2025.M40

2025L024A1EL

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2025

Agricultural Science

Higher Level

Monday 16 June Afternoon 2:00 - 4:30

300 marks

Examination Number

Date of Birth

For example, 3rd February 2005 is entered as 03 02 05

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, Month and Year 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.

This examination booklet will be scanned and your work will be presented to an examiner on screen. All of your work should be presented in the answer areas, or on the given graphs, or diagrams. Anything that you write outside of these areas may not be seen by the examiner. You are not required to use all the space provided.

Write all answers into this booklet. There is extra space at the end of Section A and at the back of the booklet. If you need to use it, 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

(a) Identify both cattle breeds in **A** and **B**.

A

B

(b) State which breed **A** or **B** has a dominant <u>polled</u> trait as a characteristic of the breed.

(c) Explain the underlined term in part (b) above.

Question 2 Answer **either** (a) **or** (b).

(a) Plant lifecycles can be distinguished as annual, biennial and perennial.

Explain **any two** plant lifecycles **and** provide an example of each one.

Annual	
Example of plant	

Biennial	
Example of plant	

Perennial	
Example of plant	

Or

(b) Read the article and answer the questions that follow.

New Wagyu beef cross programme aiming to process 150 head of cattle weekly

Japanese Wagyu beef is some of the most expensive beef in the world and is renowned for its superior marbling.

A new Wagyu beef cross programme aims to process 150 head of cattle weekly in Ireland. It will be of strong interest to dairy farmers looking for a guaranteed market outlet for their calves. Bull sires are selected on meat quality, good growth rates, ease of calving, docility and fertility.

Farmers who produce Wagyu under this heifer and steer programme will benefit from a guaranteed €200 payment for their four-week-old calf, as well as an additional €50 premium to the breeder after the animal has been processed.

(Adapted from Independent.ie, 2024)

(i) Identify the correct explanation for marbling by placing a tick (✓) in the correct box.

Distribution of muscle on an animal	
High levels of beta carotene in meat	
Intramuscular fat found in meat	

(ii) Choose **any two** characteristics of the Wagyu breed from the list below and describe how each of your chosen characteristics makes the breed suitable for crossing with dairy cows.

Meat quality	Good growth rates	Ease of calving	Docility	Fertility

	Description
Characteristic 1:	
Characteristic 2:	

(iii) Outline **one** reason why dairy farmers would favour a guaranteed market for their calves.

Question 3 Answer **either** (a) **or** (b).

(a) Cow brushes on dairy farms are becoming increasingly popular.

(i) Outline reasons why farmers install cow brushes in cattle sheds.

(ii) In relation to environmental sustainability, briefly describe the advantages of **one** other named piece of farm technology you have studied.

Named technology:

Or

(b) Read the article and answer the questions that follow.

Slurry System Technology that Reduces Ammonia Emissions

EASYFIX was awarded the first Green Impact Award for its pioneering technology designed to reduce methane and ammonia emissions from slurry storage at the 2024 National Ploughing Championship.

The system injects compressed oxygen into the slurry at specific points via non-return valves. The oxygen that flows through the valve creates a bubble and as it rises through the slurry it helps to break the slurry down and ensures that it remains in a liquid state.

The benefit of this technology is that it is proven to reduce ammonia emissions by up to 51%. It also greatly assists in the increased availability of nutrients such as Nitrogen (N), Phosphorus (P) and Potassium (K) in the slurry. The liquid state of the slurry eliminates the need for agitation.

(Adapted from enterpriseireland.ie, 2024)

(i) Briefly explain how the use of this technology could be safer for **(1)** animals and **(2)** the environment.

Animals:
Environment:

(ii) Apart from safety, outline ways this technology could benefit farmers.

Question 4 Answer **either** (a) **or** (b)

(a) Bovine Tuberculosis (TB) is a notifiable disease and zoonosis.

TB is on the increase across Ireland with some areas around the country seeing cases rise by 22%.

(i) Explain the underlined terms.

Notifiable disease:
Zoonosis:

(ii) Briefly describe how TB is spread within **or** between herds.

(iii) Outline the advice you would give to farmers to help prevent the disease entering their farms.

Or

(b) Irish farms saw a sharp increase in the incidence of blackleg disease in 2024.

(i) Identify the bacteria that causes blackleg disease by placing a tick (✓) in the correct box.

Lactobacillus	
Streptococcus aureus	
Clostridium chauvoei	

(ii) State where the bacteria identified in part (i) can be found.

(iii) Outline **one** symptom of this disease.

(iv) Describe how blackleg disease can be prevented.

Question 5

Weaning can be a stressful time for calves as they experience big changes in both their environment and diet. The Beef Welfare Scheme for 2024 aims to reduce these stresses.

(a) Outline **one** effect weaning can have on beef animals.

(b) The Beef Welfare Scheme requires feeding animals concentrates.
State **one** essential nutrient of a weanling concentrate ration **and** name a source of this nutrient.

Nutrient:
Source:

(c) Gerry had 63 calves on his suckler beef farm in Co. Wicklow.
Analyse the table on concentrate feed requirements and answer the questions that follow.

	Recommended daily feeding concentrate amount (kg/day)	Duration of feeding (weeks)
Pre-weaning	1	4
Post-weaning	2	2

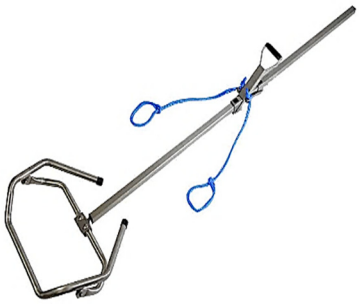
Calculate the amount of concentrate feed required for his beef calves during the six-week weaning period.

Calculation: Total feed required for calves:

Question 6

Pádraig is a sheep and beef farmer. He is getting his equipment ready for lambing.

(a) Identify the **three** pieces of equipment needed for lambing from the six images below.

A	B	C
		

D	E	F
		

(b) Briefly describe how **any one** of your named pieces of equipment identified in part (a) above is used during the lambing period.

Named piece of equipment:

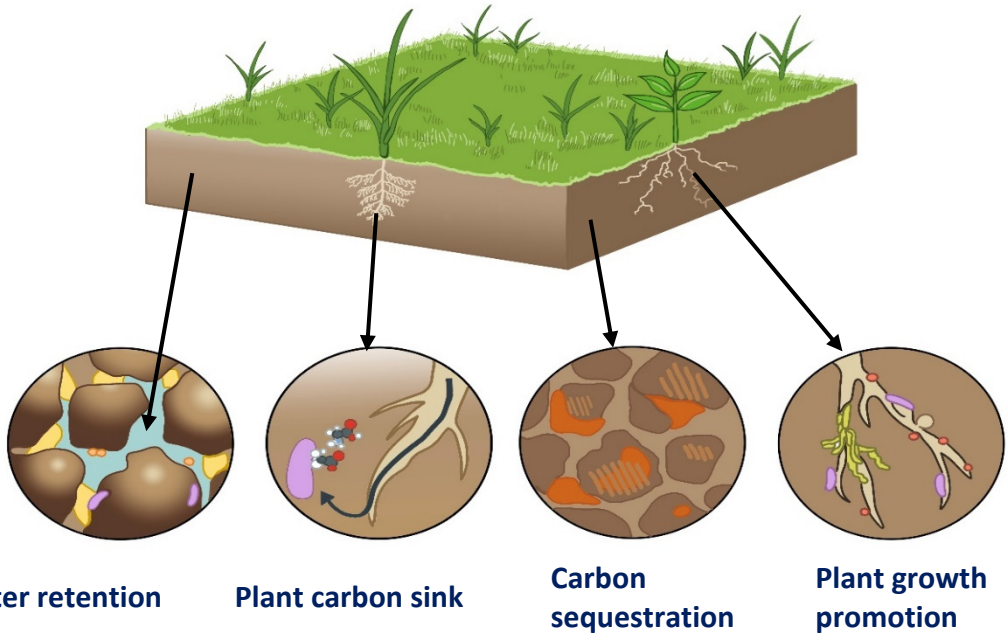
Question 7

The soil microbiome plays a large role in soil health.

(a) List **any two** components of the soil microbiome.

1.
2.

(b) Analyse the diagram below which shows processes that are carried out by the soil microbiome and answer the questions that follow.



Outline how the soil microbiome contributes to **any one** of the above processes **and** state how this process in turn benefits productivity in a named catch **or** energy crop.

Named process:

Contribution:

Named energy **or** catch crop:

Benefits productivity:

Question 8

(a) You have been asked to address a group of farmers on the topic of the nitrogen cycle and its benefits to animal **and / or** crop production on Irish farms.
Describe the points you would provide to the farmers.

Question 9 Answer **either** (a) **or** (b).

Jack was carrying out research to see if he could sow barley in his fields and found that barley crops grow best between pH 6.0 and 7.0.

(a) Briefly describe with the aid of a labelled diagram how Jack could test the pH of a soil sample.

Labelled diagram:

Or

(b) The results of the investigation to determine the pH of a number of fields are shown in the table below.
Analyse the table and answer the questions that follow.

	pH
Field 1	5.8
Field 2	6.6
Field 3	6.2

(i) Identify which fields are most suitable for growing barley crops with an optimum growing range of 6.0 - 7.0.

(ii) For fields not suitable for barley production, outline how Jack could adjust the pH to ensure he could sow barley in that field in the future.

(iii) Explain the role of pH in the uptake of nutrients in a soil.

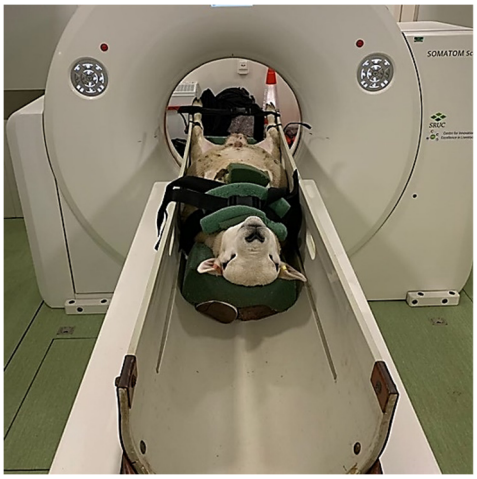
Question 10

Read the article and answer the questions that follow.

Advances in Sheep Production

Computed Tomography (CT) scanning is a great tool for identifying superior genetics within flocks producing terminal sire flocks.

The advantages of CT scanning provide a welfare friendly way of assessing the total muscle, fat and bone yield in a live sheep. This near perfect predictor of carcase composition can also be used to measure the muscling in different parts of the live animal.



(Adapted from signetdata.com, 2024)

(a) Explain the underlined term.

(b) Describe the improvements to breeding and management a farmer could make to their sheep flock based on the information from the CT scan.

Breeding:
Management:

Question 11

Cattle, sheep, pig and poultry traceability is vitally important for food safety, animal health programmes and to assure Irish access to meat, milk and egg export markets.

Ireland is recognised as having one of the best livestock traceability systems in the world. Innovation in this area is ongoing, which has enabled Irish farmers to continue to access valuable markets abroad.

(Adapted from Agriland, 2021)

(a) Outline ways farmers can ensure quality produce on their farms in order to meet these standards for the export markets.

(b) Briefly explain the importance of export markets to Irish Agriculture.

Question 12

Outline **one** scientific reason for **any four** of the following:

(a) Progeny testing in dairy cows.

(b) Having a buffer zone close to a waterway.

(c) Presence of chloroplasts in the palisade layer of a leaf.

(d) Culling of breeding ewes on a sheep farm.

(e) Movement of water from the soil through the plant to the atmosphere.

Additional writing space for **Section A**.
Label all work clearly with the question number and part.

Section B — 200 marks

Answer any **four** questions.

Each question carries 50 marks.

Question 13 Answer both (a) **and** (b) with **either** (c) **or** (d).

(a) Paula and Bill's dairy calving records for 2023 from their 120-cow dairy herd are shown in the table below. A mixture of Artificial Insemination (AI) and an Aubrac beef stock bull (shown in the image below) was used for breeding animals including their own replacements. Analyse the table and answer the questions that follow.

	Number of heifer calves	Number of bull calves
Purebred Friesian	25	25
Aubrac x Friesian	28	35

(i) Outline reasons why the farmers chose to cross some of the Friesian cows with an Aubrac stock bull.

(ii) Identify which of the dairy cows in the herd were crossed with a Friesian bull, by placing a tick (✓) in the correct box.

Early calving cows	
Late calving cows	

(iii) Outline a reason for your answer in part (ii) above.

(iv) Calculate the replacement rate for the herd.

Calculation:

(v) Calculate the number of barren (not in calf) cows on the farm.

Calculation:

(vi) State another dairy breed that would be suitable for the farm.

(vii) Outline advantages of breeding their own replacements.

(b) Paula and Bill <u>milk record</u> the cows on a monthly basis.

(i) Explain the underlined term.

(ii) Milk samples were taken and sent to the laboratory for pregnancy testing. Outline advantages of pregnancy testing in dairy herds.

(iii) Apart from pregnancy testing, outline the advantages of milk recording.

(c) The table below shows the best time for insemination of cows to achieve higher conception rates.
Analyse the table and answer the questions that follow.

Coming into heat	Standing heat	Going off heat
8 hours (0 - 24 hours)	16 hours (3 - 30 hours)	8 hours (2 - 24 hours)



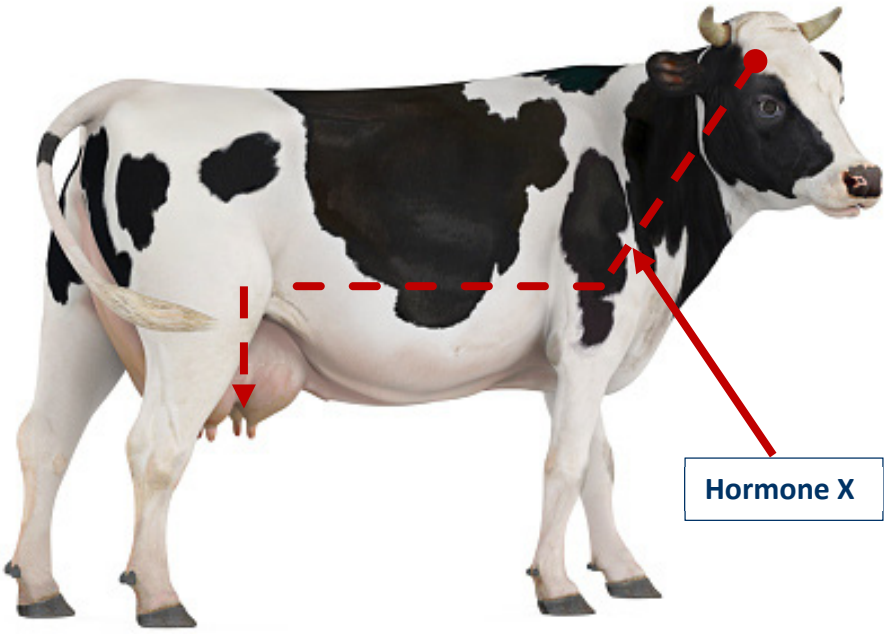
Time (hours)	0 - 6	6 - 12	12 - 18	18 - 24	24 - 30
Artificial Insemination (AI)	Too early	Good	Best	Good	Too late
Natural mating	Too early	Best		Too late	

(i) Identify the optimal time for insemination using AI.

(ii) Outline **one** reason why cows may be inseminated too early or too late.

Or

(d) A hormone is responsible for milk let down in cows.
Analyse the picture and answer the questions that follow.

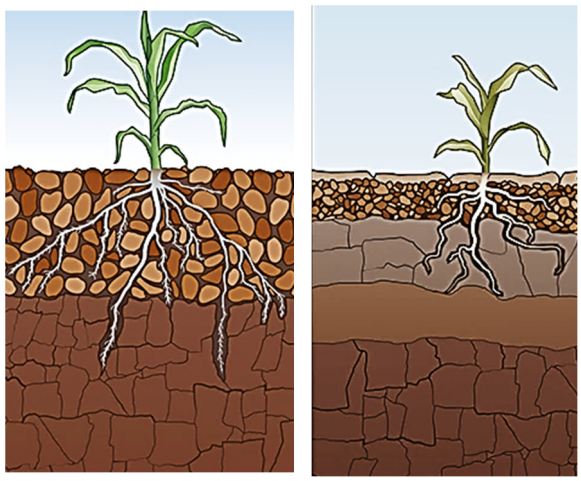


(i) Identify the hormone labelled **X** responsible for milk let down.

(ii) Identify **one** trigger of milk let down in cows.

Question 14 Answer both (a) **and** (b) with **either** (c) **or** (d).

The picture shows crop growth in compacted and uncompacted soil.
Analyse the picture and answer the questions that follow.

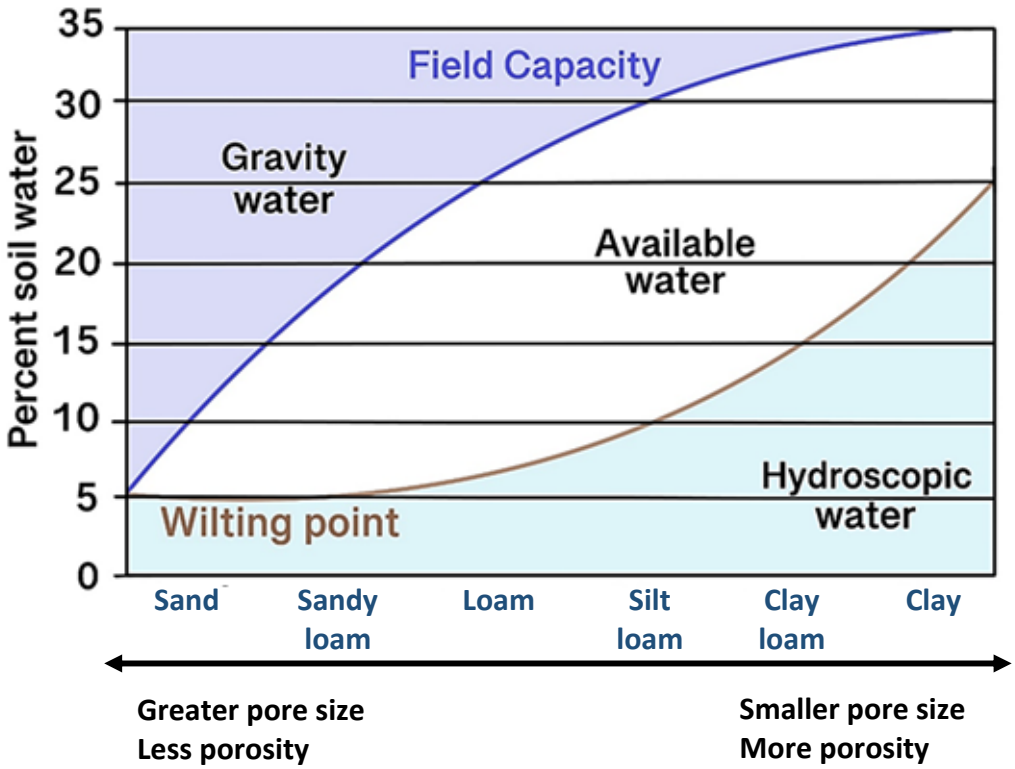


A	B

(a) **(i)** Identify which soil **A** or **B** is most compacted and outline a reason for your answer.

Soil:
Reason:

The graph shows water availability in different soil types.
Analyse the graph and answer the questions that follow.



(ii) Calculate the % available water in a silt loam soil.

Calculate:

(iii) Account for the difference in the permanent wilting point of sand soils and clay soils.

(b) **(i)** Compare, with the aid of a labelled diagram, the capillarity of a compacted and uncompacted soil. State the results of this investigation.

Labelled diagram:

(ii) Identify the variables in this investigation.

Independent	
Dependent	
Control	

(iii) Outline **two** ways to make this investigation accurate.

(c) Outline ways farmers can reduce compaction on their farm.

Or

(d) Outline ways in which soil compaction occurs on a tillage farm.

Question 15

(a) Plant breeding in agricultural crops is essential to ensure their survival. Potatoes rank as the third most consumed food globally.

In plant breeding two parent plants are selected to cross. Physical traits, disease resistance, quality and agronomic traits are considered. The plants are then cross-pollinated.

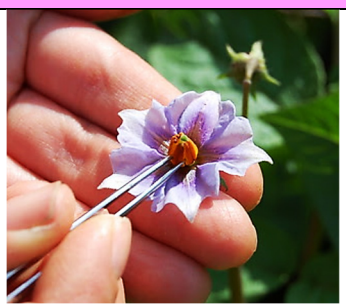
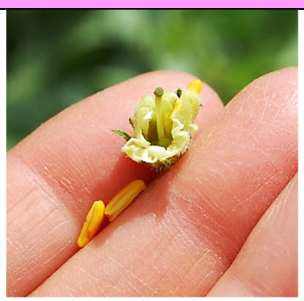
(i) Explain the underlined terms.

Physical traits:
Disease resistance:

(ii) Outline characteristics a scientist would be looking for when selecting any two parent plants for breeding.

(iii) Alex wanted to investigate genetic inheritance of petal colour in potatoes by crossing a plant with purple flowers with a plant with white flowers. Assist Alex in placing each step in the correct order by matching the correct letter to the number in the box.

A	B
 Collect seeds for planting	 Rub pollen from the purple flower on the stigma of the white flower

C	D
 Remove anthers containing pollen with sterile scalpel from the purple flower	 Remove anthers, leaving only the carpel to be pollinated on the white flower

1		2		3		4	

(iv) Alex collected 20 potato seeds and planted them. All seeds germinated and produced flowers. Alex counted the number of plants with purple flowers and white flowers. The results are shown in the table below.

	Purple flowers	White flowers
Number of plants	14	6

Identify the dominant trait in the plants and suggest how a knowledge of genetic inheritance can improve crop production on a tillage farm.

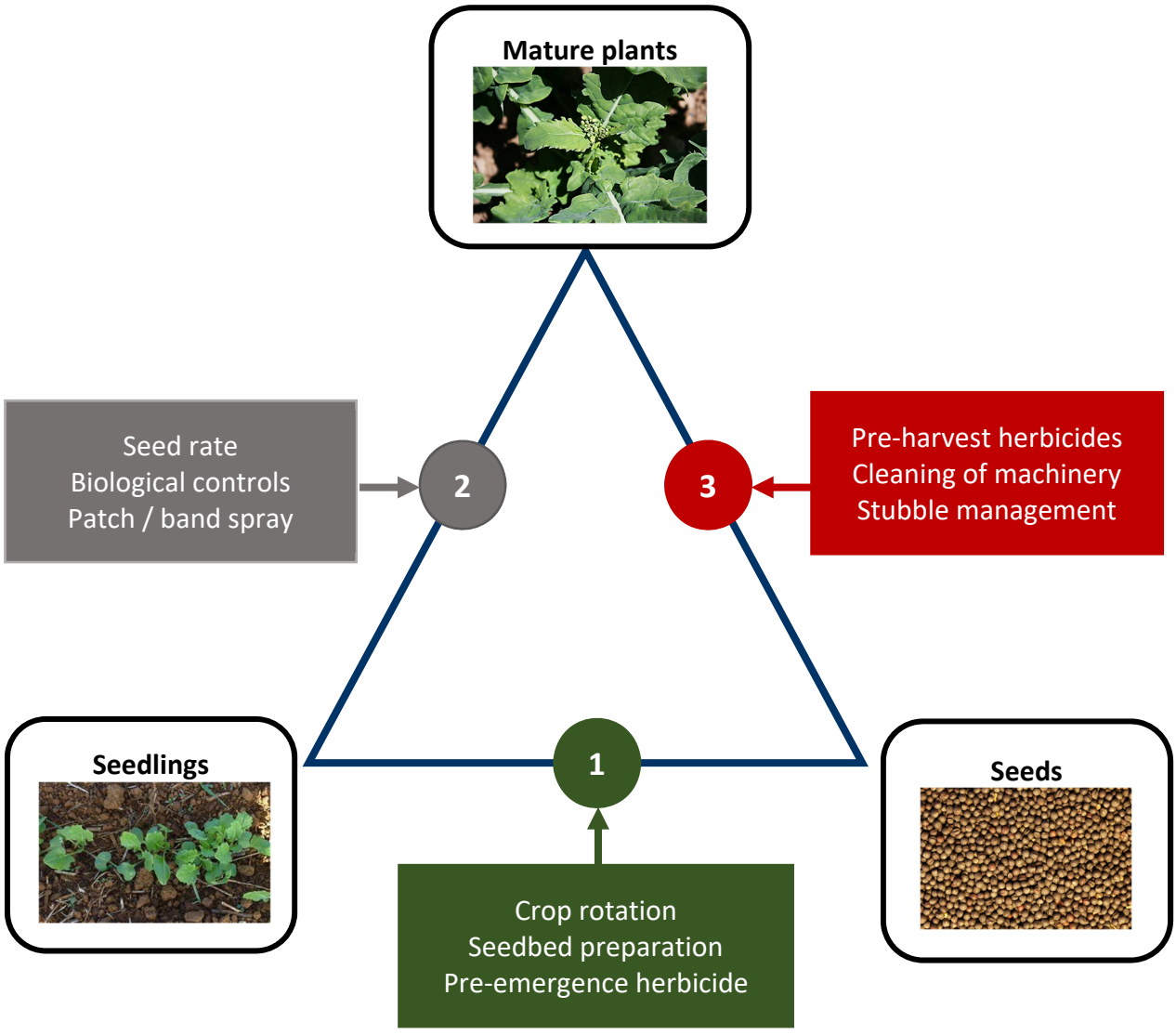
Dominant trait:
Suggestion:

(b) Identify **any three** common plants found on Irish farms in the photographs below.

A	B	C	D
			

(c) You have been asked to address a group of tillage and dairy farmers on controlling weeds on their farms in order to maximise crop productivity.
Using the diagram below, outline the advice you would give them under the following headings:

- types of weed control
- negative effects of weed control on farms
- safety considerations farmers need to consider when controlling weeds.



Question 16

(a) The table shows a suckler-bred Charolais versus a dairy-origin Holstein Friesian steer, both offered a high-concentrate finishing diet.
Analyse the table and answer the questions that follow.

	Charolais	Holstein Friesian
Age (days)	654	678
Daily Dry Matter (DM) intake (kg/day)	11.5	12.6
Feed conversion ratio (FCR)	8.4	9.8
Liveweight (kg)	725	659
Carcass weight (kg)	446	360

(Adapted from Teagasc, 2022)

(i) Identify the animal with the higher intake of feed.

(ii) Identify which animal had the better food conversion ratio (FCR).

(iii) Calculate the Daily Liveweight Gain (DLG) from birth to slaughter for the Charolais.

Calculation:

(iv) Identify which animal has the inferior feed efficiency.

(v) Explain Food Conversion Ratio (FCR).

(vi) Outline factors affecting FCR in animals.

(b) The factory quoted a base price of €5.25 / kg.
Show using calculations how much each animal would earn and identify the animal that would earn the most money.

Calculation:

Animal:

(c) Jack used an Artificial Intelligence (AI) app on his phone to research silage making and found the following information.
Analyse the paragraph and answer the questions that follow.

Jack's prompt: *Tell me how to make silage in Ireland.*

Response given by AI app
Silage making in Ireland involves a controlled fermentation process that preserves grass and other green fodder for livestock feed. After cutting, the forage is wilted to reduce its moisture content before being compacted and sealed in airtight conditions, such as in a silo, pit, or bale. The presence of oxygen allows anaerobic bacteria, primarily lactic acid bacteria, to ferment the plant sugars, producing butyric acid. This acidification raises the pH, inhibiting harmful microbes and preserving the feed's nutritional value. Silage is a key component of Ireland's livestock farming, ensuring a reliable food source throughout the winter months.

(i) Identify **two** inaccurate pieces of information from the paragraph above.

1.
2.

(ii) Outline the correct information for each inaccuracy stated in part (i) above.

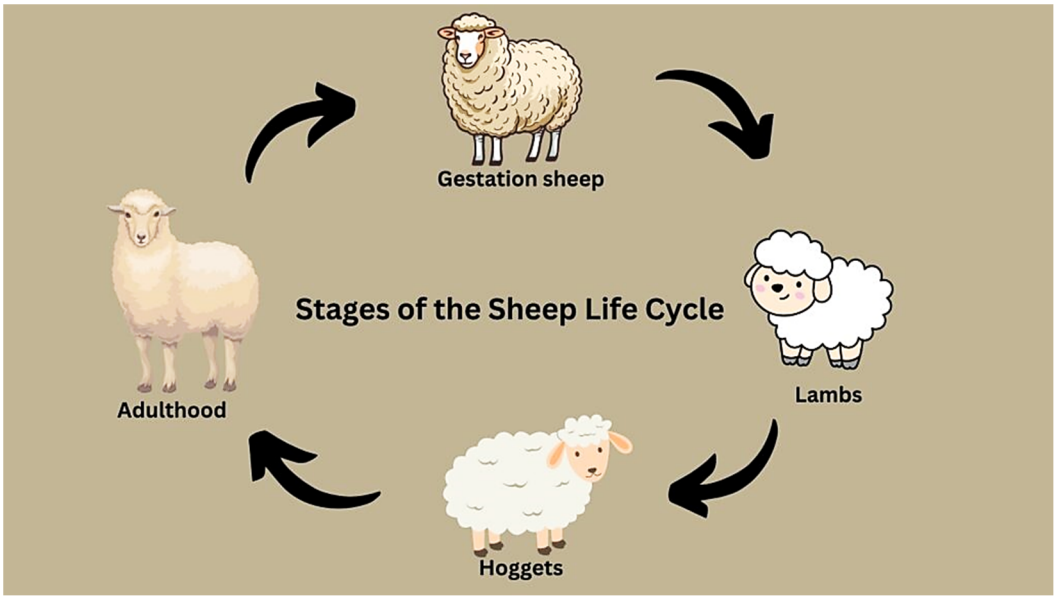
1.
2.

(iii) Suggest a better prompt Jack could have put into the app.

(iv) Suggest a suitable source of information Jack could use when researching agricultural information.

Question 17

(a) The lifecycle of a sheep is outlined in the diagram below.
Analyse the diagram and answer the questions that follow.



(i) Explain what is meant by the term *hogget*.

(ii) State the gestation length (in days) of a sheep.

(iii) Describe the management practices at breeding to ensure a successful breeding season.

(iv) Describe the characteristics a farmer would look for in a suitable replacement in a ewe lamb.

(v) State with reason if it is good practice to keep ram lambs on the farm if not intended for breeding.

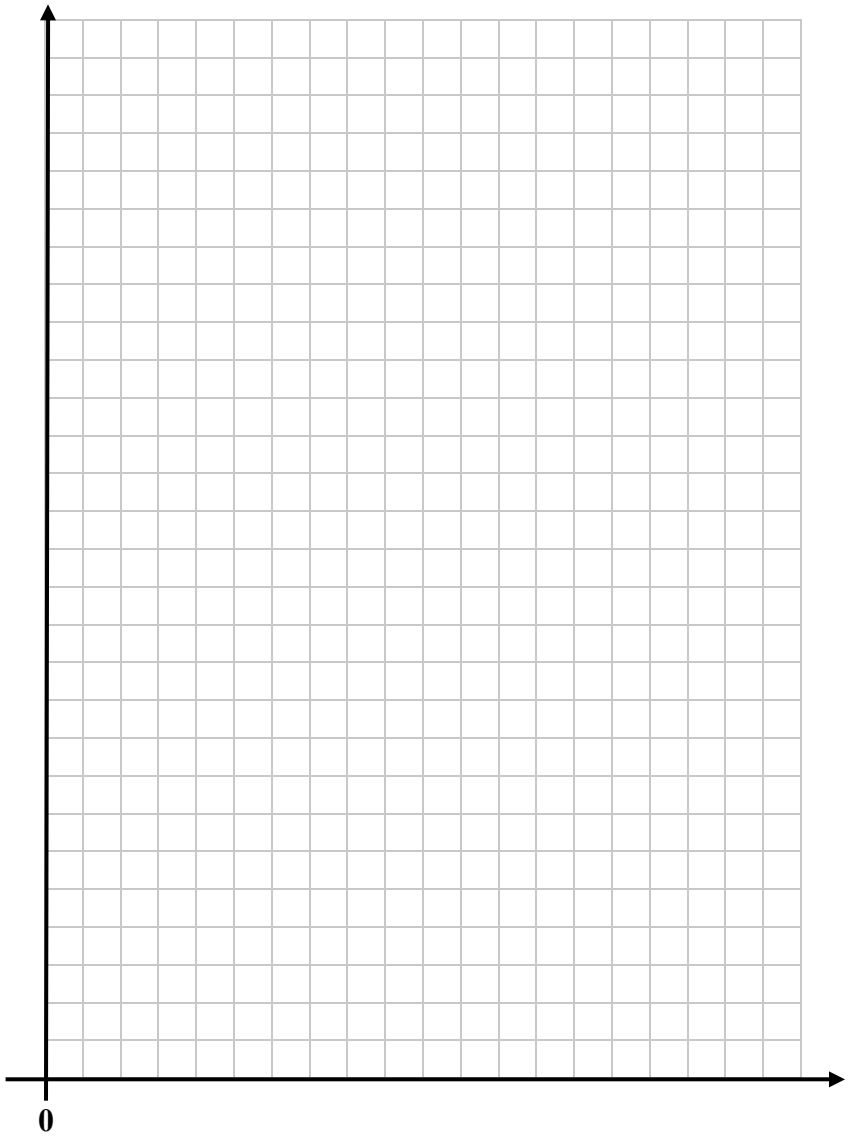
(b) **(i)** Housing sheep in winter is more for the shepherd than the sheep.
Briefly describe the features of good sheep housing.

(ii) Outline safety considerations when working with sheep.

(c) **(i)** An investigation was carried out over a six-week period to compare the dry matter production in two varieties of kale.
Using the data in the table below, plot a graph showing the DM yield for the Caledonia variety over the six-week period.

Dry Matter yield of kale varieties in thousands of kg per hectare						
Kale variety	**Week 1**	**Week 2**	**Week 3**	**Week 4**	**Week 5**	**Week 6**
Regal	14.7	14.3	13.9	14.3	14.2	14.8
Caledonia	16.0	15.5	15.0	16.5	16.5	17.5

DM yield for the Caledonia



(ii) Identify which variety of kale would provide the highest DM intake for livestock.

Question 18

(a) Olivia and Jim were reseeding 20% of their grassland for their mixed beef and dairy farm.

(i) List with reason **three** types of plants they could include in the mixture.

Types	Reason
1.	
2.	
3.	

(ii) Describe the cultivation of the seedbed for the grassland mixture.

Named method:

(iii) Outline the nutritional requirements of the reseeded land.

(b) Olivia and Jim wanted to investigate the establishment of grass with that of another crop. Describe with the aid of a labelled diagram how they could carry this investigation.

Labelled diagram:

(c) **(i)** Explain crop establishment.

(ii) Spring 2024 was very wet.
Describe the difficulties crops had in establishing.

Additional writing space for **Section B**.
Label all work clearly with the question number and part.

Additional graph paper.
Label all work clearly with the question number and part.

Acknowledgements
Image(s)

Page 3	epgstraws.com; farminglife.com
Page 4	pixabay.ie
Page 5	independent.ie
Page 6	kerbl.com
Page 7	irishfarmersjournal.ie
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Page 25	soilhealth.wsu.edu; pacificbiochar.com
Page 28	allotment-garden.org
Page 30	apothecary-shoppe.com; irishwildflowers.ie; notcutts.co.uk; agriland.ie; issuu.com; britannica.com
Page 35	sheepgoatinsights.com

Text

Page 5	Horan, Niall. https://www.independent.ie/farming/news/new-wagyu-beef-programme-aiming-to-process-150-head-of-cattle-weekly/a1921260490.html (9 Jan 2024).
Page 7	https://www.enterprise-ireland.com/en/news/ireland-rise-as-a-global-agriculture-innovation-hub (19th September 2024).
Page 16	Computed Tomography. https://signetdata.com/technical/sheep-recording/computed-tomography.

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Leaving Certificate – Higher Level

Agricultural Science

Monday 16 June

Afternoon 2:00 - 4:30