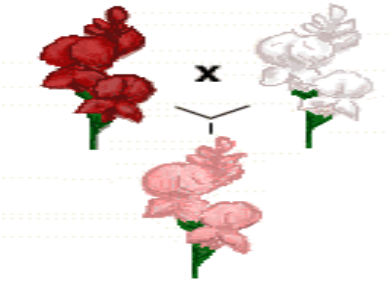
3.1.4 Suggest an appropriate method of applying the chemical above.

_____

(2)

3.2

The pattern of inheritance can lead to differences in the phenotype. If white flowers (W) are crossed with red flowers (R), the offspring in the F_1 generation will all be pink as shown in the picture below.



3.2.1 Use the Punnett square method to show the offspring of the F_2 generation from the F_1 parents above.

(4)

3.2.2 Indicate the type of dominance in the offspring of the F_1 generation that are all pink.

_____

(2)

3.2.3 Give a reason for the answer in Question 3.2.2.

_____

_____

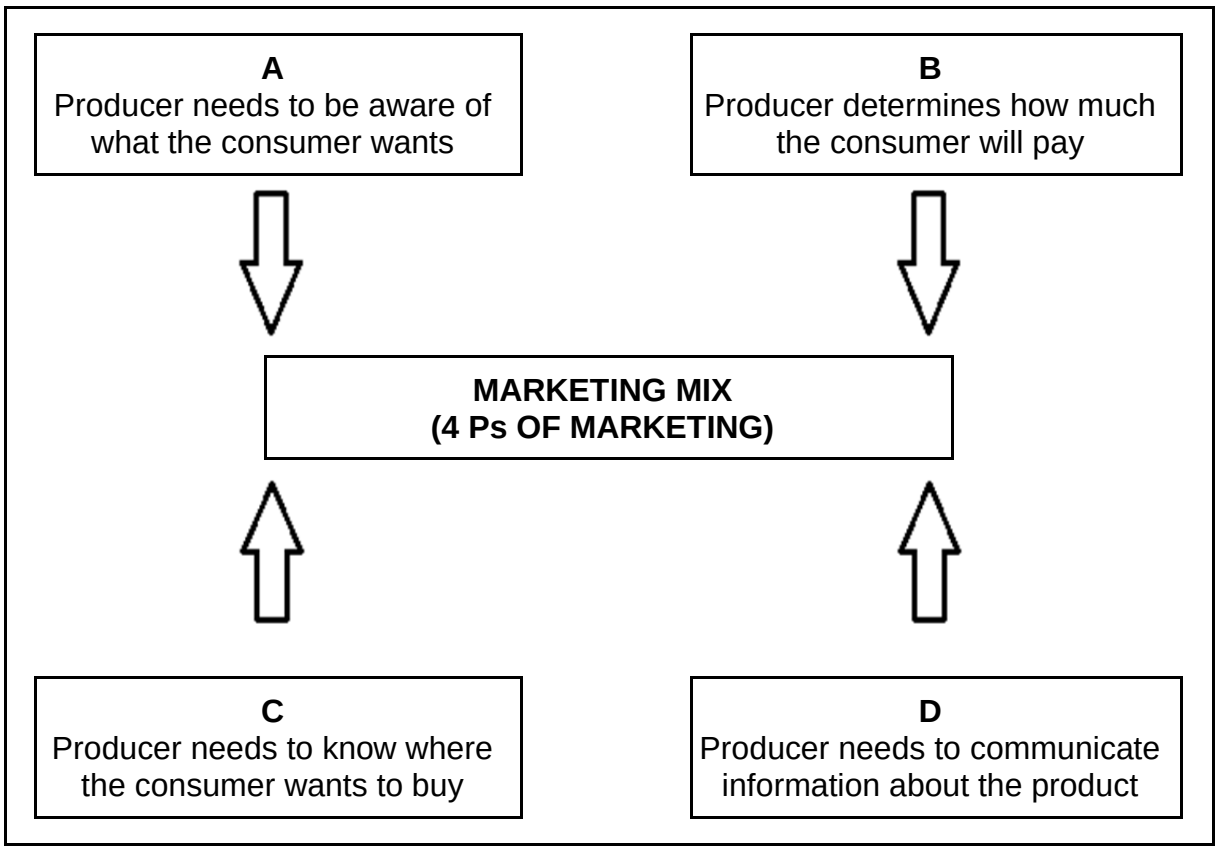
(2)

3.2.4 Give the phenotypic ratio of the F_2 generation.

_____

(2)

3.3



3.3.1 Identify the strategies for developing a market represented by **A**, **B**, **C** and **D** above.

A _____

B _____

C _____

D _____

(4)

3.3.2 What are the TWO factors that the farmer should consider when planning the strategies represented by …?

(a) **B** _____

_____

(2)

(b) **D** _____

_____

(2)

3.3.3 Name FOUR main functions of agricultural marketing that the farmer should take into consideration during planning.

(4)

3.4 The table below shows the price of lamb and the number of lambs sold by a farmer in six months. Lambs are marketed at a slaughtering mass of 27 kg.

TIME (MONTHS)	NUMBER OF LAMBS AVAILABLE TO BE SOLD	PRICE (R/kg)
September	55	79
October	60	81
November	65	87
December	45	110
January	50	75
February	35	79

3.4.1 Draw a line graph to show the relationship between the number of lambs sold in a period of six months and the months of the year.

(8)

3.4.2 Deduce the month in which the farmer had the highest income from the sale of lambs.

(1)

3.4.3 Calculate the price per lamb for September.

(2)

3.4.4 Calculate the possible income that could be generated by the farmer in February.

(3)

3.4.5 Suggest an economic reason for the decrease in the supply of lambs by the farmer in February.

(2)

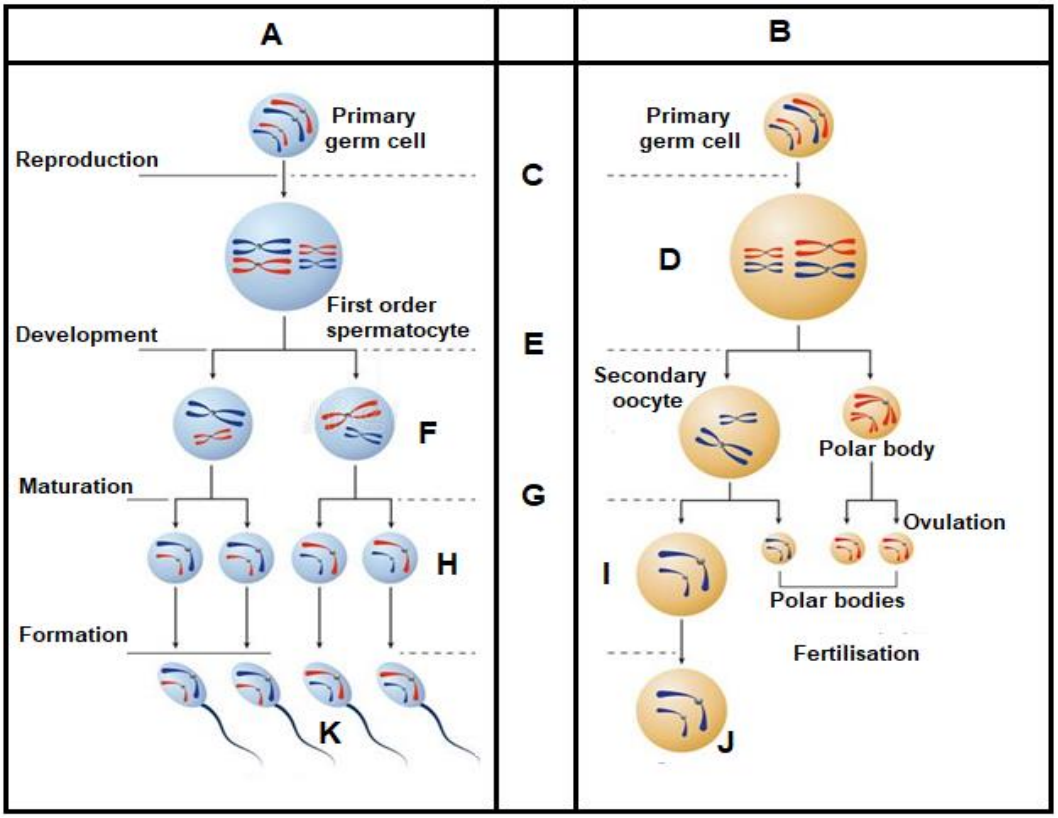
3.4.6 Refer to the table and suggest TWO marketing strategies this farmer could adopt to increase the income possibilities.

(4)
[50]

QUESTION 4

4.1

Gametogenesis is the production of gametes from haploid precursor cells. In animals and higher plants, two morphologically distinct types of gametes are produced (male and female) via distinct differentiation programs. Animals produce a tissue that is dedicated to forming gametes, called the germ line. Individual germ line cells are called germ cells. During the process of gametogenesis, a germ cell undergoes meiosis to produce haploid cells that directly develop into gametes. Hence, in animals, meiosis is an integral part of gametogenesis. In plants, some fungi, and some algae, meiosis is temporally separated from gametogenesis. Diploid cells undergo meiosis to produce haploid spores, which give rise to a haploid generation called the 'gametophyte'. Cells in the latter eventually develop into gametes, sometimes in response to environmental or chemical stimuli. Many unicellular and simple multicellular eukaryotes produce gametes from haploid cells many generations after meiosis or, in some species, immediately following meiosis.



[E.M. Maine, in Brenner's Encyclopedia of Genetics (Second Edition), 2013]

4.1.1 Identify the forms of gametogenesis represented by **A** and **B** in the schematic representation above.

A _____

B _____

(4)

4.1.2 Name the types of cell division shown by **C**, **E** and **G** in the schematic representation on page 23.

C _____

E _____

G _____

(3)

4.1.3 Label **D** and **F**.

D _____

F _____

(2)

4.1.4 Name the products represented by **H** and **I** that are formed after cell division **G**.

H _____

I _____

(4)

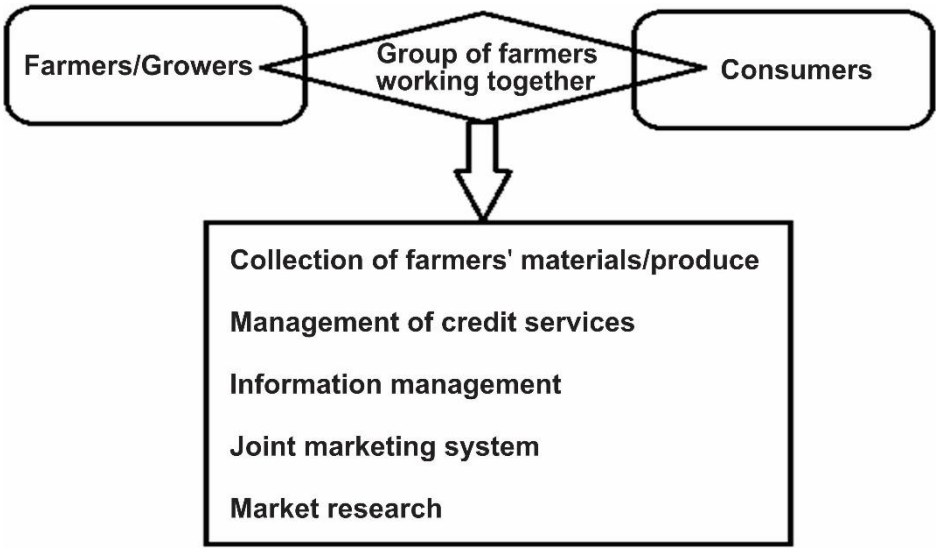
4.1.5 What is the end product represented by **J** and **K** of each process shown on page 23?

J _____

K _____

(2)

4.2



4.2.1 Identify the type of marketing system depicted in the illustration above.

_____

(2)

4.2.2 Justify the answer in Question 4.2.1 by giving TWO reasons from the illustration.

_____

_____

(2)

4.2.3 Indicate THREE agricultural cooperative principles.

_____

_____

_____

(3)

4.2.4 Give TWO benefits or advantages of agri-cooperatives.

_____

_____

_____

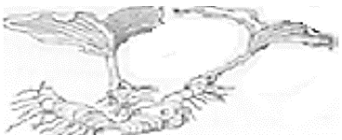
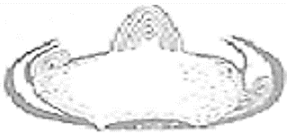
_____

(2)

4.2.5 Name FIVE channels of free marketing that a farmer can use to market farm products.

(5)

4.3

Plant part	Name
	**A**
	**B**
	**C**
	**D**

4.3.1 Provide labels for **A**, **B**, **C** and **D**.

A _____

B _____

C _____

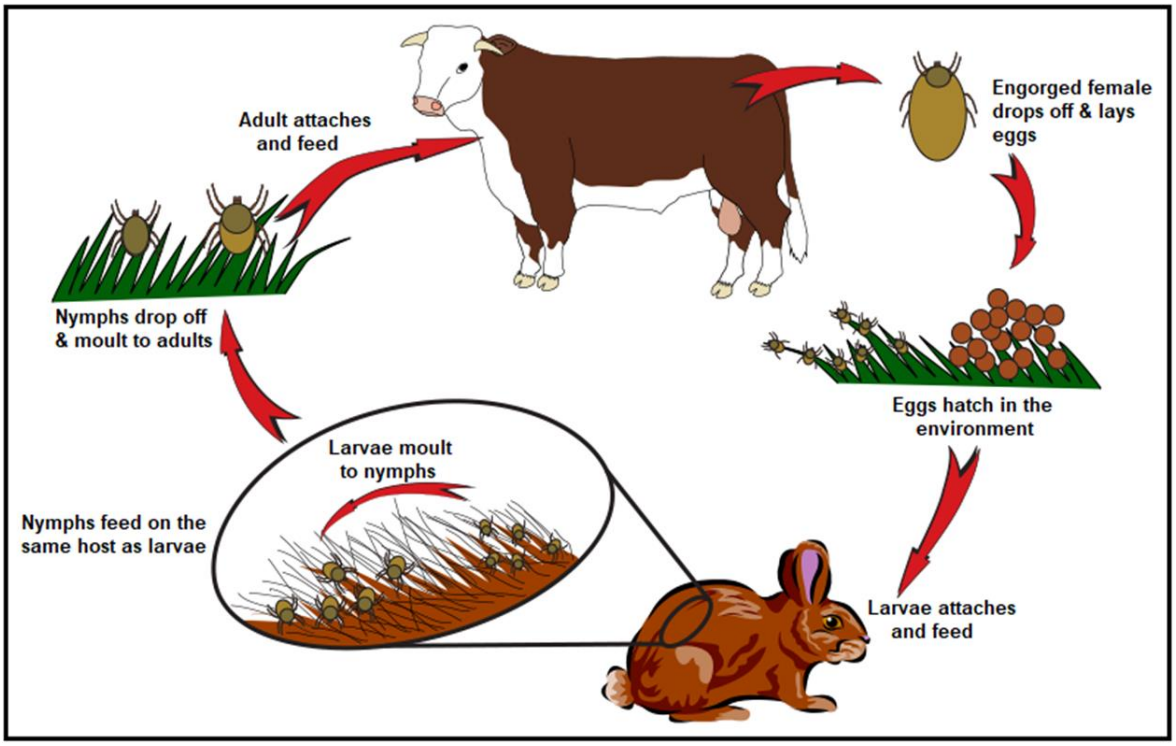
D _____

(4)

4.3.2 Define *double fertilisation*.

(2)

4.4



4.4.1 Identify the type of parasite represented in the diagram above.

_____

(2)

4.4.2 Classify the parasite in the diagram above based on its life cycle.

_____

(2)

4.4.3 From the diagram above, identify FOUR forms in which the parasite appears during its life cycle.

_____

_____

_____

_____

(4)

4.4.4 Name FOUR examples of the type of parasite in Question 2.1.1, except the one shown in the life cycle.

(4)

4.4.5 State THREE economic losses to the farmer that may be caused by the parasite on page 27.

(3)
[50]

QUESTION 5

5.1

With swarms of satellites, drones and sensors in our cadre, globally we are well equipped to engage in precision agriculture, aka satellite farming or site-specific crop management (SSCM). There is a wave of innovations – from satellite geomapping developed by the US's NASA to drones used to collect aerial data, to sensors used to collect moisture, temperature and other weather data on the land – providing insight into the health of the land on a real-time basis. Technologies such as advanced sensors and monitoring equipment now enable farmers to monitor crops more precisely and continuously, thereby enabling more strategic decision-making to increase productivity, with a reduced impact on the environment. A farmer uses technology that enables him to move from blanket fertilisation to applying only the fertiliser required for a specific area. It also allows farmers to compare harvest information and identify poor spots in lands. The farmer uses New Information and Communication Technologies (NICT), such as GPS and GIS.

[<https://www.afgri.co.za/precision-agriculture>]

5.1.1 Give TWO basic principles of precision agriculture.

_____

_____

_____

_____

(4)

5.1.2 Identify the main ultra-modern technologies listed below by writing out its full name.

(a) GIS _____

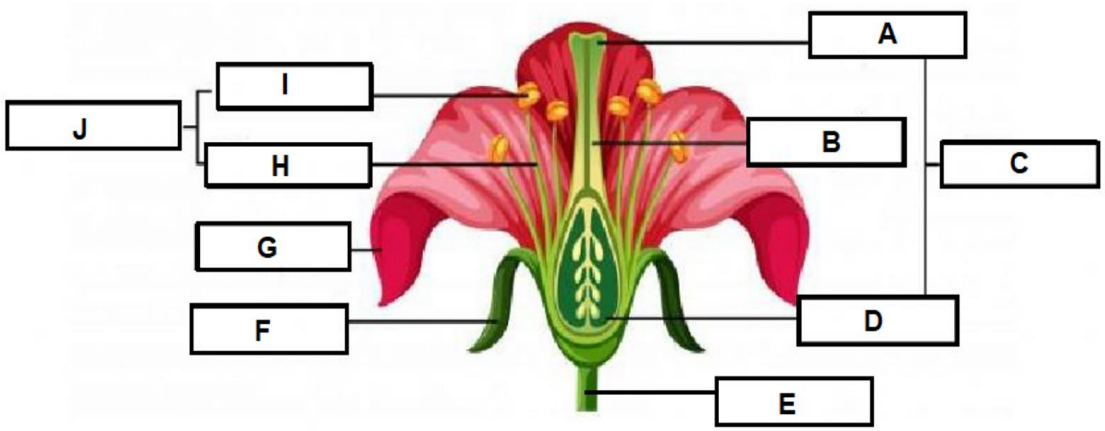
(2)

(b) GPS _____

(2)

5.2

PARTS OF A FLOWER



5.2.1 Indicate the labels for parts **B**, **H**, **I** and **J**.

B _____

H _____

I _____

J _____

(4)

5.2.2 Give ONE function for the parts labelled:

(a) **A** _____

(2)

(b) **D** _____

(2)

5.3

	January	February	March
Opening balance	R500,00	R10 150,00	R13 538,00
Receipts:			
Bank loans	R3 500,00	R3 500,00	R2 000,00
Seed account	R4 300,000	–––	–––
Capital	R5 500,00	R4 500,00	R2 200,00
Receipts total	**R13 300,00**	**R8 000,00**	**R4 200,00**
Payments:			
Accounts paid	R2 800,00	R3 700,00	R4 600,00
Wages	R500,00	R500,00	R3 500,00
Interest on account owed	R350,00	R412,00	R674,00
Payment total	**R3 650,00**	**R4 612,00**	**R8 774,00**
Nett cash	**R9 650,00**	**R3 388,00**	**R4 574,00**
Closing balance	**R10 150,00**	**R13 538,00**	**R8 964,00**

5.3.1 Identify the financial record in the table above.

_____

_____

(2)

5.3.2 Support the answer in Question 5.2.1 by referring to TWO items from the table.

_____

_____

(2)

5.3.3 Name the financial record that a farmer may use to determine the net worth of a farming business.

_____

(2)

5.3.4 Differentiate between an enterprise budget and a whole-farm budget.

_____

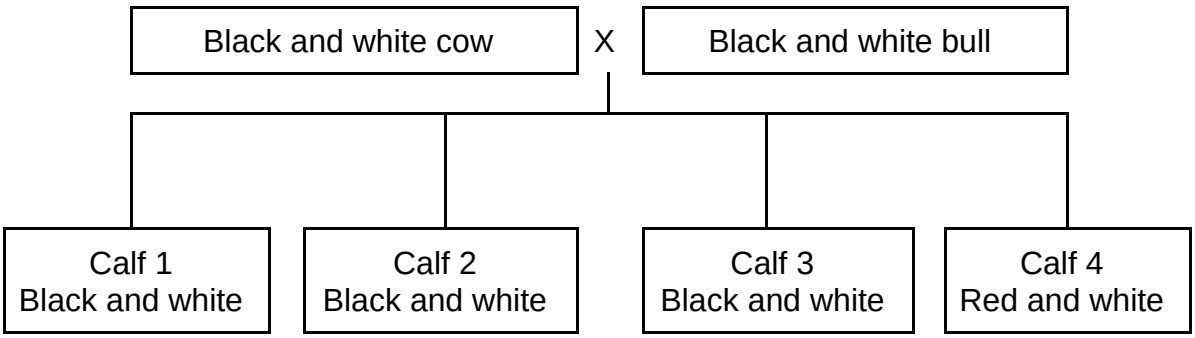
_____

_____

_____

(2)

5.4



5.4.1 Identify the pattern of inheritance represented above.

_____

(2)

5.4.2 Justify the answer to Question 5.4.1.

_____

_____

_____

_____

(2)

5.5 The table below represents a portion of the contract.

Employment contract entered into between:	
1. Herein after referred to as "**the employer**" **Name, ID number and address**	Ace Farming Enterprise 5903245903063 14 Domino Street Zastron 5701
2. Herein after referred to as "**the employee**" **Name, ID number and address**	Jojo Tank 6301225703087 Dombolo Village Queenstown 5702
3. **Commencement:** This contract will begin on this date and continue until retirement or terminated as set out in clause 16	1 April 2020 until retirement
4. **Job description**	Tractor driver and machinery operator
5. **Mode of payment**	Monthly through bank deposit
6. **Salary: Amount**	R3 150,00
7. **Terms of employment:** • Working hours • Leave	 • 06H00 to 18H00 • 1 week paid leave per annum
8. **Protective clothing:**	None
9. **Training opportunities:**	Employee will attend skill development practical training quarterly
10. **Management of disputes:**	All matters related to disputes between the employer and the employee will be resolved according to clause 21
11. **Signatures:** • Employer: _____ (Signature) • Employee: _____ (Signature)	 _____ at _____ (Date) (Place) _____ at _____ (Date) (Place)

5.5.1 Indicate the type of farm worker who signed the contract above.

_____

(2)

5.5.2 Justify the answer in Question 5.2.1.

_____

(2)

5.5.3 Select an item from the contract of employment that relates to the following labour legislation:

(a) Labour Relations Act

_____

(1)

(b) Occupational Health and Safety Act

_____

(1)

(c) Basic Conditions of Employment Act

_____

(1)

(d) Skills Development Act

_____

(1)

5.5.4 The farm worker mentioned in the contract above was diagnosed with COVID-19. Explain TWO ways in which the illness of the farm worker could have an impact on the productivity of the farm.

_____

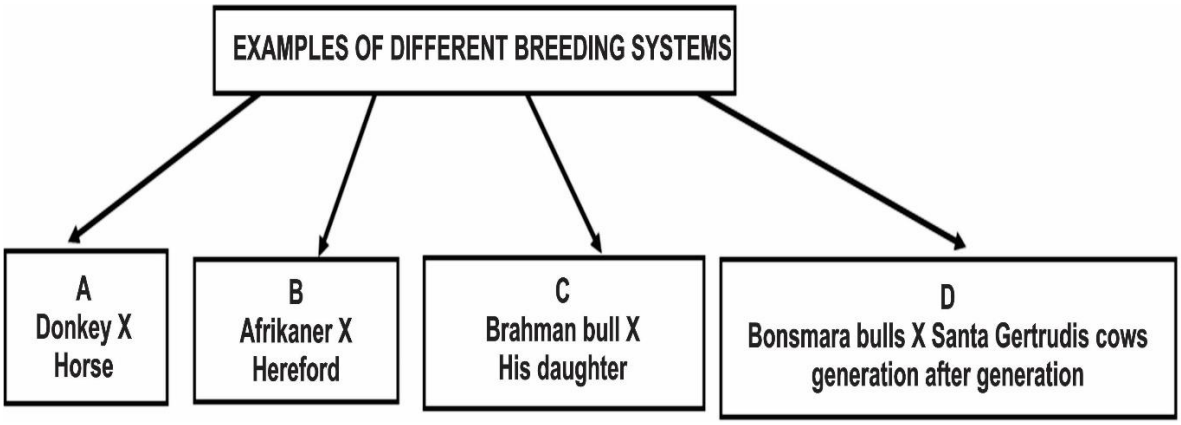
_____

_____

_____

(4)

5.6 The table below represents different breeding systems.



Identify the breeding system A to D that corresponds with each of the statements below. Write down only the letter (A to D) next to the question number ((a) to (d)).

	Statement	Answer
(a)	Continual use leads to a gradual decrease in the performance of animals.	
(b)	It produces hybrid vigour.	
(c)	A new breed is gradually imported into a new environment.	
(d)	Its negative effects can be reduced by outcrossing.	
(e)	The offspring are hardy and can work under unfavourable conditions.	

(10)
[50]

200 marks

SECTION C

QUESTION 6

Discuss pollination under the following subheadings:

- *The concept:* pollination. (2)
- The differences between self-pollination and cross-pollination. (4)
- The description of the main agents of pollination. (4)
- The description of the structure of a matured/ripe pollen grain and a receptive stigma (use illustration/diagrams to explain). (5)
- The description of germination of a ripe pollen grain on a receptive stigma until fertilisation (use illustration/diagrams to explain). (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.

