



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2022
Agricultural Science
Ordinary Level

Monday 20 June Afternoon 2:00 - 4:30

220 marks

Examination Number

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Day and Month of Birth

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For example, 3rd February
is entered as 0302

Centre Stamp

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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 **seven** questions from this section. There is internal choice in **four** questions.
Each question carries 10 marks.

Section B Answer any **three** 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

70 marks

Answer any **seven** questions.

Each question carries 10 marks.

Question 1

Two examples of farm machinery are shown in the photographs.



A



B

(a) Identify **and** state the function of machine **A** and **B**.

A:
Function:
B:
Function:

(b) State **one** safety precaution when working with machine **B**.

Question 2

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

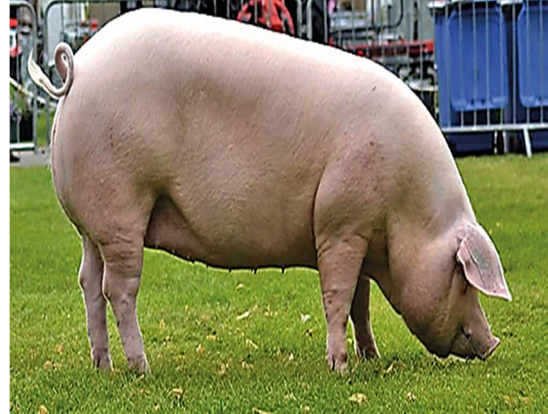
- (a) (i) The photographs below show breeds of animals found on Irish farms.
Identify **any three** of the following breeds using the list below.

Jersey	Blackface mountain	Landrace	Simmental
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A



B



C



D

A:
B:
C:
D:

- (ii) Describe **two** traits which make animal **A** shown in part (i) above suitable for selection as a sire.

1.
2.

Or

- (b) Jessica is a young sheep farmer and she is looking to buy a ram to breed replacements with her Suffolk cross ewes. Look at the pictures below and answer the questions which follow.

E



F



- (i) Identify breed **E** and **F**.

E:

F:

- (ii) Jessica could choose either breed **E** or **F** to cross with her Suffolk cross ewes for replacements in her flock. Advise Jessica with reasons which breed to choose.

Breed:

- (iii) Outline **one** reason why Jessica choose to have Suffolk cross ewes rather than purebred ewes on her farm.

Question 3

- (a) A student carried out an investigation in the school laboratory to determine the pH of a soil sample.



Briefly describe how the student carried out this investigation.

- (b) The result of the investigation is shown in the table below. Suggest **one** implication this has for growing crops on the land and **one** way the student could alter the pH of the soil.

	pH
Soil sample	5.2

Implication:
Alter pH:

Question 4

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

- (a) “Under the European Union biodiversity strategy, at least 25% of the European Union’s agricultural land must be organically farmed by 2030”.

(Adapted from Irish Farmers Journal, 2020)



- (i) Explain the underlined word.

- (ii) Describe **two** management practices you would observe on organic farms.

1.
2.

- (iii) State **one** advantage of farming organically.

Or

- (b) Indicate if the following statements are true or false by place a tick (✓) in the correct box.

The first one has been done as an example.

		True	False
Example	<i>Duration of heat in cattle is 48 hours</i>	☐	☒
(i)	The length of the oestrus cycle in cows is 17 days	☐	☐
(ii)	Gestation length in cattle is 283 days	☐	☐
(iii)	pH of the rumen is 7	☐	☐
(iv)	Ideal Body Condition Score (BCS) for a cow at calving is 4.5	☐	☐
(v)	The number of compartments in the ruminant stomach is 3	☐	☐

Question 5

- (a) Farm animals are fed diets for maintenance and production. Explain the underlined terms.

Maintenance:
Production:

- (b) A concentrate ration fed to beef animals has the following composition:

Food Constituent	% Present
Crude protein	14
Crude oil and fat	4
Crude fibre	6.6



State the function of protein **and** fibre in the diet of a beef animal.

Protein:
Fibre:

Question 6

The safety symbols below are present on a selective herbicide used to control all species of docks in an established grassland sward.



A



B



- (a) Explain the underlined term.

- (b) Identify the safety symbols labelled **A** and **B** above.

A:
B:

- (c) State **two** precautions farmers should take when applying herbicides.

1.
2.

Question 7

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

- (a) A student plants some seeds to investigate germination. During the investigation they also discover that a plant root structure is an important feature for the absorption of nutrients.



- (i) Identify **one** feature of the root which allows it to absorb nutrients.

- (ii) State **one** nutrient absorbed through the root which is required for healthy plant growth.

--

- (iii) A farmer discovers his crop is deficient in the nutrient named in (ii) above. Describe (1) a symptom **and** (2) the treatment for this deficiency.

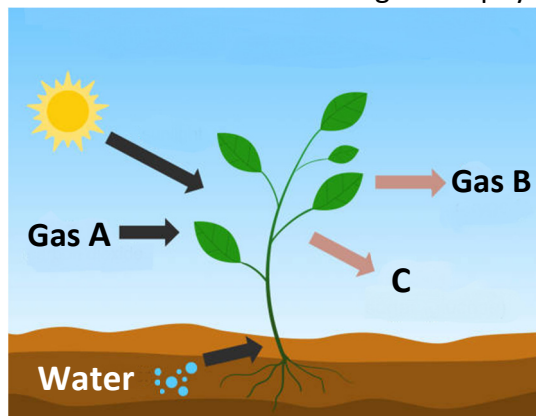
Symptom:
Treatment:

Or

- (b) Photosynthesis is the method by which green plants make their own food using chlorophyll.

- (i) Identify what **A**, **B** and **C** are representing in the picture illustrating photosynthesis.

A:
B:
C:



- (ii) Describe **two** ways a leaf is adapted to carry out photosynthesis.

1.
2.

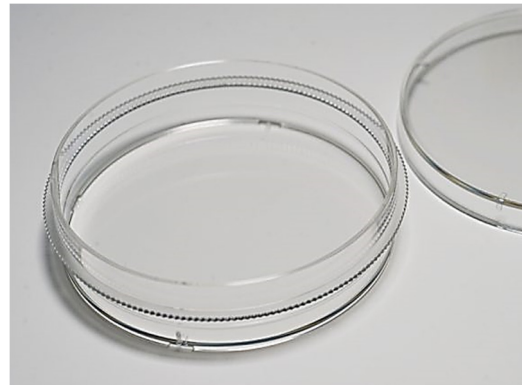
Question 8

A student was asked to carry out an investigation to isolate and grow bacteria from clover root nodules. The following pictures represent some of the equipment a student may use during this investigation.

A



B



- (a) Identify each piece of equipment **A** and **B** above.

A:
B:

- (b) State a suitable prediction for this investigation.

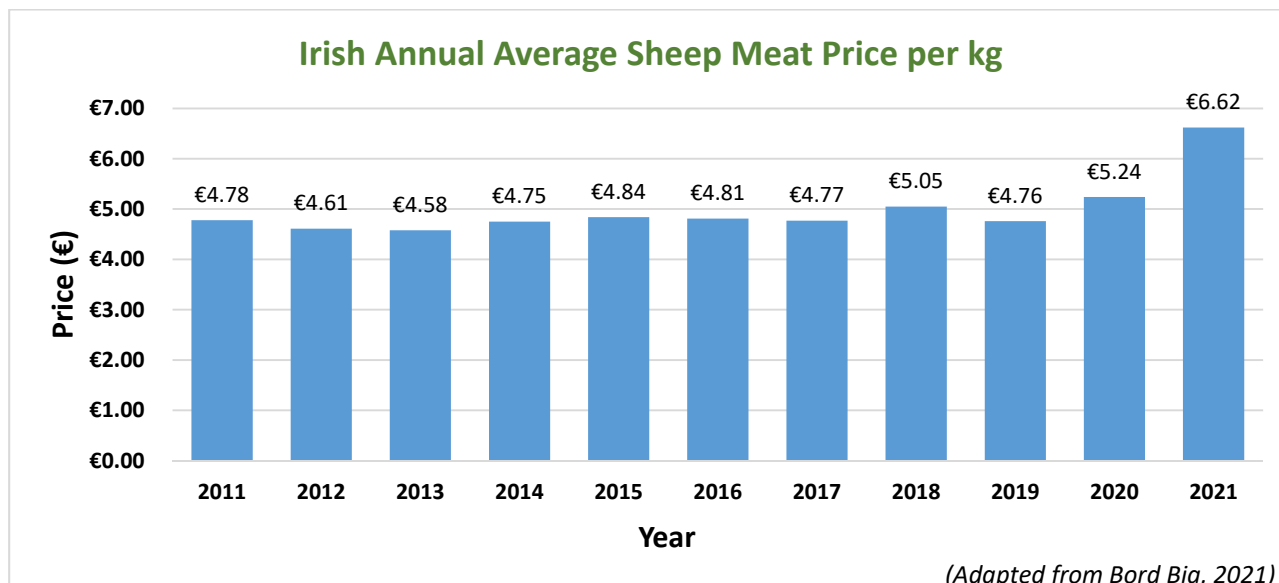
- (c) Students are advised to wash the clover roots in disinfectant before carrying out this investigation. State a reason for this.

- (d) Identify the bacteria in the root nodules of clover that are responsible for fixing nitrogen by placing a tick (✓) in the correct box.

<i>Clostridium</i>	
<i>Rhizobium</i>	
<i>E. coli</i>	

Question 9

Analyse the graph showing the average Irish sheep meat price per kg and answer the questions which follow.



- (a) Identify which year farmers achieved the highest price per kg for their sheep meat and give **one** reason for your answer.

Year:
Reason:

- (b) State which year farmers achieved the lowest price per kg for their sheep meat.

--

- (c) Identify the average slaughter weight of lambs by placing a tick (✓) in the box below.

Slaughter Weight (kg)	
30	
50	
42	

- (d) State the ideal fat class required for lambs at slaughter.

--

Question 10

Beef, sheep and dairy farmers require high quality silage for winter feed.



- (a) Describe **two** tests a farmer could do to assess the quality of the silage at the pit face.

1.
2.

- (b) A student carried out an experiment to determine the dry matter % (DM %) content of a silage crop and the results are listed below.

Mass of fresh silage sample	85g
Mass of dry silage sample	20g

Calculate the DM % of this silage sample.

Calculation:

- (c) State **two** precautions the student should take when obtaining samples of silage from the pit face to ensure they take a representative sample.

1.
2.

Question 11Answer **either** (a) **or** (b).

- (a) Seán noticed a number of his calves had a husky cough and after examination by his local vet they were diagnosed with hoose.



- (i) State the organism which causes this disease.

- (ii) State **one** way this disease can be treated.

- (iii) Briefly explain **one** way Seán could prevent this disease on his farm.

- (iv) Young calves are more susceptible to hoose than older animals on the farm.
Outline **one** reason why this is the case.

- (v) Hoose is an economically important disease.
Explain the underlined terms.

Or

- (b) (i) The heifer shown is a Blonde d'Aquitaine.
State if this breed is a continental or
british breed by placing a tick (✓) in the
correct box.

British breed	
Continental breed	



- (ii) The picture shows a heifer that graded U for conformation in the factory at kill out.
Explain the underlined term.

- (iii) The heifer weighed 533kg at turnout on 1st March 2021 and reached a slaughter weight
at 30 months of age at 788kg on 1st September 2021 (185 days later).
Calculate the average daily gain (ADG) of the heifer from March to September.

Calculation:

- (iv) In her second summer on grass the heifer underwent compensatory growth.
Suggest **one** advantage of compensatory growth.

Question 12

Soil formation is a process that takes thousands of years and is influenced by many factors.



- (a) Describe how any **three** of the following factors are involved in soil formation.

Factors

Parent material

Topography

Time

Climate

Organisms

Factor 1:

Factor 2:

Factor 3:

- (b) Compare the named soil types under the headings which follow by placing the word **higher** in the correct box.

The first one has been done as an example.

	Brown Earth	Podzol
Water content		Higher
Fertility		
Humus content		

[illegible]

Section B**150 marks**

Answer any **three** questions.

Each question carries 50 marks.

Question 13

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

Two agricultural science students, Padraig and Eileen collected one soil sample each from their own farms to determine the soil type. They each carried out an investigation to determine the texture of this soil sample.

(a) (i) Explain soil texture.

(ii) The results of their investigation are in the table below.

	Padraig's Result	Eileen's Result
Soil Particle	% Present	
Sand	30	70
Silt	31	17
Clay	39	A

Calculate **A** (% clay) for Eileen. Show your calculations in the space provided.

Calculation:

A (% clay):

(iii) State **one** error that could have been made by Padraig or Eileen during the investigation **and** explain how this error could be reduced if this investigation was repeated.

Error:

Reduce error:

- (iv) Eileen used the sedimentation method and Padraig used the hand testing method to determine the soil texture on their farms. Describe, with the aid of a labelled diagram, how Eileen determined the soil texture on her farm.

Labelled diagram:

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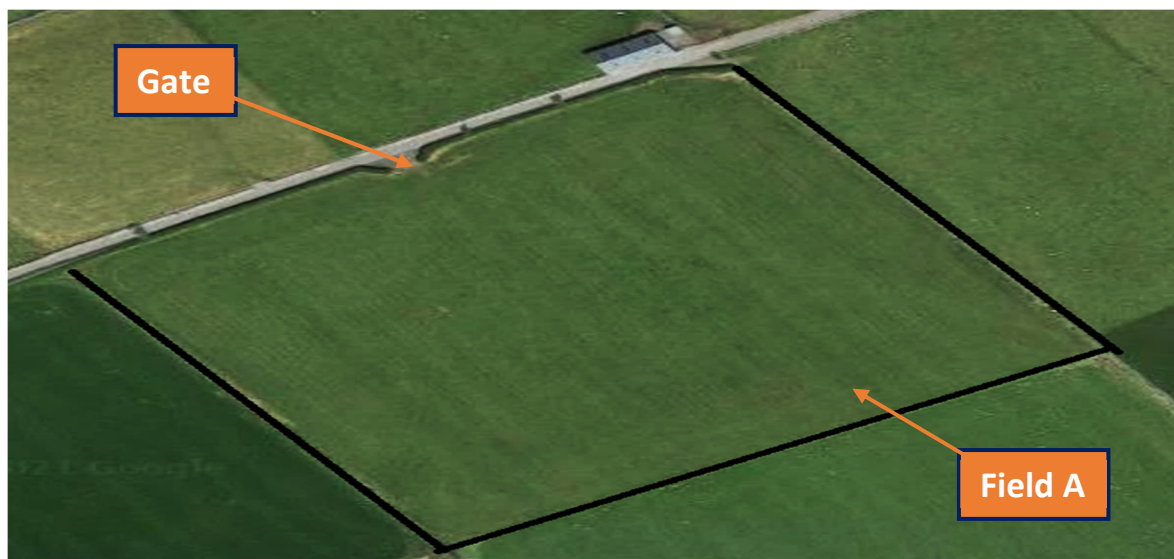
(v) Briefly describe which method, Eileen's or Padraig's is more accurate.

(vi) State which soil sample from the table in part (ii), Padraig or Eileen's, is more suitable for tillage and give **two** reasons for your answer.

Soil sample:

Reason 1:
Reason 2:

- (b) The photograph shows a grassland field where a farmer wants to carry out soil analysis.
- (i) Sketch **onto the photograph** of field **A** below, the pattern the farmer would use when taking a number of soil samples. **(Please use your pen).**



- (ii) State the piece of equipment the farmer would use to carry out the soil sampling.

--

- (iii) Advise the farmer as to how many soil samples he should take per hectare.

--

Or

- (c) (i) Briefly outline **two** reasons why the farmer would carry out a soil analysis on his farm.

1.
2.

- (ii) State **one** area in a field the farmer should avoid when soil sampling **and** give a reason for your answer.

Area:
Reason:

Question 14

- (a) Good shed design is essential on all livestock farms.



Outline **two** reasons for good ventilation in sheds.

1.
2.

- (b) The provision of good animal handling and housing facilities is important.

- (i) Outline **two** advantages of housing sheep before lambing.

1.
2.

- (ii) Many cattle and sheep farmers have installed “headlock barriers” in their sheds.



Outline **two** advantages of incorporating this feature into the design of their shed.

1.
2.

- (c) (i) Liam and Hannah were housing their 136 ewes two months prior to lambing. Describe how they would house the ewes to ensure best management practices.

- (ii) Describe the feeding requirements of the pregnant ewe during flushing and steaming up.

- (iii) Briefly describe **two** advantages of flushing.

1.
2.

- (iv) Hannah and Liam want to minimise mortality at lambing.

Complete the table below to outline **three** ways to minimise mortality and give a reason for each action.



The first one has been done as an example

How to minimise mortality	Reason for action
<i>Correct feeding in late pregnancy</i>	<i>Prevent oversized lambs</i>

Question 15

- (a) When it comes to dairy and dairy by-products consumers are increasingly looking for natural, sustainable, high-quality products.

Grass fed means that for an average of 220 days a year the diet of the animal is composed of a minimum of 90% grass. The grass can be consumed by in situ grazing or grass forage.



- (i) Outline **two** advantages of grass-fed dairy animals.

1.
2.

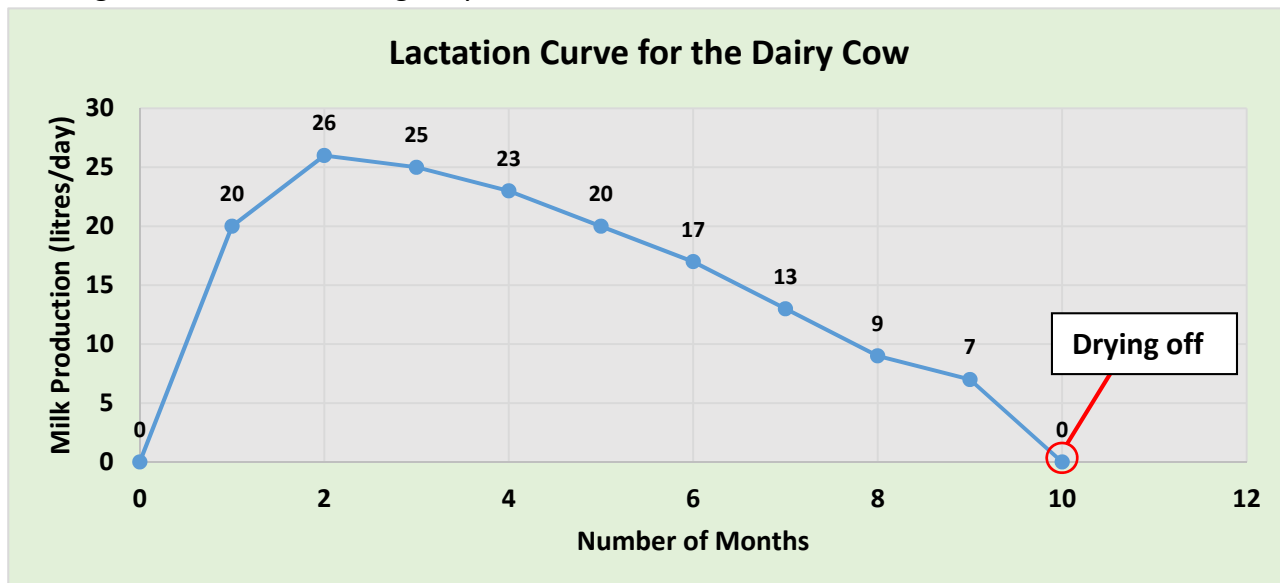
- (ii) Good grassland management during springtime will ensure excellent milk production from grazed grass for the remainder of the year.

Draw a labelled diagram of **one** named method of grazing employed by the dairy farmer.

Name of grazing system:

Labelled diagram:

- (b) The graph shows the lactation curve for a dairy cow on Laura's farm. Laura is considering culling this cow and is looking for your advice.



- (i) Identify the cow's peak milk yield in litres/day.

- (ii) Laura wanted to estimate the annual total milk yield for this cow.
Determine the estimated total yield for the cow using the following calculation.

$$\text{Peak yield (litres)} \quad \times \quad 220 \text{ (days)} \quad = \quad \text{Total Yield (litres)}$$

Calculation:

- (iii) The average yield on the farm is 7215 litres per year. Using the data from part (ii) above to support your answer, outline what advice you would give to Laura in relation to culling of this cow.

(iv) Explain why the cow was dried off at 10 months.

(v) State the length of the dry period (in days).

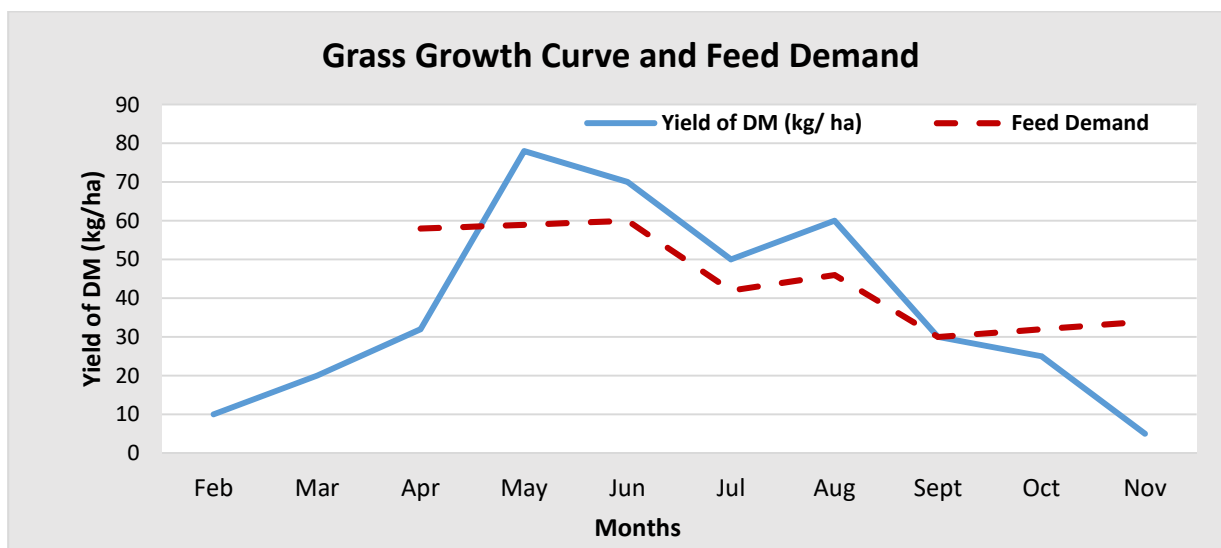
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(vi) Describe the diet Laura would feed her dairy cows in early lactation.

Question 16

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

- (a) The graph shows the growth of grass in kg/ha for the months February to November 2021.



(Adapted from gouldings, 2021)

- (i) Identify the month most suitable to make first cut silage **and** give a reason for your answer.

Month:
Reason:

- (ii) Shade **onto the graph** above the portion which represents the **excess grass** in summer months.

- (iii) Explain why a line graph is the most suitable way to present this data.

- (iv) Excess grass is produced during the summer months; this grass can be conserved as hay or silage. Explain the underlined term.

- (b) Hay production in Ireland is a common practice of preserving grass for farm animals for winter feed. The summer of 2021 saw ideal conditions for the production of hay.

(i) List **three** weather conditions essential for the production of top-quality hay.

1.
2.
3.

(ii) Describe **four** steps involved in the production of hay.

1.
2.
3.
4.

(iii) Identify the ideal moisture content of hay at time of storage, by placing a tick (✓) in the correct box.

Moisture content (%)	
43	
34	
18	

(c) The pictures are of common plants found growing on Irish farms.



A



B

(i) Identify each of the plants **A** and **B**.

A:
B:

(ii) State **one** impact plant **A** has on farming or the environment.

Or

(d) (i) Identify each of the following plants commonly found on Irish farms.



C:



D:

(ii) State **one** use for plant **D**.

Question 17

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

Robotics and Automation in Agriculture

The future of farming will likely be in automation, using robotic and self-driving machinery to sow, fertilise and harvest crops or manage animals. Already, automated or robotic milking machines are in use in Ireland and over 50% of all new milking machines installed in the European Union (EU) are automated.

Robotic milking has a number of advantages. There is more consistency, reduced labour costs, the possibility of increased milking frequency (three times a day) and better overall herd management.



(Adapted from Science and Technology in Action, 2013)

(i) Outline **two** advantages of technology in agriculture.

1.
2.

(ii) Briefly describe **two** reasons for the increased installation of robotic milking machines.

1.
2.

(iii) Outline **two** potential disadvantages of using technology on Irish farms.

1.
2.

- (b) John's farm is Bord Bia Quality Assured. He aims to make his farm more sustainable. He is part of the Beef Emergency Aid Measure (BEAM) and is required to reduce his bovine nitrogen livestock figures by 5%.



Analyse the data and answer the questions which follow.

Bovine nitrogen livestock figures for 2020-21			
Type of livestock	Number of livestock on John's farm	Nitrogen produced per year (kg)	Bovine nitrogen produced on John's farm
Suckler Cows	46	65	2990
Cattle (0 - 1 year)	44	24	1056
Cattle (1 - 2 year)	40	57	A
Bull (1 - 2 year)	1	57	57
Bull >2 years	1	65	65
Total bovine nitrogen produced on John's farm			B

- (i) Calculate the total bovine nitrogen (figure **A**) for John's 1 – 2 year-old cattle for 2020-21.

Calculation:

- (ii) Calculate the total bovine nitrogen (figure **B**) for all animals on John's farm for 2020-21.

Calculation:

- (iii) The bovine nitrogen reference figure for the previous year 2019-20 is 6992kg on John's farm. State if John achieved his target of 5% bovine nitrogen reduction in 2020-21. Show your calculation in the box below.

Calculation:

- (iv) State **two** possible environmental benefits John could see if he achieved the 5% bovine nitrogen reduction on his farm.

1.
2.

- (c) Increasing energy efficiency is key on all farms, but especially on intensive pig and poultry farms.



Describe **three** ways to improve energy efficiency on all types of farms.

1.
2.
3.

Question 18

- (a) The Department of Agriculture Food and the Marine (DAFM) produce a recommended list of perennial ryegrass seed varieties annually.
Analyse the data in the table and answer the questions which follow.



Variety	Heading Date	Total Yield (t DM/ha)	Ground Cover (t DM/ha)	Spring Growth (t DM/ha)	Autumn Growth (t DM/ha)	% Dry Matter Digestibility (DMD)
Moyola	11 May	105	6.4	109	107	100
Genesis	12 May	103	6.7	118	102	99.7

(Adapted from DAFM, 2021)

- (i) List **three** physical traits assessed by the DAFM when recommending grass seed varieties.

1.
2.
3.

- (ii) Identify which variety of perennial ryegrass produces the highest yield.

--

- (iii) Identify which variety would produce more grass in autumn.

--

- (b) Harry wanted to reseed 20% of his grassland this year with certified seed.

- (i) Describe how Harry should prepare his seedbed.

- (ii) State **one** reason why Harry has chosen certified seed to reseed his grassland.

- (c) Soya bean is a crop that has been genetically engineered. It is an example of genetically modified (GM) food. Soya bean meal is a major protein source in animal feeds.

- (i) Genetic modification involves a number of steps which are listed below.
Place these steps in the correct order.

The first one is done for you.

A	Produce large quantities of seed for commercial growing and sale
B	Test the modified plants
C	<i>Identify the desired gene in an organism</i>
D	Remove the desired gene from the organism
E	Insert the desired gene into a plant's DNA

C				
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- (ii) Many farmers see the benefit but also have concerns about crops being genetically modified.
State **two** advantages associated with GM crops.

1.
2.

- (iii) Briefly explain any **two** concerns that farmers may have about GM crops.

1.
2.

[illegible]

Acknowledgements

Images

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Text

Text on page 32	Robotics and Automation in Agriculture, <i>Digital Technology in Agriculture</i> . <www.sta.ie>, Science and Technology in Action, (13 th Edition, 2013).
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Leaving Certificate – Ordinary Level

Agricultural Science

Monday 20 June

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