2021.M39 V1

2021L024G1EL

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2021

Agricultural Science

Ordinary Level

Monday 21 June Afternoon 2:00 – 4:30

220 marks

Examination Number

Day and Month of Birth

For example, 3rd February is entered as 0302

Centre Stamp

The 2021 examination papers were adjusted to compensate for disruptions to learning due to COVID-19. This examination paper does not necessarily reflect the same structure and format as the examination papers of past or subsequent years.

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

(a) Identify each of the following plants by placing a tick (✓) in the correct box.

(i)

Soyabean	
Cocksfoot	
Oilseed Rape	
Maize	

(ii)

Wheat	
Barley	
Linseed	
Oats	

(iii)

Plantain	
Clover	
Dandelion	
Chicory	

(iv) Plants can be classified by their life cycle.
Distinguish between biennial and perennial plants.

Or

(b) **(i)** Identify each of the following plants commonly found in grassland.

A

B

C

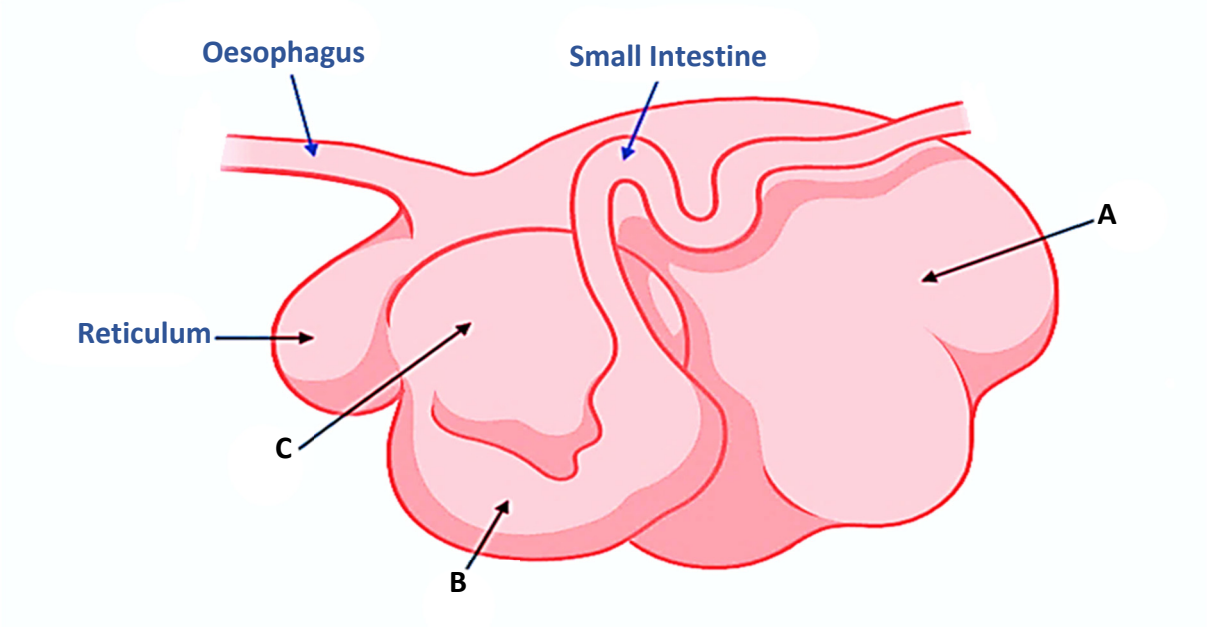
D

A:
B:
C:
D:

(ii) Describe **one** method used to kill plant **B**.

Question 2

The diagram shows part of the digestive system of a sheep.



Omasum	Rumen	Abomasum

(a) Identify the labelled parts **A**, **B**, **C** on the diagram using the correct word from the list.

A:
B:
C:

(b) The digestive system of a ruminant animal contains billions of microorganisms.
Briefly explain **two** functions of these microorganisms.

1.
2.

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

(a) Crop rotation is a common practice on Irish tillage farms.

(i) Explain the underlined term.

(ii) State **two** advantages of crop rotation.

1.
2.

(iii) Suggest **two** disadvantages of using chemical sprays in crop production.

1.
2.

Or

(b) **(i)** Define the term biological control.

(ii) Give **two** examples of biological control on farms.

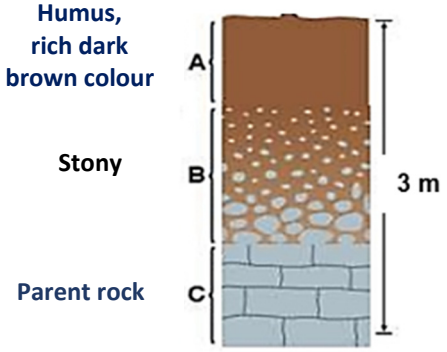
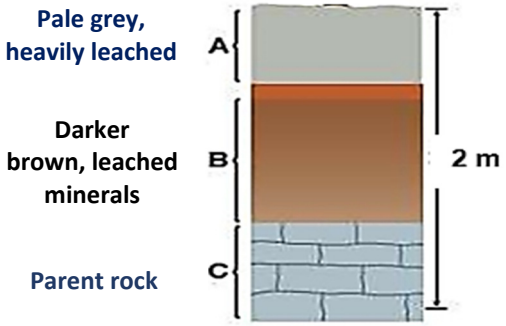
1.	2.

(iii) Outline **two** advantages of using biological controls in crop production.

1.
2.

Question 4

Diagrams **A** and **B** show the profiles of two common soil types in Ireland.

A	B
	

(a) Identify the **two** types of soils shown in profile diagrams **A** and **B** above.

A:
B:

(b) Outline **one** use for soil **A**.

(c) Describe **two** disadvantages associated with the use of soil **B**.

1.
2.

Question 5

A student carries out an investigation to compare the infiltration rate of two soils; a compacted soil and an uncompacted soil.

(a) State the independent variable the student controlled during the investigation.

(b) Describe how they measured the infiltration rate in this investigation.

(c) Identify which type of soil had the higher infiltration rate from the above investigation.

(d) Suggest **one** way in which farmers could improve the infiltration rate of their soil.

Question 6

Complete the sentences below in relation to sheep nutrition using words from the list.

Steaming up	Milk fever	Twin lamb disease	Flushing	Maintenance diet

(a) High levels of feeding prior to and during mating is known as …….

(b) Gradual increase of concentrates prior to lambing is known as ……

(c) Ewes being fed just enough to support body processes is known as …….

(d) Pregnancy toxaemia is also known as …….

(e) Calcium is added to the ration of the ewes prior to lambing to prevent …….

Question 7

Indicate whether each of the following is true or false by placing a tick (✓) in the correct box.

The first one has been done as an example.

		True	**False**
Example	***A Wicklow Cheviot is a breed of sheep***	✓	
(a)	Quantitative data cannot be measured accurately		
(b)	The abolition of milk quotas has led to a reduction in dairy output		
(c)	Analysis is an identification of trends and patterns in data		
(d)	Common Agricultural Policy (CAP) is a system of subsidies and support programmes for agriculture supported by the European Union		
(e)	Genome editing is the use of any technology that allows a change to an organisms DNA		

Question 8 Answer **either** (a) **or** (b).

(a) As part of the Bord Bia Quality Assurance Schemes, farmers must ensure that all of their medicines are locked away in a medicine cabinet.

(i) Outline **one** reason why all medicines must be locked away.

(ii) What is meant by this farm safety sign?

(iii) A farmer is planning to spray his crops with herbicide and is looking for your advice on what personal protective equipment (PPE) he would need. Suggest **two** pieces of PPE that you would recommend he wears.

1.
2.

(iv) Sarah was dosing her cattle for endo-parasites and noticed a few of them have ringworm. Briefly explain **one** precaution she should take to prevent transmission of ringworm to her from the cattle.

Or

(b) **(i)** Explain this farm safety sign.

(ii) The picture shows a cow post calving. Describe **one** safety precaution a farmer would take when handling the cow and calf immediately post-calving.

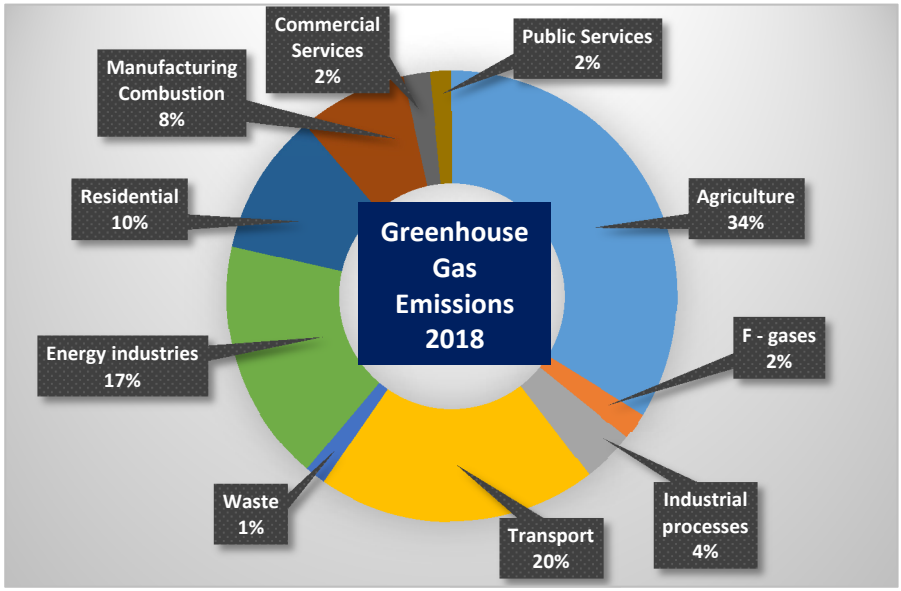
(iii) A farmer is planning on spreading slurry. Outline **three** safety precautions he should take when agitating and spreading the slurry.

1.
2.
3.

Question 9

This chart shows the greenhouse gas emissions in 2018.

Analyse the chart and answer the question which follow.



(Adapted from Environmental Protection Agency, 2020)

(a) Where would you rank the greenhouse gas emissions from agriculture in 2018?

(b) List **two** sources of greenhouse gases from agriculture.

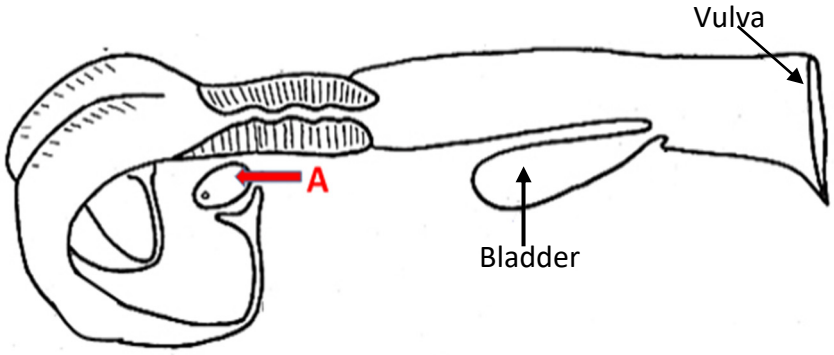
1.
2.

(c) Seán and Lisa are beef and sheep farmers in the west of Ireland. They are concerned about the environment and the effect agriculture is having on the planet. Briefly explain **two** ways in which they could increase biodiversity on their farm.

1.
2.

Question 10

The following is the reproductive system of a cow. Look at the diagram and answer the questions which follow.



(a) Name the part labelled **A** on the diagram.

(b) Outline the function of the part labelled **A**.

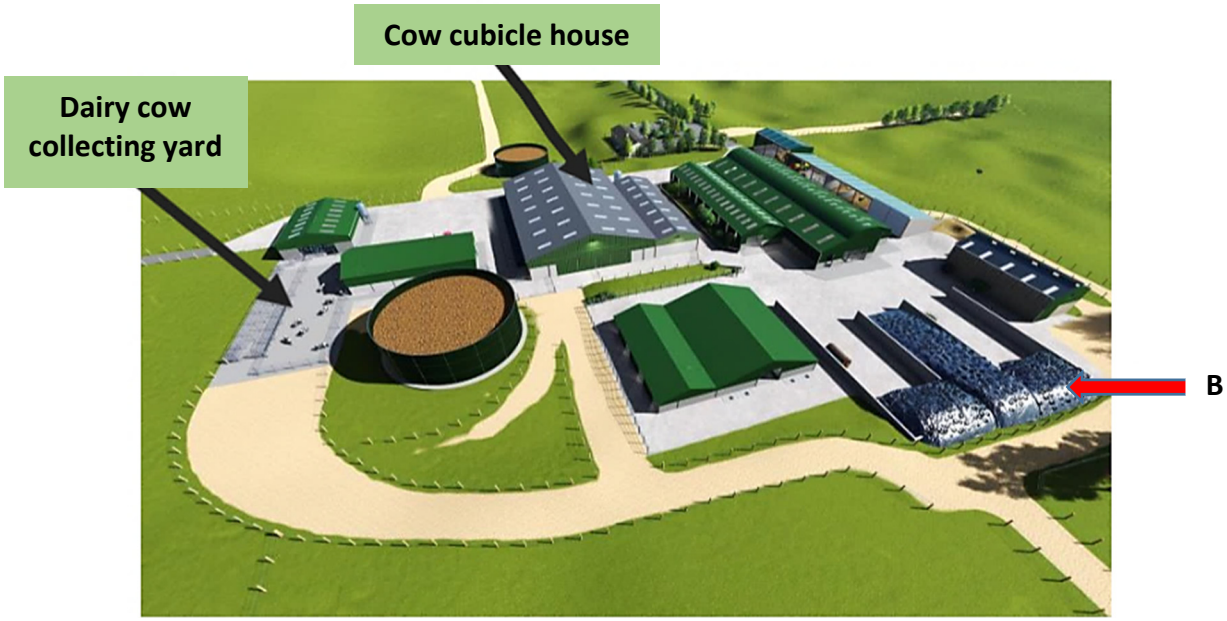
(c) State the gestation length and the oestrous cycle length (number of days) of a cow.

	Number of days
Gestation length	
Oestrous cycle length	

(d) A stage in artificial insemination involves placing an insemination gun inside the reproductive tract of the cow. Indicate by placing an **X** on the diagram exactly where the top of the insemination gun needs to be positioned.

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

(a) The use of 3D plans are likely to become more common in the future development of new infrastructure of farms.



(i) Identify the structure located at **B**.

(ii) Describe **one** environmental hazard and **one** potential safety hazard of structure **B**.

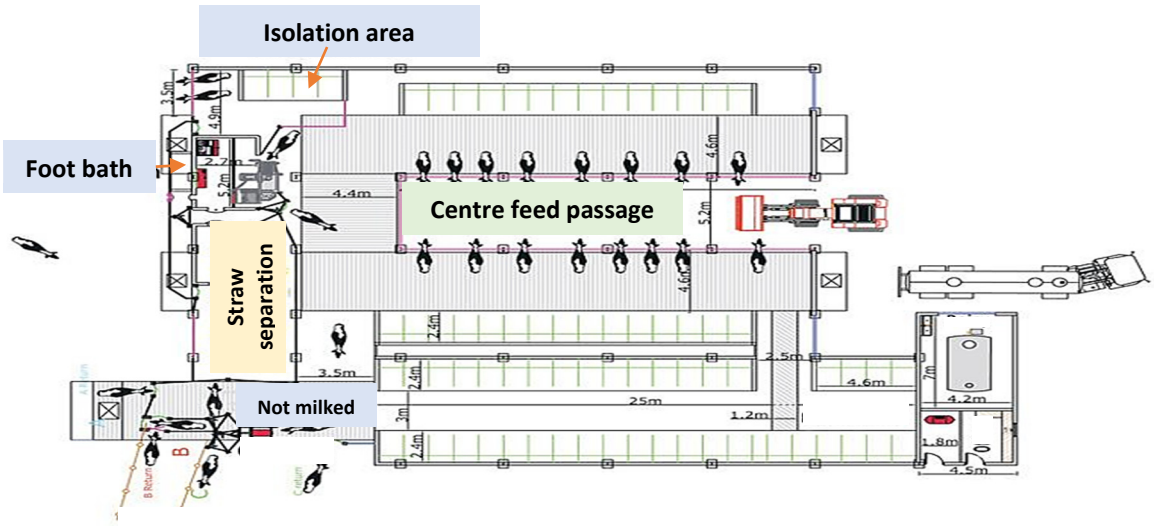
Environmental:
Safety hazard:

(iii) Outline **one** way in which the farmyard layout is economically sustainable.

(iv) Explain how **one** named piece of new technology that you have studied could enhance economy of labour on this farm.

Or

(b) The following is a plan view of a combined robot milking unit and cow housing for Claire and John who plan to convert their suckler farm to a dairy farm.



(Adapted from Farmers Journal, 2020)

(i) Explain why they have included an isolation area on the plan.

(ii) Describe the purpose of the footbath.

(iii) Outline **one** reason why Claire and John would have opted to install a robotic milking machine rather than a traditional herringbone or rotary parlour.

(iv) Place an **X** on the plan view above to show **one** place where you would advise Claire and John to install slatted tanks. Give a reason for your answer.

Question 12

(a) The photographs show some common breeds of cattle and sheep.
Identify each breed using the list of names and write your answer in the space provided.

A

B

C

D

Limousin	Jacob	Border Leicester	Charolais

A:
B:
C:
D:

(b) Describe **one** characteristic of a named breed of either pig **or** horse **or** poultry that you have studied.

Named breed:

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

Section B — 150 marks

Answer any **three** questions.

Each question carries 50 marks.

Question 13

(a) Read the following article on liver fluke and answer the questions which follow.

Liver fluke thrive in the Irish wet climate. It is estimated to cost Irish farmers over €90 million annually.

It is an issue in both cattle and sheep, but sheep are often the most badly affected. It affects all ages of sheep as it is picked up off the grass when sheep are grazing. This commonly occurs in the autumn and winter months.

(Adapted from Teagasc, 2020)

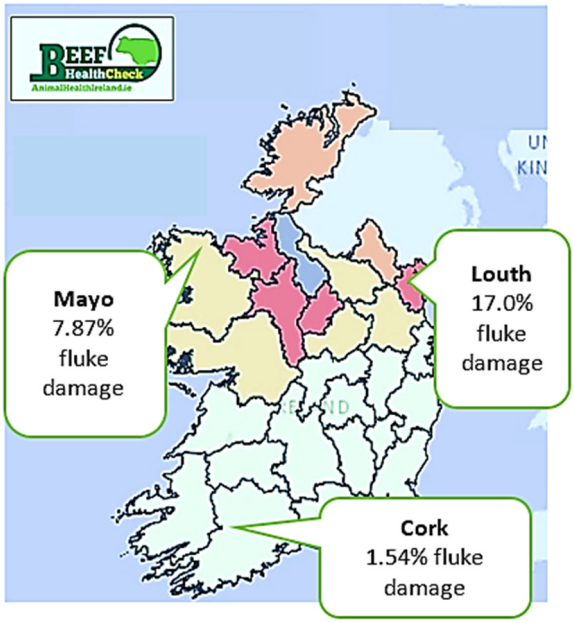
(i) Identify the estimated cost of liver fluke to Irish farmers annually.

(ii) Outline **one** environmental condition that allows liver fluke to thrive.

(iii) Suggest **three** ways in which farmers can control / prevent liver fluke on their farm.

1.
2.
3.

(b) The following is a map showing the incidence of liver fluke damage to beef cattle livers in the third quarter of 2020 based on Beef HealthCheck slaughter data. Look at the map and answer the questions which follow.



(*Adapted from Animalhealthireland, 2020*)

(i) Which county has the highest % fluke damage?

(ii) State **one** reason why the fluke damage in Cork is less than in more northern counties.

(c) **(i)** Explain notifiable disease.

(ii) List **two** notifiable diseases found in Irish farm animals.

1.
2.

(iii) Outline the importance to Irish Agriculture of farmers complying with regulations in relation to notifiable diseases.

(iv) State **three** practices farmers could employ to ensure good biosecurity on their farm.

1.
2.
3.

(v) Discuss **three** management practices farmers should consider when housing farm animals to ensure high standards of animal welfare.

1.

2.

3.

Question 14

(a) **(i)** Name **two** dairy breeds that a farmer would choose to produce good quality milk for the dairy industry.

1.
2.

(ii) Maintaining hygiene before, during and after milking is important for both cow health and achieving a good milk price. Outline any **three** ways a farmer can maintain high levels of hygiene.

1.
2.
3.

(iii) Dairy farmers obtain a price for their milk based on the quality of their milk. List any **two** tests carried out on milk that are used in calculating the milk price paid to the farmer.

1.
2.

(iv) Apart from hygiene practices, briefly explain **two** ways dairy farmers could improve the quality of the milk on their farm.

1.
2.

(b) The dairy farmer wanted to carry out an investigation to test the hygienic quality of a milk sample over time.

(i) Identify **one** variable for this investigation.

(ii) Describe, using a labelled diagram, a method the farmer could use to carry out this investigation.

Labelled diagram:

(iii) State **one** error that could occur during this investigation and outline **one** way that this error could be reduced if doing this investigation again.

Error:
Reduce error:

(iv) State whether the results obtained from the investigation at part (ii) above are quantitative or qualitative. Justify your answer.

Result:
Justification:

Question 15

(a) **(i)** List **two** grasses commonly used for silage production.

1.
2.

(ii) Outline **one** reason for using any one of the grasses named at part (i) above.

(iii) State at what stage of the grass growth cycle the grass should be cut for good quality silage and justify your answer.

Stage:
Justification:

(b) Advise a beef farmer of the different steps involved in making good quality first cut silage under the following headings.

Time of year of cutting:

Fertiliser requirements:

Harvesting and storage:

(c) The table below shows the analysis of the farmer's silage.
Use these results to answer the questions which follow.

	Farmer's analysis	Target analysis
Dry Matter (DM)	**?**	25%
Dry Matter Digestibility (DMD)	67%	70% +
Crude protein	12%	15% +
pH	4.7	3.8 – 4.2

(i) Calculate the DM% of the farmer's silage.

Average fresh weight of silage	124g
Average dried weight of silage	37g
DM %	Calculate DM %:

(ii) Based on the silage quality analysis results above, outline **two** reasons why the farmer should feed concentrates to his finishing beef steers.

1.
2.

(iii) Outline **two** ways the farmer could have achieved the target pH during the production of the silage in line with the target analysis.

1.
2.

(iv) Name **one** bacteria species required to make good quality silage.

Question 16 Answer **both** (a) **and** (b) **with either** (c) **or** (d).

(a) Compare sandy and clay soil types under the following headings.

Fertility:

Drainage:

Organic matter content:

Tillage suitability:

(b) **(i)** Suggest **three** examples of soil management practices for sustainable land use.

1.
2.
3.

(ii) Outline **two** steps involved in collecting samples of soil for analysis.

1.
2.

(c) A farmer is getting soil samples tested for pH and percentage (%) water content.

(i) Briefly explain **two** steps taken to measure the pH of the soil sample.

1.
2.

(ii) After analysis, the soil sample results showed a pH of 5.1.
Outline the effect this pH level has on the number of earthworms in the field **and** the advice you would give the farmer to ensure good grass growth.

Number of earthworms:
Good grass growth:

(iii) Using the results in the table below, calculate the % water in the soil sample.

Weight of soil before drying	120g
Weight of soil after drying	50g
% Soil Water	Calculate % Soil Water:

(iv) Briefly explain what the result calculated at part (iii) above tells you about the condition of the soil.

(v) State **one** implication the result has on the management of the field and give **one** reason for your answer.

Or

(d) **(i)** State **two** principles of organic food production.

1.
2.

(ii) Suggest **three** advantages of farming organically.

1.
2.
3.

(iii) An organic farm has soil with a pH of 5.2 and is also lacking in nitrogen.
Suggest **three** recommendations for improving both the pH and the nitrogen content of the soil suitable for organic farming.

1.

2.

3.

Question 17

(a) A student was asked to investigate the effect of temperature on the percentage germination of certified grass seeds.

The student conducted the investigation at five set temperatures (15°C, 20°C, 25°C, 30°C and 35°C). At each temperature 100 seeds were sown. The student repeated the investigation four times and calculated the mean (average) percentage germination.

(i) Explain the underlined terms.

Germination:
Certified grass seeds:

(ii) State a suitable hypothesis for this investigation.

(iii) List **two** factors that the student kept constant (fixed) during the investigation.

1.
2.

(iv) How would the depth of sowing of the seeds affect the germination rate?

(v) The student collected the following data from the number of seeds that germinated at 20°C.

Temperature (20°C)	Trial 1	Trial 2	Trial 3	Trial 4
Number of seeds germinated	62	59	61	58

Calculate the mean percentage germination of the grass seeds at 20°C.

Calculation:

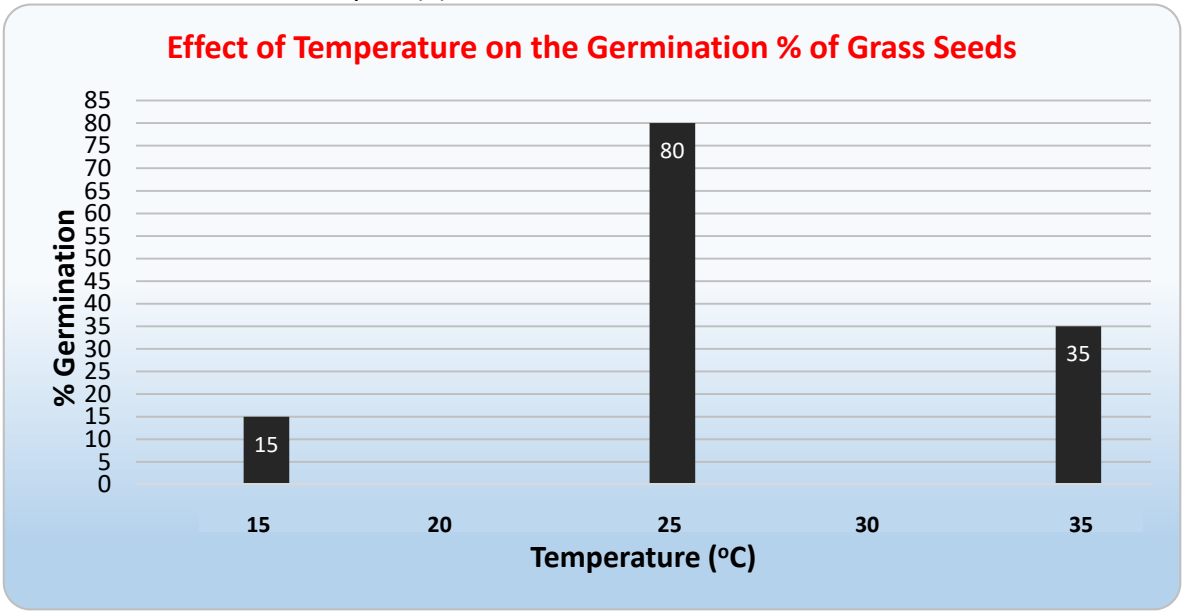
Mean =

(vi) Suggest **one** reason why the student repeated the investigation four times at each temperature.

(vii) Outline **two** safety precautions the student could take when carrying out this investigation.

1.
2.

(b) **(i)** The table and graph below show the results obtained by the student.
The percentage germination of the grass seeds at 15°C and 25°C are already plotted on the graph.
Complete the graph below by plotting the percentage germination of the grass seeds at 20°C as calculated at part (a) and at 30°C.



Temperature (°C)	15	20	25	30	35
% Germination	15	**Calculated at part (a)**	80	65	35

(ii) State **one** piece of advice you would give to farmers on the sowing of grass seed based on your conclusion and also supported by the results of this investigation.

(iii) Name **two** other factors that are necessary for seeds to germinate and **one** practice farmers can do to ensure the seeds are exposed to each of these factors.

Factor 1:
Practice:
Factor 2:
Practice:

Question 18 Answer **both** (a) **and** (b) **with either** (c) **or** (d).

(a) **(i)** Discuss the production of a named crop that you have studied under the following headings.

Named Crop:

Seedbed preparation:

Weed control:

(ii) Briefly describe **one** safety precaution taken by a farmer during harvest of the named crop at part (i) above.

(iii) Farmers are increasingly using Global Positioning Systems (GPS) when spreading chemical fertiliser on the land.

Outline **two** advantages of using this technology when spreading chemical fertiliser.

1.
2.

(b) **(i)** Explain natural selection.

(ii) State **two** ways farmers can genetically improve their animal production system.

1.
2.

(iii) The following are pictures of two beef cattle breeds, Aberdeen Angus and Belgian Blue. Both breeds have been selectively bred based on physical traits.

State **one** physical trait, in either of the animals above, **and** give **one** reason why this trait is an advantage to beef farmers.

Physical trait:
Reason:

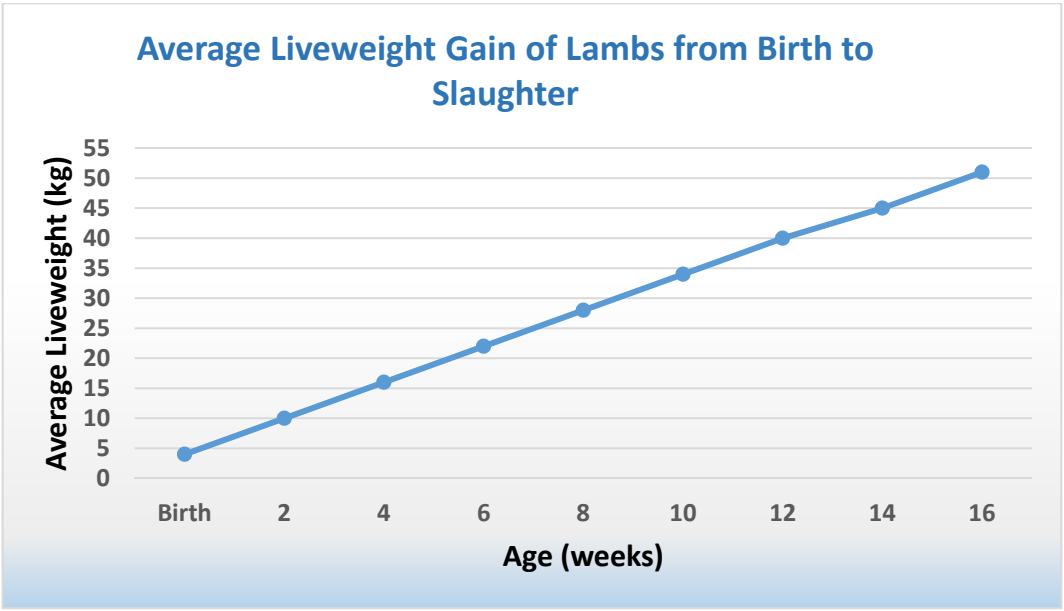
(c) A farmer is producing early lambs for the Easter market. The lambs were born in January with an average birthweight of 4 kg. The lambs were weighed every two weeks and the table below shows the average liveweights of these animals.

Weeks	0	2	4	6	8	10	12	14	16
Average Liveweight (kg)	4	10	16	22	28	34	40	45	51

(i) Calculate the average daily liveweight gain (DLG) of the lambs over the 16-week period (112 days).

Calculation:

(ii) The farmer aims to sell the lambs at a minimum average liveweight of 45 kg.
Using the graph, determine the minimum number of weeks for the lambs to reach this liveweight.



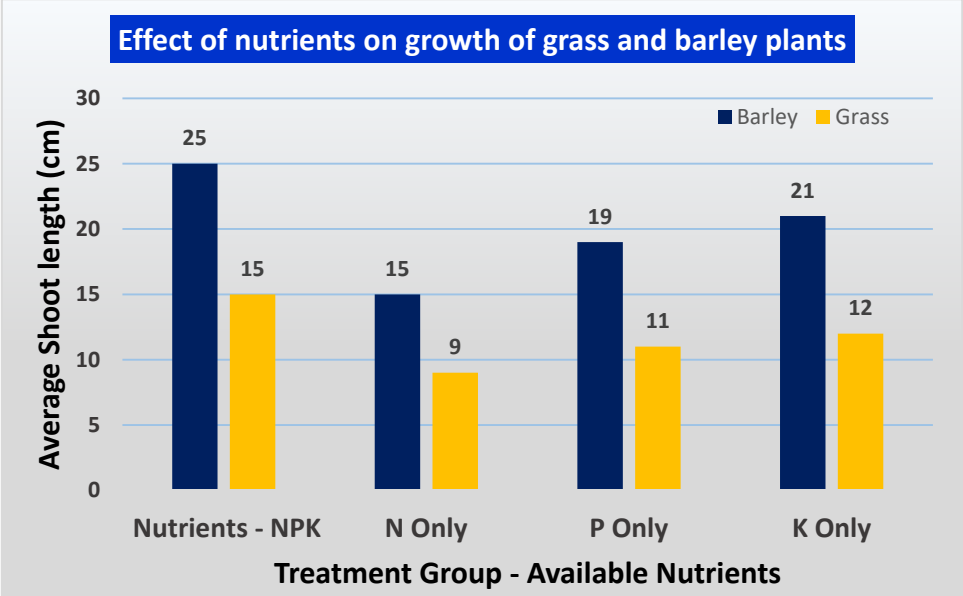
Minimum number of weeks:

(iii) The graph at part (ii) is almost a straight line.
Briefly describe what this information tells the farmer about the growth rate of the lambs.

(iv) Suggest a suitable diet a farmer would feed lambs from birth to slaughter in order for the lambs to reach a slaughter weight of 45 kg in the minimum number of weeks as stated at part (ii).

Or

(d) A student carried out an investigation to see if nutrients, N, P, K effected the growth rate of grass and barley plants. The student recorded the shoot length of multiple plants, calculated the mean (average) and graphed the results as shown.



N = Nitrogen	P = Phosphorus	K = Potassium

(i) State **one** reason why the student calculated the mean shoot length of multiple plants in the investigation.

(ii) Identify which treatment group had the greatest effect on plant growth.

(iii) Outline **one** way in which the student could have measured the shoot length of the barley / grass plant.

(iv) Slurry and farmyard manure are frequently spread on land as a source of nutrients. Compare slurry and farmyard manure under the following headings.

	Slurry	**Farmyard Manure**
Composition		
Organic matter content		
Storage		
How it is applied to the land		

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

Acknowledgements

Images

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Images on page 4	pixabay.com
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Texts

Text on page 19	Corbett, Glen. *Watch out for Liver Fluke in Sheep*. <https://www.teagasc.ie/news--events/daily/sheep/watch-out-for-liver-fluke-in-sheep.php> (9 October, 2020).

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Leaving Certificate – Ordinary Level

Agricultural Science

Monday 21 June

Afternoon 2:00 – 4:30