



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2023
Agricultural Science
Ordinary Level

Monday 19 June Afternoon 2:00 - 4:30

300 marks

Examination Number

----------------------	----------------------	----------------------	----------------------	----------------------	----------------------

Day and Month of Birth

----------------------	----------------------	----------------------	----------------------

For example, 3rd February
is entered as 0302

Centre Stamp

--

Instructions

There are **two** sections to this examination.

It is recommended that you spend about 50 minutes on Section **A** and 100 minutes on Section **B**.

Section A Answer **ten** questions from this section. There is internal choice in **four** questions.
Each question carries 10 marks.

Section B Answer any **four** questions from this section. There is internal choice in **two** questions.
Each question carries 50 marks.

Write your Examination Number and your Day and Month of Birth in the boxes on the front cover.

Write your answers in blue or black pen. You may use pencil for sketches, graphs and diagrams only.

Write your answers in the spaces provided to all parts of the examination into this answerbook.

This answerbook will be scanned and your work will be presented to an examiner on screen.

Anything that you write outside of the answer areas may not be seen by the examiner. You are not required to use all the space provided.

There is extra space at the end of Section **A** and at the back of the booklet. Label any extra work clearly with the question number and part.

Section A

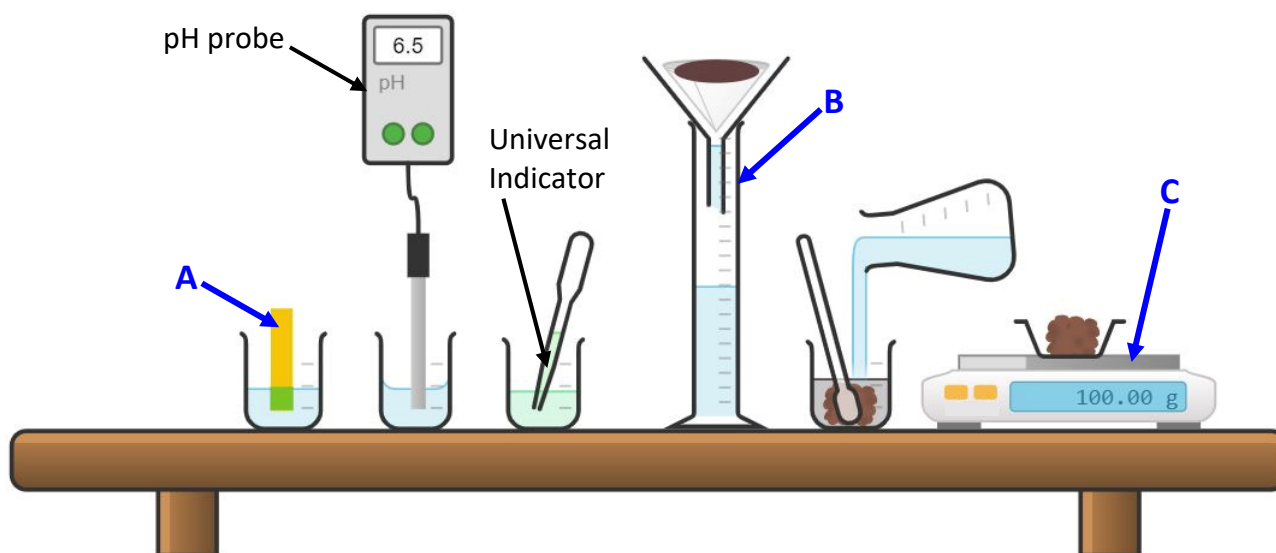
100 marks

Answer any **ten** questions.

Each question carries 10 marks.

Question 1

An agricultural science student wanted to test the pH of a sample of soil before deciding what crops to sow.



- (a) Identify any **two** pieces of equipment labelled **A**, **B** or **C** required for this investigation.

A:

B:

C:

- (b) State the pH of the soil filtrate.

--

- (c) State a conclusion the student can make in relation to growing crops.

Question 2

Jimmy went to his local mart to buy continental beef cattle.

(a) Assist Jimmy in identifying any **three** of the following continental beef cattle using the list below.

Belgian Blue	Aubrac	Limousin	Charolais	Simmental
--------------	--------	----------	-----------	-----------



A



B



C



D



E

A:
B:
C:
D:
E:

(b) The bulls in pictures **B**, **D** and **E** have a ring in their nose.
Outline a reason why farmers put a ring in a bull's nose.

Question 3

A group of transition year students purchased three week old beef heifer calves to rear as part of their agricultural science class. The calves were staying on a student's farm beside the school.



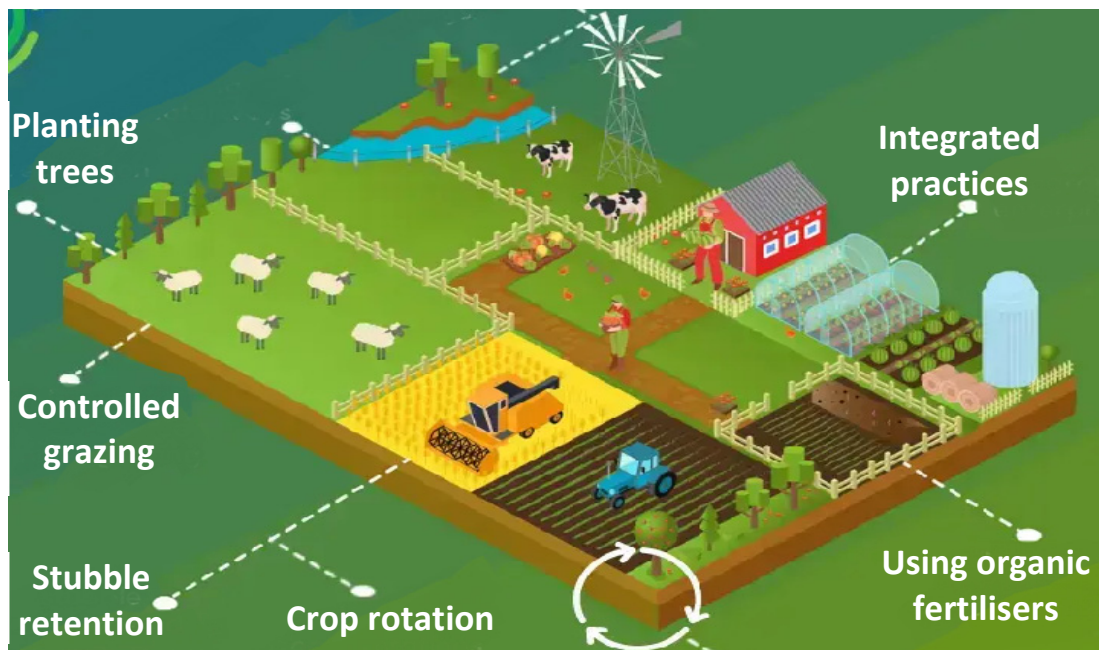
- (a) Outline **three** management practices carried out by the students from the time the calves arrived on the farm to weaning.

- (b) Identify the weight of an average dairy beef calf at weaning by placing a tick (✓) in the correct box.

130kg	
90kg	
75kg	

Question 4

The diagram shows some regenerative farming practices.
Analyse the diagram and answer the questions which follow.



Outline **one** reason why each of the following farming practices is carried out.

Controlled grazing (management of forage with grazing animals):

Crop rotation:

Using organic fertilisers:

Question 5

Biosecurity is crucial in maintaining healthy animals.
Analyse the picture and answer the questions which follow.



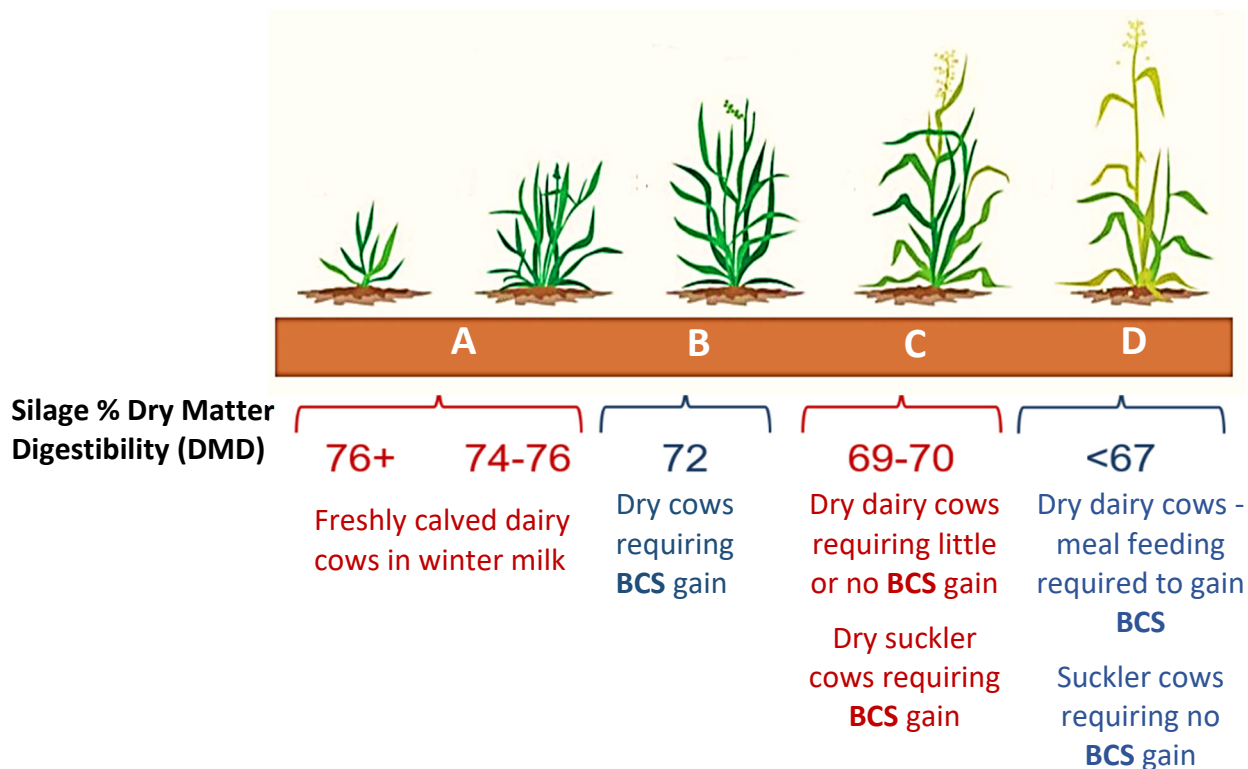
Using your knowledge of biosecurity, explain how each of the following can threaten the biosecurity on a farm and outline what the farmer can do to reduce the risk.

	Threaten biosecurity	How to reduce risk
Sick animals		
Contaminated vehicles and equipment		

Question 6

Answer **either** (a) **or** (b).

- (a) The diagram shows the grass growth cycle and how each growth stage affects silage quality. Analyse the picture and answer the questions which follow.



- (i) In the diagram above, the letters BCS are used. State your understanding of BCS.

- (ii) Identify the best quality silage and state for which animals this silage is suitable.

Silage quality:
Animal:

- (iii) State which silage DMD % is suitable for dry suckler cows that have a good BCS.

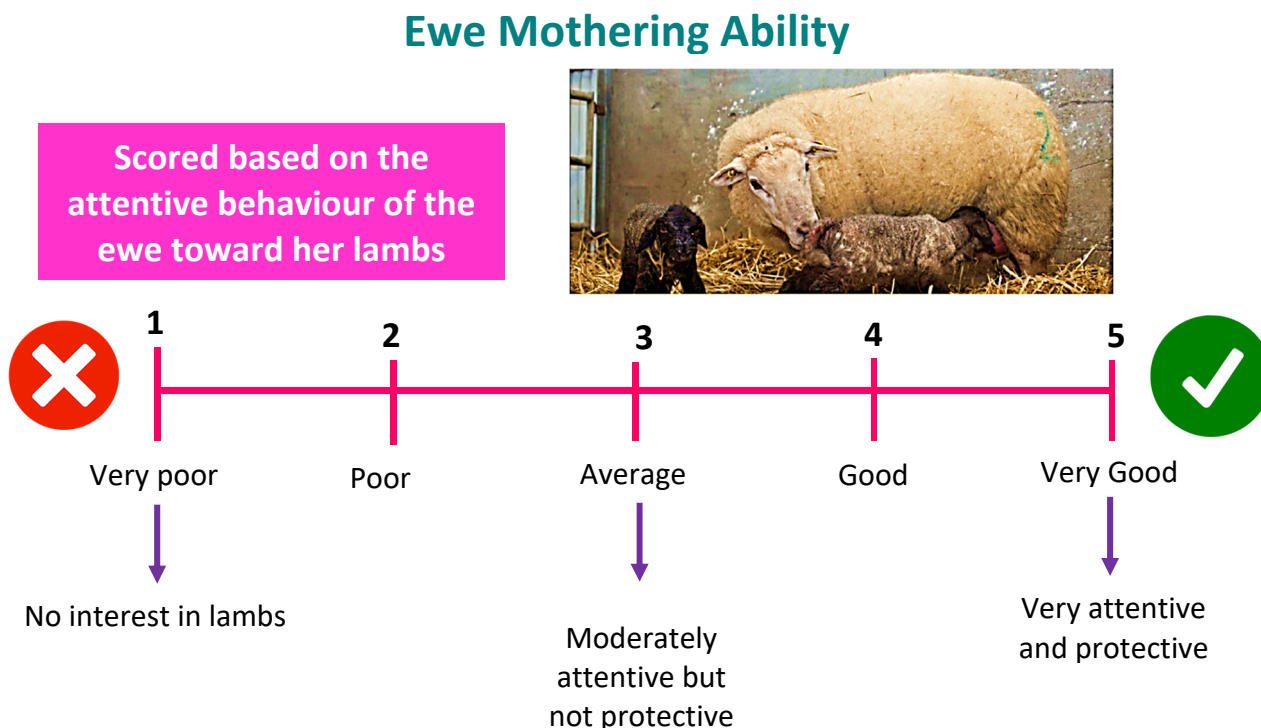
Or

- (b)** Silage quality is an important aspect of animal feeding.
Outline the process a farmer would carry out to make good quality silage.

[illegible]

Question 7

The diagram below is used to rate how good a ewe is at looking after her lambs.
Analyse the diagram and answer the questions which follow.



- (a) Dónal was scoring his ewes mothering ability after lambing and recorded the results in the table below.

Complete the table below for Dónal describing the implications of his results.

The first one has been done as an example.

Ewe Number	Mothering Ability Score	Implications for Farmer
106	5	Very good, attentive mother and will protect lambs from predators and the weather
107	3	
108	1	

- (b) Briefly describe why it is important for ewes to be protective of her lambs.

Question 8

Answer **either** (a) **or** (b).

- (a) Pauline noticed a cow with mastitis and treated her with antibiotics. Treating a cow with antibiotics involves a number of steps which are listed below.
Place the steps in correct order.

The first one is done for you.

A	Antibiotic tube inserted into teat
B	Teat wiped with antiseptic wipe
C	Teat dipped in iodine
D	<i>Cow milked out</i>
E	Teat massaged to move antibiotic from teat into udder

D				
----------	--	--	--	--

Or

- (b) (i) Identify the bacteria that **do not** cause mastitis in dairy cows by placing a tick (✓) in the correct box.

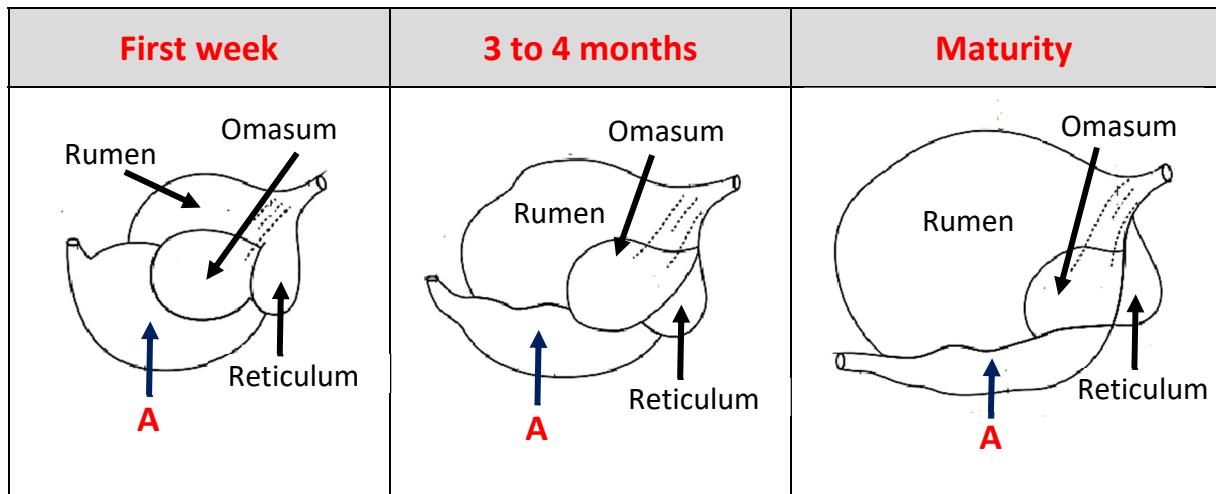
Bacteria	
<i>Rhizobium</i>	
<i>E. coli</i>	
<i>Pseudomonas</i>	

- (ii) Apart from teat dipping, outline ways farmers can reduce the incidence of mastitis on their farms.

Question 9

Answer **either** (a) **or** (b).

- (a) The diagrams show the development of a ruminant stomach from birth to maturity. Analyse the diagrams and answer the questions which follow.



- (i) Identify the stomach chamber A.

--

- (ii) Explain the changes in the structure of the ruminant stomach as the animal gets older.

- (iii) Identify the pH of the rumen by placing a tick (✓) in the correct box.

pH	
7.0	
4.0	
9.0	

Or

- (b) (i) Explain the function of each of the following ruminant stomach chambers.

Stomach chamber	Function
Rumen	
Omasum	

- (ii) State **one** example of an animal with a ruminant stomach.

--

- (iii) State **one** difference between a ruminant stomach and a monogastric stomach.

Ruminant stomach	Monogastric stomach

Question 10Answer **either** (a) **or** (b).

- (a) Four out of every five calves born on beef farms are sired by a stock bull. The stock bull fertility is key to maintaining a compact calving period, increasing the genetic merit and value of the calves, and overall herd profitability.



- (i) Explain the underlined terms.

Compact calving period:
Increasing genetic merit:

- (ii) Briefly describe ways to ensure the stock bull on the farm is fertile during the breeding season.

Or

- (b) The vet was called to a farm to carry out a fertility test on four stock bulls. The vet collected a sample of semen from the four bulls for analysis. The results are shown in the table below. Analyse the table and answer the questions which follow.

	Bull 1	Bull 2	Bull 3	Bull 4
Sperm motility (%)	100	95	90	95
Abnormal structure (%)	5	8	8	10



- (i) Identify which bull has the most abnormal sperm cells.

--

- (ii) Identify which bull has the best sperm motility.

--

- (iii) State which bull is the most fertile and best to use with the maiden heifers on the farm.

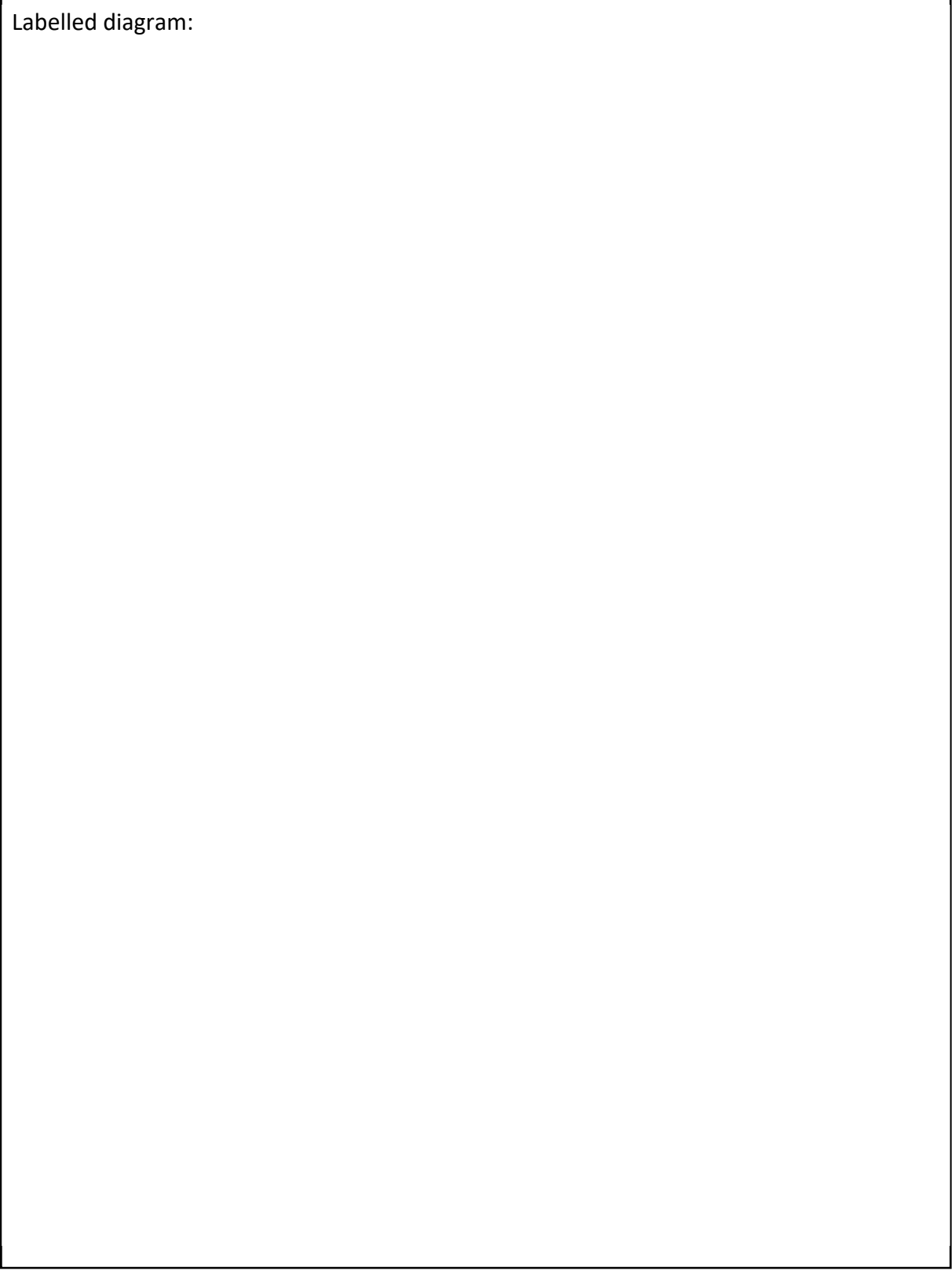
--

- (iv) The vet asked for the bulls to be restrained for the procedure.
Outline how the bulls could be restrained for the vet to carry out the procedure.

Question 11

A student was carrying out an investigation to show the activity of earthworms.
Draw a labelled diagram showing this activity.

Labelled diagram:



Question 12

Read the article and answer the questions which follow.

Using a Portable Microscope in Agriculture

You sow seeds, water them and collect the harvest. Crop production involves continuous monitoring and inspection.

Crop plants respond to environmental changes and many internal factors. Plants are also prone to many diseases caused by organisms. Some of these diseases are contagious.

Farmers often need to send away diseased crop samples for further analysis including microscopic analysis. The development of portable microscope technology will allow for on-site testing.



(Adapted from Medprimetech, 2022)

- (a) Explain the underlined term.

- (b) List **two** examples of environmental factors that can affect crop production.

1.
2.

- (c) Briefly explain how this new onsite technology can benefit crop production.

[illegible]

Section B**200 marks**

Answer any **four** questions.

Each question carries 50 marks.

Question 13

Answer (a) **and** (b) with **either** (c) **or** (d).

- (a) (i) Reseeding grassland is an important aspect of ensuring farm sustainability.
Outline reasons why reseeding is recommended.

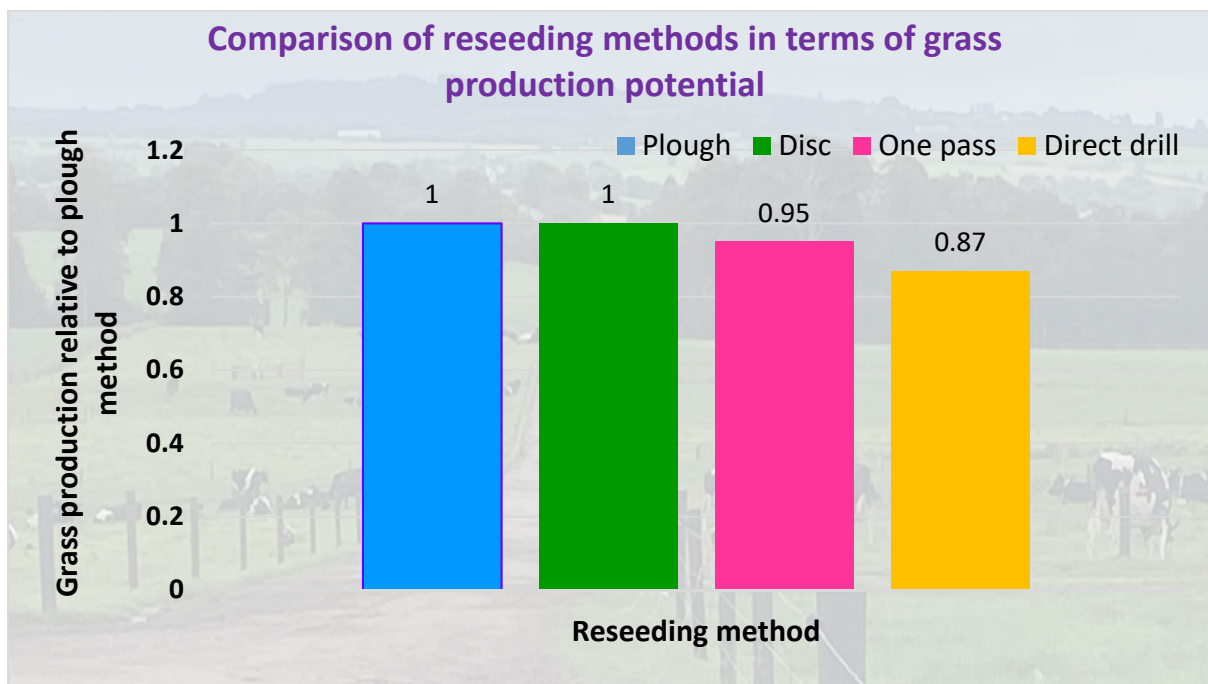
- (ii) Identify the plants below that may be sown in a newly reseeded pasture.

A**B****C**

--	--	--

- (iii) Outline reasons for sowing plants **A** and **C** shown in part (ii) in a newly sown sward.

- (b) Traditional reseeding methods involve mainly ploughing the land. Research into more sustainable practices (disc, one pass and direct drill) are shown in the graph below. Sustainable practices are being compared to ploughing which has a grass growth potential of 1. Analyse the graph and answer the questions which follow.



(Adapted from Teagasc, 2022)

- (i) Identify which sustainable reseeding method has the highest potential for grass production.

--

- (ii) Outline what conclusion the researchers can make in relation to the sustainable reseeding methods.

- (iii) Briefly describe the advantages of reseeding using the one pass system.

- (c) (i) Outline key points a farmer needs to consider when deciding what grass mixtures to sow.

- (ii) The farmer wants to research information on grass varieties and their suitability on Irish farms.
Advise the farmer as to where to access this information.

Or

- (d) Describe how a farmer would manage a newly reseeded sward in its first year after sowing.

Question 14

- (a) Lisa wanted to sow a food crop in a two hectare field in an environmentally friendly way. Using a food crop (other than grass) you have studied, answer the questions which follow.

Named food crop:

- (i) When selecting the seed for sowing, Lisa checked the disease resistance and time of harvest.
Explain the underlined terms.

Disease resistance:
Time of harvest:

- (ii) State **one** essential element required by the crop and describe its role.

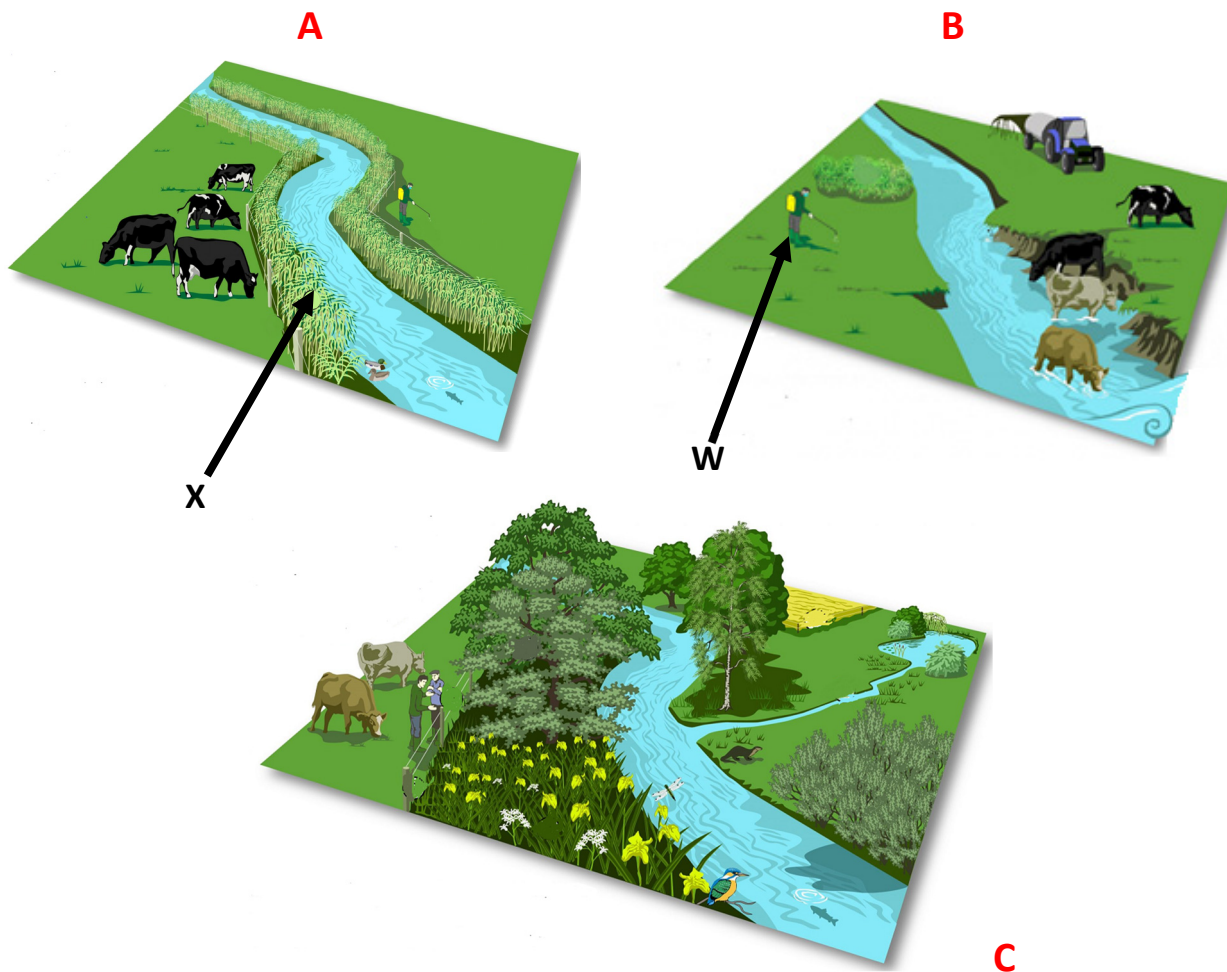
Element:
Role:

- (iii) Briefly outline **two** factors which affect the preservation of the crop.

1.
2.

- (iv) The field is on a steep slope beside a fast moving river.
Describe the safety considerations Lisa should consider when harvesting the crop.

(b) Analyse the diagrams and answer the questions which follow.



- (i) State which diagram **A**, **B** or **C** has a higher biodiversity level and give a reason for your answer.

Diagram:
Reason:

- (ii) Outline the reason for the crop **X** being sown between the cows and the river in diagram **A**.

- (iii) The farmer **W** is spot spraying the weeds in the field in diagram **B**.
Outline the advantage of spot spraying compared to spraying the whole field.

- (iv) State which diagram represents farming in the least environmentally friendly way and give **two** reasons for your answer.

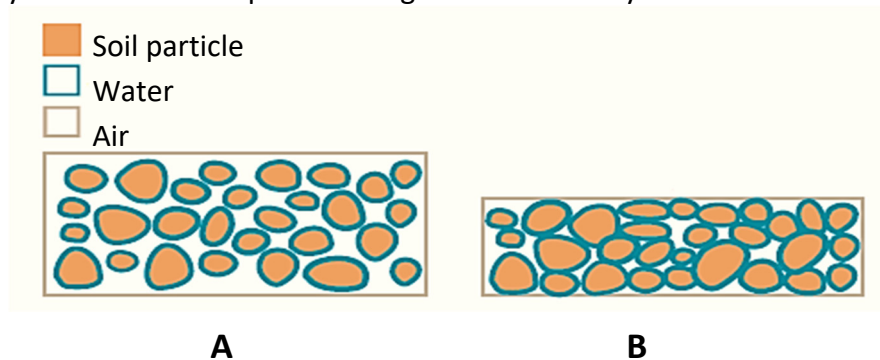
Diagram:
Reasons:

Question 15Answer (a) with **either** (b) **or** (c).

Brian bought 120 hectares of land for a mixed tillage and beef enterprise. He carried out a number of tests on the soil.

- (a) (i) Describe how he took soil samples for analysis.

- (ii) Two soil samples **A** and **B** were collected are represented in the diagrams. Identify which soil is compacted and give a reason for your answer.

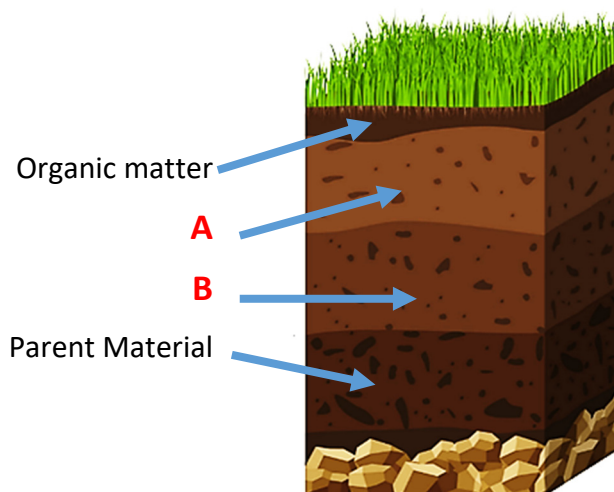


Soil sample:
Reason:

- (iii) Outline the effects of soil compaction on a farm.

- (iv) Suggest ways farmers can reduce soil compaction on their farm.

- (b) Brian discovered the soil type to be a brown earth soil as shown in the diagram below. Assist Brian in labelling the diagram.

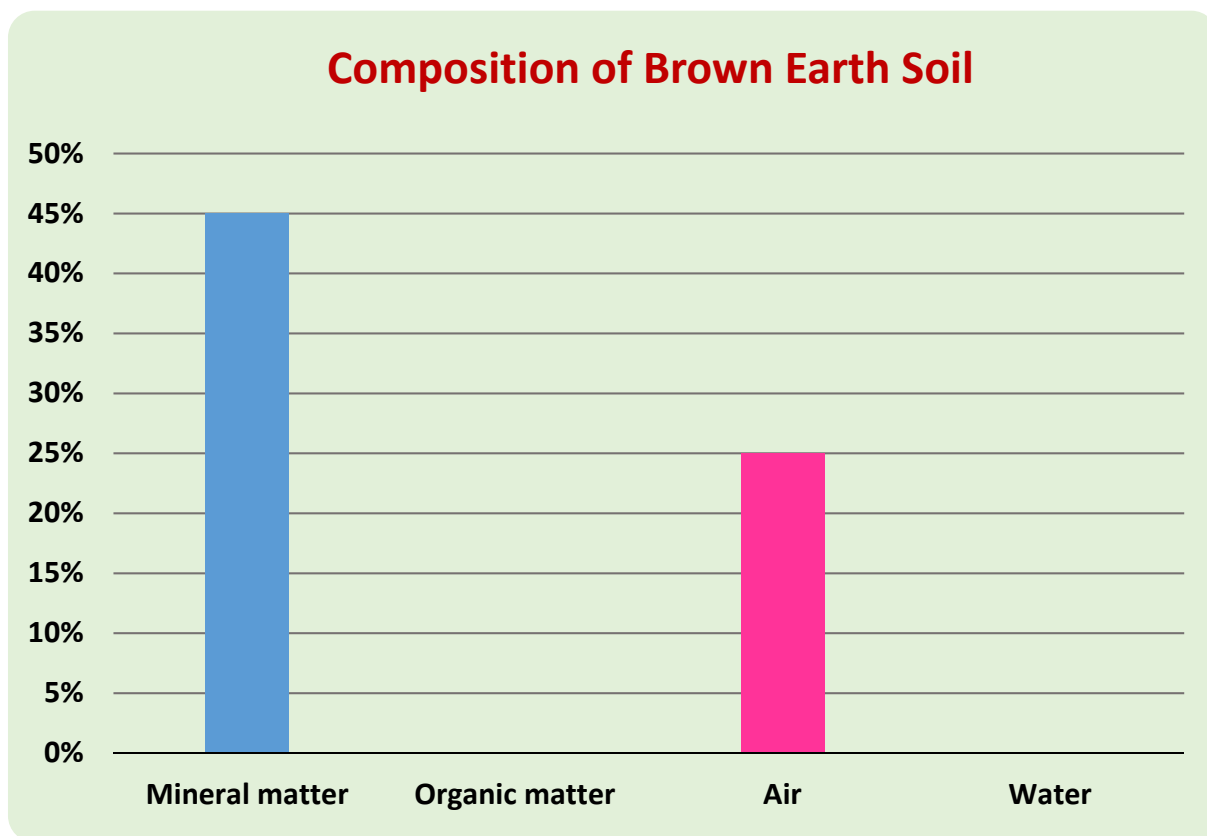


A:

B:

Or

- (c) Complete the graph to show the average organic matter and water composition of a brown earth soil.



Question 16

- (a) (i) Pat is doing a screening on his dairy herd. He wanted to check the quality of a milk sample.

Describe with the aid of a labelled diagram, how he would carry out this investigation.

[illegible]

Labelled diagram:

- (ii) Identify the following variables in the investigation in part (i).

Independent	
Dependent	
Control	

- (iii) State with reason if the data collected is qualitative or quantitative.

Data type:
Reason:

- (b) (i) Based on the results of his investigation, he noticed that the total bacterial count (TBC) had increased.
Outline ways Pat could reduce the number of bacteria entering the milk.

- (ii) Pat gets paid for the milk produced based on its quality using the calculation $A + B - C$. Calculate the price Pat gets for 1000 litres of his milk in the table below if the milk fat is 3.8% and protein is 3.4%.

	Milk composition price	Milk composition of 1000 litres	Price per kg (€)
A	Fat (€4.48/kg fat)	39.0kg of fat	174.72
B	Protein (€9.07/kg protein)	35.0kg of protein	317.45
C	Processing cost deduction (€0.04/l)		40.00
		Total price / 1000 litres	?

Calculation:

--

- (c) Read the article below and answer the questions which follow.

Irish-based ration achieves 47% reduction in emissions

A large portion of dairy rations fed to cattle on Irish farms are made using ingredients from outside of Ireland and the European Union (EU).

Because of this, the emissions associated with these rations are quite high, and these contribute towards overall farm emissions. The farm is focused on becoming the first climate-neutral dairy farm, with a wide range of measures being used to achieve this target.

One of the measures used on the farm is the feeding of a concentrate ration made from Irish sources. The ration fed to cows on the Shinagh demonstration farm is made from Irish oats (33%), Irish beans (33%) and Irish barley (34%).



(Adapted from Agriland, 2022)

- (i) Explain the underlined term.

- (ii) Outline why each of the following ingredients are added to the diet of a dairy cow.

Beans	
Barley	

Question 17

A young farmer purchased 20 ewes in his local mart in late November. The farmer doesn't know exactly how long the ewes are in lamb or if they are barren. The farmer got ultrasound scanning done on the ewes.



- (a) (i) Briefly describe the advantages of ultrasound scanning.

- (ii) Explain the importance of having a good marking system for the ewes at scanning.

- (iii) The results of scanning twenty ewes are shown in the table.

Outline the advice you would give on the management of the ewes, based on the results.

Number of lambs being carried by the ewes	Number of ewes
0	2
1	6
2	7
3	4
4	1

(b) The results from scanning the twenty ewes showed they were due to lamb in early March.

(i) Advise the farmer as when to house the ewes prior to lambing.

(ii) Suggest reasons for housing the ewes prior to lambing.

(iii) List features of winter housing for sheep.

(c) Describe the management practices carried out on lambs in the first week after birth under the following headings.

Feeding	
Housing	
Health	

Question 18

- (a) Read the article and answer the questions which follow.

DNA evidence proves Welsh farmer stole neighbour's cow

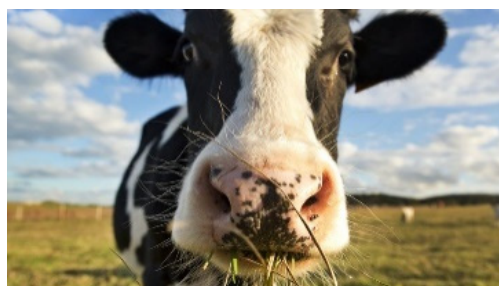
A farmer in Wales was fined £4,000 after DNA evidence was used to prove he had stolen his neighbour's cow, police have said.

The £3,000 heifer was re-tagged by his neighbour and claimed it as his own after it escaped from a neighbouring field.

Police said it has become the first police force in the UK to use DNA evidence from a stolen cow in a resulting criminal court case.

The cow's real owner reported one of his 300 cows had been stolen in December 2017 after spotting it in his neighbour's field, despite the farmer denying he had seen it. The farmer provided police with a cow passport, listing ear tag numbers for the cow and the animal he claimed was its mother.

A warrant was issued for the cow and blood samples taken from it were successfully matched with other cows from its original farm, and his neighbour was charged.



(Adapted from RTE, 2020)

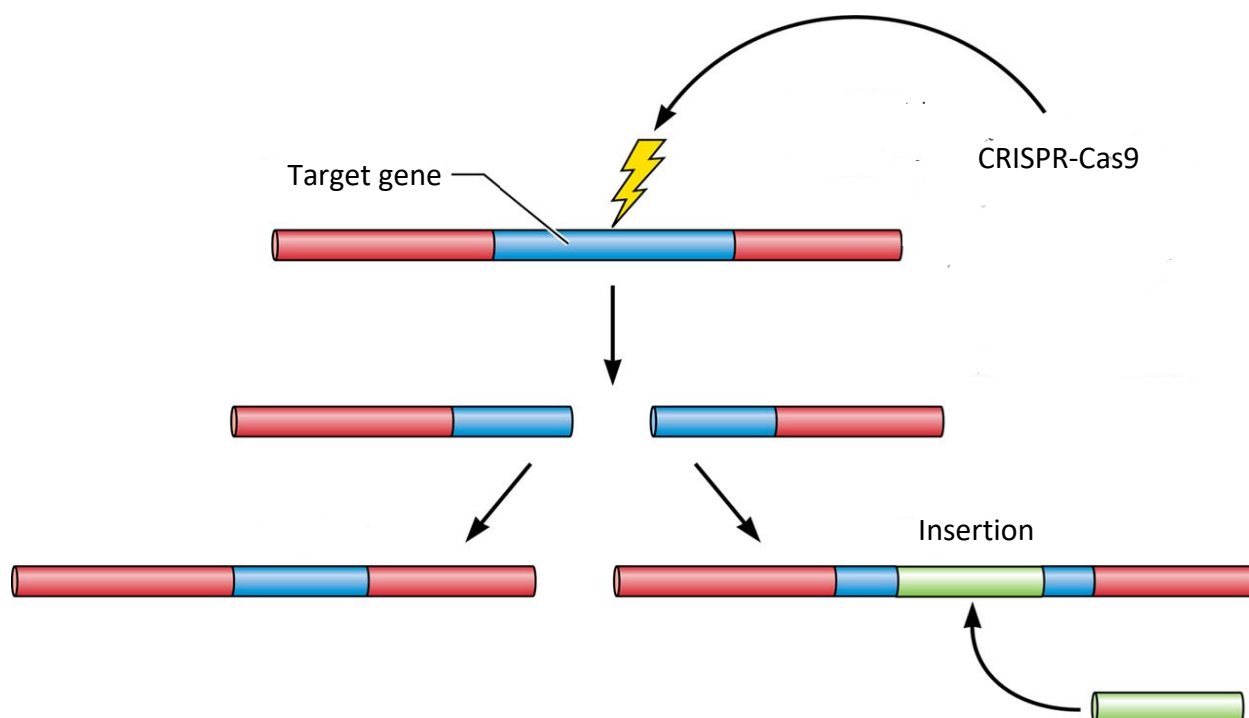
- (i) Identify the description which best explains the underlined term by placing a tick (✓) in the correct box.

Physical appearance	
Alternative form of a gene	
Genetic information	

- (ii) Explain how the police used the DNA evidence to prove that the heifer was stolen.

- (iii) Briefly describe another innovative method used on farms you have studied.

- (b) Plant breeding is the process of developing new plant varieties. Gene editing is one way of developing new plant varieties. The diagram shows a gene being edited using the tool CRISPR-Cas9.



- (i) With the aid of the diagram above, explain how the gene editing process works.

- (ii) Briefly describe the advantages of gene editing.

- (iii) Many countries around the world are now turning to genetically modified (GM) crop production due to food security concerns.

Explain any **two** of the following ethical or economic issues of producing GM crops in Ireland.

Impact on the environment
Effect on food chain
Increase in production



- (c) (i) Farmers and scientists have been improving crops and animals through selective breeding. Explain the underlined term.

- (ii) Briefly explain **two** characteristics farmers or scientists could select for in their plant or animal breeding programme.

1.
2.

[illegible]

Acknowledgements

Image(s)

Page 3	chemix.ie
Page 4	independent.ie; cows.ie; farmersjournal.ie; icbf.ie; norbreckgenetics.com
Page 5	wicklowcalfcompany.ie
Page 6	soilsforlife.org.au
Page 7	agricloud.org
Page 8	fas.scot
Page 9	sutterstock.com
Page 10	teagasc.ie
Page 12	calfcare.ca
Page 14	teagasc.ie
Page 15	gstatic.com
Page 17	medprimetech.com
Page 20	pixabay.com; istockphoto.com; irishwildflowers.ie
Page 21	State Examinations Commission
Page 24	farmingfornature.ie
Page 26	cafre.ac.uk
Page 28	vectorstock.com
Page 31	agriland.ie
Page 32	teagasc.ie
Page 34	rte.ie
Page 35	journals.asm.org
Page 36	scitechdaily.com

Text

Page 17	<i>Why Use a Portable Microscope for Agriculture.</i> https://www.medprimetech.com/blog/why-use-a-portable-microscope-for-agriculture/ , (27 August 2022).
Page 31	Mc Donnell, B. <i>Irish based ration achieves 47% reduction in emissions.</i> https://www.agriland.ie/farming-news/irish-based-ration-achieves-47-reduction-in-emissions , (18 September 2022)
Page 34	<i>DNA evidence proves Welsh farmer stole neighbour's cow.</i> https://www.rte.ie/news/newslens/2020/0205/1113374-cows , (5 February 2020).

Do not write on this page

Copyright notice

This examination paper may contain text or images for which the State Examinations Commission is not the copyright owner, and which may have been adapted, for the purpose of assessment, without the authors' prior consent. This examination paper has been prepared in accordance with *Section 53(5) of the Copyright and Related Rights Act, 2000*. Any subsequent use for a purpose other than the intended purpose is not authorised. The Commission does not accept liability for any infringement of third-party rights arising from unauthorised distribution or use of this examination paper.

Leaving Certificate – Ordinary Level

Agricultural Science

Monday 19 June

Afternoon 2:00 - 4:30