Coimisiún na Scrúduithe Stáit

State Examinations Commission

Leaving Certificate 2025

Marking Scheme

Agricultural Science

Ordinary Level

Note to teachers and students on the use of published marking schemes

Marking schemes published by the State Examinations Commission are not intended to be standalone documents. They are an essential resource for examiners who receive training in the correct interpretation and application of the scheme. This training involves, among other things, marking samples of student work and discussing the marks awarded, so as to clarify the correct application of the scheme. The work of examiners is subsequently monitored by Advising Examiners to ensure consistent and accurate application of the marking scheme. This process is overseen by the Chief Examiner, usually assisted by a Chief Advising Examiner. The Chief Examiner is the final authority regarding whether or not the marking scheme has been correctly applied to any piece of candidate work.

Marking schemes are working documents. While a draft marking scheme is prepared in advance of the examination, the scheme is not finalised until examiners have applied it to candidates' work and the feedback from all examiners has been collated and considered in light of the full range of responses of candidates, the overall level of difficulty of the examination and the need to maintain consistency in standards from year to year. This published document contains the finalised scheme, as it was applied to all candidates' work.

In the case of marking schemes that include model solutions or answers, it should be noted that these are not intended to be exhaustive. Variations and alternatives may also be acceptable. Examiners must consider all answers on their merits, and will have consulted with their Advising Examiners when in doubt.

Future Marking Schemes

Assumptions about future marking schemes on the basis of past schemes should be avoided. While the underlying assessment principles remain the same, the details of the marking of a particular type of question may change in the context of the contribution of that question to the overall examination in a given year. The Chief Examiner in any given year has the responsibility to determine how best to ensure the fair and accurate assessment of candidates' work and to ensure consistency in the standard of the assessment from year to year. Accordingly, aspects of the structure, detail and application of the marking scheme for a particular examination are subject to change from one year to the next without notice.

How to use the marking scheme

- Examiners must conform to this scheme, however the descriptions, methods and definitions given in the marking scheme are not exhaustive and alternative valid answers are acceptable.
    - This does not preclude synonyms or terms or phrases which convey the same meaning as the answer in the marking scheme. Although synonyms are generally acceptable, there may be instances where the scheme demands an exact scientific term or unequivocal response and will not accept alternatives.
- The marking scheme is a concise and summarised guide to awarding marks and is constructed in order to minimise its word content.
    - In many cases only key phrases are given in the marking scheme. These points contain the information and ideas that must appear in a candidate's answer in order to merit the assigned marks.
- If an examiner determines that a candidate has presented a valid answer, and where there is no provision in the scheme for accepting that answer, then the examiner must first consult with his / her advising examiner before awarding marks.
- The detail required in any answer is determined by the context, the phrasing of the question, and by the number of marks assigned to the answer in the examination paper. This may vary from year to year.
- Where only one answer is required alternative answers are separated by '**or**'.
- Use of an **asterisk***
    - This happens when the only acceptable answer is a specific word or term. Each such instance is indicated in the scheme by an asterisk*.
- Use of a **solidus** (**/**)
    - Words, expressions or statements separated by a solidus (**/**) are alternatives that are equally acceptable for a particular point.
    - Where multiple answers are required each word, term or phrase for which marks are allocated is separated by a solidus (**/**) from the next word, term or phrase.
- Use of **brackets ( )**
    - A word or term that appears in brackets **( )** in the scheme is not a requirement of the answer, but is used to contextualise the answer or may be an alternative valid answer.
- **Note** however, that words, expressions or phrases must be correctly used in context and not contradicted and where there is evidence of incorrect use or contradiction, the marks may not be awarded.
- The mark awarded for an answer appears in **bold** in the mark's column, e.g. **2**.
- Where there are several parts in the answer to a question, the mark awarded for each part appears as e.g. **3(2)**. This means there are 3 parts to the answer, each part is allocated 2 marks.
- Award unit marks separately e.g. if an answer merits three 2-mark units, write 3 separate '2's, under each other, in the space at the right-hand side of the question in the answer book (**2, 2, 2**).

- The answers to subsections of a question may not necessarily be tied to a specific mark e.g. there may be four parts to a question - (i), (ii), (iii), (iv) and a total of 10 marks allocated to the question. The marking scheme might be as follows: 4 + 2 + 2 +2. This means that the first correct answer encountered is awarded 4 marks and each subsequent correct answer is awarded 2 marks.
- Italics are used where the examiner's attention is being drawn to an instruction relating to the answer or to some qualification of the answer.
- In general, names and symbols / formulae of elements / compounds are equally acceptable. However, in some cases where a name is specifically asked for, the symbol / formula may be accepted as an alternative. This will be clarified within the scheme.
- All blank pages should be marked to indicate they have been inspected.

Cancelled answers

- The following is an extract from S.63O *Instructions to Examiners, 2023* (section 5.4, p.18), *"Where a candidate answers a question or part of a question once only and then cancels the answer, you should ignore the cancelling and treat the answer as if the candidate had not cancelled it."*
- If the only answer offered is cancelled ignore the cancelling and mark as usual.
- If an answer is cancelled and a second version of the answer is given, you should accept the cancellation and award marks, where merited, for the un-cancelled version only.
- If two un-cancelled versions of an answer are given to the same question or part of a question, mark both and accept the answer that yields the greater number of marks. You may not, however, combine points from both versions to arrive at a manufactured total.

Surplus answers

- A surplus wrong answer cancels the marks awarded for a correct answer.
    - e.g. Question: Identify the cattle and sheep breeds.
      Marking scheme: A = Suffolk / B = Shorthorn / C = Belgian blue / D =Texel - **4(1)**
      Candidates Answer = A = Texel, Suffolk / B = Shorthorn / C = Belgian blue / D =Texel
      The surplus answer (Texel) is incorrect,
      Therefore, the candidate scores 4 - 1 = 3 marks.

Annotations used in the marking

The scripts were marked on-line by examiners. The following table illustrates the various **annotations** (symbols) applied by the examiners when marking the scripts. The meaning and use of each of the annotations applied are explained in the table below. These annotations will be seen on a script if viewed as part of the appeal process. In some sections of the 'Individual Investigative Study' (IIS), where the mark award was greater than 12 marks for a single item(s), two annotations will be used to show the total marks awarded for the item(s). Annotations applied by an examiner will be viewed in red. Scripts that were also marked by an advising examiner will show annotations in a green colour.

Annotation	Meaning
✓	This symbol indicates a correct response / answer. Use when all marks awarded to any additional correct answers.
✗	This symbol indicates an incorrect response / answer.
[	This symbol indicates a surplus incorrect answer. A surplus incorrect answer has cancelled a correct answer.
	This symbol is placed on all blank pages or part of page to indicate it has been seen by the examiner.
	This symbol can be used by an examiner to indicate a part of a question answer of significance.
	This symbol is used to indicate where a candidate answer was awarded zero marks.
✓1	This symbol can be used by an examiner to indicate **One** mark awarded
✓2	This symbol can be used by an examiner to indicate **Two** marks awarded
✓3	This symbol can be used by an examiner to indicate **Three** marks awarded
✓4	This symbol can be used by an examiner to indicate **Four** marks awarded
✓5	This symbol can be used by an examiner to indicate **Five** marks awarded
✓6	This symbol can be used by an examiner to indicate **Six** marks awarded
✓7	This symbol can be used by an examiner to indicate **Seven** marks awarded
✓8	This symbol can be used by an examiner to indicate **Eight** marks awarded
✓9	This symbol can be used by an examiner to indicate **Nine** marks awarded
✓10	This symbol can be used by an examiner to indicate **Ten** marks awarded
✓11	This symbol can be used by an examiner to indicate **Eleven** marks awarded
✓12	This symbol can be used by an examiner to indicate **Twelve** marks awarded

Marking the Individual investigative Study (IIS)

Read the entire Individual Investigative Study (IIS) without allocating any marks. Mark the IIS using the marking criteria and total the marks. Each section of the IIS is awarded a single mark, which varies between sections (e.g. Introduction and back ground research is awarded 20 marks). To assist in the awarding of marks 'indicative content' has been stated for each section; e.g. in considering the allocation of marks for the introduction and background research section, this can be considered under;

- Introduction (context for the IIS) and
- Background Research (research, sources and knowledge).

To finalise the marks, review the criteria descriptors against the marked work.

Ordinary Level Agricultural Science Marking Criteria for Individual Investigative Study

Before commencing marking read the entire Individual Investigative Study to familiarise yourself with the content presented for marking.

Note: Be careful not to penalise skilful brevity, nor to reward unwarranted length.

These descriptors should be interpreted in the context of the challenges and demands of the investigation the candidate has chosen.

Section	Very Good	Good	Fair	Weak
Introduction and background research *Suggested range between 300 and 500 words*	Study reasonably addresses the brief theme in a context, even if the context is limited. Adequate level of knowledge with understanding; does not need to be fully coherent throughout. Identifies and interrogates a limited range of relevant and credible sources of evidence to support study. No significant omissions / errors.	Brief theme is addressed at a basic level with the context not well developed. Basic knowledge and limited understanding of the theme. Lacks depth and structure. Identifies and presents a narrow range of evidence simply with an overreliance on unsubstantiated data. Contains minor omissions / errors.	Brief theme is vaguely addressed and understood with no context developed. Knowledge and understanding of theme are poor. Very simplistic structure. Evidence presented is limited, simplistic or confused and only vaguely relevant to the theme. Contains major omissions / errors.	Brief theme is completely misunderstood. Little or no understanding and knowledge of the theme. Little or no evidence presented, with presented evidence not relevant to the theme. Information may be incorrect or contradictory. Contains significant omissions / errors.
20 marks	**16-20**	**12-15**	**8-11**	**0-7**

Award a single mark out of 20 for this section. In arriving at this mark consider the indicative content requirements below.

Introduction *- Context for the IIS – 10 marks*	• Very Good - 8 – 10m • Good - 6 – 7m • Fair - 4 – 5m • Weak - 0 – 3m	***Background Research*** *-Research, sources and knowledge – 10 marks*	• Very Good - 8 – 10m • Good - 6 – 7m • Fair - 4 – 5m • Weak - 0 – 3m

Section	Very Good	Good	Fair	Weak
The investigative process *Suggested range between 500 and 800 words*	Identifies and provides a description of the investigative process undertaken, which may have some limitations. A valid hypothesis was generated and tested. Ideas, concepts and theories make tentative links between at least some aspects of the task. At least one experiment involving gathering and processing data. A logical description of how data was gathered, which may have some omissions / errors. An attempt at linking to learning outcomes of specification.	Identifies and provides a simplistic description of the investigative process undertaken. A simplistic hypothesis was generated and tested. At least one experiment involving gathering and processing data. Description of how data was gathered is vague, with some omissions / errors. Vague linking to learning outcomes of specification	Simplistic or confused details of the investigative process presented and only vaguely relevant to the theme. Very simplistic hypothesis generated and tested. At least one experiment involving gathering and processing data with only a very poor description of how data was gathered with major omissions / errors. Very poor linking to learning outcomes of specification	Little or no details of the investigative process presented and which has no relevance to the theme. A very poor hypothesis or no hypothesis generated. At least one experiment involving gathering and processing data with very poor description of how data was gathered which is also incorrect and /or contradictory. No link with learning outcomes of specification.
25 marks	**20-25**	**15-19**	**10-14**	**0-9**
Award a single mark out of 25 for this section. In arriving at this mark consider the indicative content requirements below.				
Details of the actions undertaken in response to stated hypothesis – 12 marks • Very Good - 10 – 12m • Good - 8 – 9m • Fair - 5 – 7m • Weak - 0 – 4m			*Data collection undertaken – 13 marks* • Very Good - 11 – 13m • Good - 8 – 10m • Fair - 6 – 7m • Weak - 0 – 5m	

Section	Very Good	Good	Fair	Weak
Results, analysis, and conclusions *Suggested range between 600 and 1000 words*	Provides an adequate interpretation and evaluation of the data. Presentation is good but may lack some structure. Constructs informed independent conclusion to justify own position (hypothesis), which does not necessarily need to display great depth and structure. Conclusions are based on an analysis of evidence, even if basic in nature.	Limited and basic analysis of the data, with some inaccuracies. Presentation of the data is limited and may have some errors. Some very basic independent conclusion(s) made to justify own position (hypothesis). Conclusions are flawed or made with limited evidence in support. Repetition of material is evident.	Very little interrogation of the data, with many inaccuracies evident. Presentation of the data is very limited and contains many errors. Very limited independent conclusions made to justify own position (hypothesis). Conclusion is flawed with limited evidence of analysis / superficial analysis with significant inaccuracies. Significant repetition of material.	Poor / confused / illogical interrogation of the data. Presentation of data is very poor. Little or no evidence presented / or not relevant, with little or no justification of own position (hypothesis). Analysis is poor or not present. Conclusions are not present or significantly flawed. Significant amounts of and presentation and irrelevant material evident.
35 marks	**28-35**	**21-27**	**14-20**	**0-13**
Award a single mark out of 35 for this section. In arriving at this mark consider the indicative content requirements below.				
Appropriate presentation of data – 10 marks • Very Good - 8 – 10m • Good - 6 – 7m • Fair - 4 – 5m • Weak - 0 – 3m	*Informed judgement and conclusions following analysis and interpretation of data, results and evidence – 15 marks* • Very Good - 12 – 15m • Good - 9 – 11m • Fair - 6 – 8m • Weak - 0 – 5m	*Limitations of study considered and clear linkage of conclusions to research question- 10 marks* • Very Good - 8 – 10m • Good - 6 – 7m • Fair - 4 – 5m • Weak - 0 - 3m		

Section	Very Good	Good	Fair	Weak
Reflection on the study *Suggested range between 150 and 200 words*	A personal reflection on the completed work is evident. Considers some elements of the learning gained through engagement with the study. Considers some aspects of reliability, possible error(s), changes / modifications while relating it back in some way to the theme and hypothesis.	A personal reflection base on some insights gained through completion of the work is attempted. Considers at a basic level the learning gained through engagement with the study. Considers very simply reliability, possible error(s), changes / modifications with some attempt to link back to the theme and hypothesis.	A limited personal reflection on the completed work. Poor reference to the learning gained. Poor consideration of reliability and possible error(s) and any possible changes / modification, with very limited link back to the theme and hypothesis.	Weak / no personal reflection on the completed work. Little or no reference to the learning gained. Little or no consideration of reliability and possible error(s) and any possible changes / modification very limited or absent. Very weak linkage to the theme and hypothesis.
10 marks	**8-10**	**6-7**	**4-5**	**0-3**
Award a single mark out of 10 for this section. In arriving at this mark consider the indicative content requirements below.				
The candidate presents coherent reflections, lessons learned and significance of the study - 10 marks		• Very Good - 8 – 10m • Good - 6 – 7m • Fair - 4 – 5m • Weak - 0 – 3m		
References	References for the all or almost all of sources used during the study and / or referred to in the report.	References for most sources used during the study and / or referred to in the report.	References missing for a significant number of sources used during the study and / or referred to in the report.	Lack of referencing and references for sources used during the study and / or referred to in the report.
-	-	-	-	-
References should be checked within section(s) and linked to this section of study. *Any issues with the referencing should affect the mark awarded to the section in which the references are being cited in the study.*				

Section	Very Good	Good	Fair	Weak
Communication and innovation *(This is not a distinct section of the report)*	The study has a reasonable coherence in its structure and adheres to the IIS structure. Work is focused with material labelled appropriately and organised. Communication of data and information is clear but simplistic. Some evidence of innovative thinking and an individual approach.	In the main, the study adheres to the IIS structure. The work may lack focus in parts and there may be some omissions in both content and errors in labelling of material. Study organisation and coherence is of a basic level with limited evidence of originality and innovative thinking.	Poor construction and structure, with only some adherence to the IIS structure. Organisation and coherence is limited and confused throughout with many errors. Little evidence of originality and innovative thinking.	The work lacks structure, organisation, coherence, focus, context and clarity. IIS structure not well used. Irrelevant material and significant errors. No evidence of originality and innovative thinking.
10 marks	**8-10**	**6-7**	**4-5**	**0-3**
Award a single mark out of 10 for this section. In arriving at this mark consider the indicative content requirement below				
The report has an overall coherence, quality and clarity with the inclusion of individual innovative thinking by the candidate - 10 marks			• Very Good - 8 – 10m • Good - 6 – 7m • Fair - 4 – 5m • Weak - 0 – 3m	

Section A		Answer any 10 questions 10 marks for each question Total for section is 100 marks	Marks
Q1	**(a)(i)**	*Identify any three breeds, A, B, C or D* *A:* Charolais *B*: Jersey *C*: Limousin *D*: Holstein Friesian	**3x2**
	(ii)	*State **one** beef breed from part (i) above* Limousin or Charolais	**4**
		OR	
	(b)(i)	*Identify with reason which bull Aberdeen Angus or Belgian Blue you would choose.* *Bull:* Aberdeen Angus *Reason*: Easy calving / good conformation / no horns (polled)	**4** **1**
	(ii)	*Identify the correct meaning of the term polled* Has no horns	**2**
	(iii)	*State which bull, Aberdeen Angus or Belgian Blue is more likely to produce calves with E or U carcase conformation* Belgian Blue	**3**
Q2	**(a)** **(b)** **(c)** **(d)** **(e)**	*Indicate if the following are true or false* False False True True True	**5x2**
Q3	**(a)** **(b)** **(c)** **(d)** **(e)**	*Identify the farm machinery from the descriptions* Combine harvester Plough Roller Mower Tedder	**5x2**

<table>
<tr><td rowspan="3">Q4</td><td>(a)</td><td>Suggest two ways in which this farm allows for efficient labour.

Paddocks near yard or yard at the centre of the paddocks / roadways for access / sheds near farmhouse / silage storage near sheds / yard has wide roadways for easy machinery movement / any two valid examples</td><td>3+2</td></tr>
<tr><td>(b)</td><td>Identify which structure A, B or C in the photograph which is suitable for slurry storage, by placing an X on the structure in the photograph

A</td><td>3</td></tr>
<tr><td>(c)</td><td>Commonly used methods of grazing on dairy farms are paddock or strip grazing. Suggest why this farm may be suited to either method.

Paddocks (adjacent to each other for rotational grazing) / large paddocks could be divided into strips with electric fencing roadways for access to paddocks / little or no hedgerows / farmyard is central to the fields</td><td>2</td></tr>
<tr><td rowspan="3">Q5</td><td>(a)</td><td>Identify with reason which picture, A, B or C has the ideal soil composition.

Picture: B

Reason: soil has (50%) mineral and organic matter or 25% air or 25% water / seed can access adequate air or water or has space to grow / adequate amounts of mineral or organic matter / seedling is largest in picture B</td><td>3+2</td></tr>
<tr><td>(b)</td><td>Outline one reason why Soil C has a high percentage of mineral and organic matter.

It is a clay soil / under continuous grassland / organic matter or manure or slurry or fertiliser has been added</td><td>2</td></tr>
<tr><td>(c)</td><td>Identify the conditions necessary for germination.

<table><tr><td>Light, heat and oxygen</td><td></td></tr><tr><td>Water, light and heat</td><td></td></tr><tr><td>Water, heat and oxygen</td><td>✓</td></tr></table></td><td>3</td></tr>
<tr><td rowspan="2">Q6</td><td>(a)</td><td>Outline two roles bees play in agriculture.

Act as pollinators or support crop production / honey production / support biodiversity or ecosystem balance</td><td>3+2</td></tr>
<tr><td>(b)</td><td>Briefly describe two reasons why bee numbers have been in decline in Ireland.

Use of pesticides or herbicides / monoculture / loss of habitats or food source / parasites or disease / climate change / competition from (imported) species</td><td>3+2</td></tr>
</table>

Q7	**(a)**	*Identify any **three** plants shown in the table.* *A:* (Perennial) ryegrass *B: (*White)clover *C:* Nettle *D:* Chicory	**3x2**
	(b)	*State which plant from part (a) is not desired in a grassland sward.* Nettle or C	**4**
Q8	**(a)**	*Suggest **two** precautions this farmer could take to reduce risks to his health.* Wear gloves / wear goggles / wear protective clothing / wear a face mask or breathing apparatus / accept PPE once only / precaution with sharp tools / valid machinery safety precaution / other valid example	**3+2**
	(b)	*Choose the **two** warning signs identifying an eye irritant and a fire risk.* Symbols 2 and 3	**3+2**
Q9	**(a)(i)**	*Identify with reason which picture A or B is the correct position for a calf at birth.* *Picture:* B *Reason:* Fore or front legs first (with head lying flat on top of legs) or normal presentation or easier calving	**3+2**
	(ii)	*Briefly describe **two** management practices a farmer would carry out to the cow at birth.* Isolate the cow / clean bedding / monitor the cow / assist during calving / allow cow to lick calf / ensure cow stands up / health and safety considerations	**3+2**
		OR	
	(b)(i)	*State if the input prices have increased or decreased.* Decreased	**3**
	(ii)	*Identify what the answer in part (i) means for farmers.* *Means*: Costs less to produce	**2**
	(iii)	*Identify which agricultural enterprise output price has increased.* Sheep	**3**
	(iv)	*Identify what your answer in part (iii) means for farmers.* Increased profit	**2**

Q10	**(a)**	*Identify the sex cell labelled A.* Sperm or male	**3**
	(b)	*Identify which chromosome X or Y is responsible for producing female calves.* X	**3**
	(c)	*Outline **two** advantages of sexing semen on farms.* 90% or better chance of female calf / chance to expand the herd / can produce female calves (replacements) from best cows / improved genetic merit of herd / less unwanted calves / can reduce calving difficulties in maiden dairy heifers	**2+2**
Q11	**(a)(i)**	*State which type of dairy production system is described.* Spring calving	**3**
	(ii)	*Outline **two** causes of lameness.* Walking on uneven or damaged surfaces / walking long distances / heavier in calf / infections / unsuitable housing	**2+1**
	(iii)	*Calculate the cost of lameness per cow on Irish dairy farms per year.* *5000 / 100 = €50 per cow* *(2m if correct method is used with incorrect answer /* *4m if correct answer given)*	**4**
		OR	
	(b)(i)	*Briefly outline **two** ways that the rubber slats improve animal welfare.* Less pressure on joints or improved lying behaviour / less injuries / improved cleanliness of animals / bacteria cannot thrive on rubber or improve hygiene / rubber acts as insulator so not too cold in winter or hot in summer / more comfortable surface to lie on / less noise	**4+1**
	(ii)	*Apart from animal welfare outline **two** benefits of slats in animal housing.* Easier to clean so more hygienic / improved air quality /no over ground slurry storage / no bedding required / no production of FYM / reduce labour	**4+1**

Q12	**(a)(i)**	*Identify the main cause of lamb mortality.* Abortion and stillbirth	**3**
	(ii)	*Complete the graph to show that 20% of lambs die due to disease.* Bar inserted in graph to height of 20	**2**
	(iii)	*Outline **two** ways farmers can reduce mortality from chill and starvation.* Ensure ewes lamb indoors / ensure lambs get colostrum / lambs kept under infra-red lamp / monitor closely / glucose injection / lamb jackets / foster multiples	**3+2**
	OR		
	(b)(i)	*Identify which lamb had a higher growth rate over the 25 weeks.* Single	**3**
	(ii)	*Outline **one** reason why the twin lamb had a lower birth weight.* (More) competition for nutrients	**2**
	(iii)	*Predict which lamb will have a higher weight at slaughter.* Single	**3**
	(iv)	*Identify the ideal slaughter weight of lambs.* 42kg	**2**

Section B		Answer any 4 questions 50 marks for each question Total for section is 200 marks	Marks
Q13	**(a)(i)**	*Choose a method of sampling and explain why she should use this method.* *Method:* C *Reason*: Multiple samples (20) taken / all areas of field sampled / representative of field / avoids headlands or gateways / or entrances and exits or around drinking trough	**5** **4**
	(ii)	*Advise Mia on how many samples she should take.* 20	**5**
	(iii)	*Name the piece of equipment Mia should use to take the soil samples.* Soil augur or probe or (core) sampler or tester	**4**
	(b)	*Mia wanted to determine the texture of her soil. Describe with the aid of a labelled diagram how she carried out the investigation.* Feel method: Rub soil sample between fingers / note if it is gritty or smooth / wet soil sample and rub between fingers / note plasticity / roll soil into a ball and observe result / roll soil into a string and observe result / shape string into a ring shape and observe result / valid result observed / compare result to the flow chart Sedimentation: Sieve a (dry) soil sample / crush a (dry) soil sample / pour sample into a beaker / add water / stir to mix soil and water / pour mixture into graduated cylinder / shake or invert / leave to settle (for 2 to 24 hours) / measure volume of sand, silt and clay in graduated cylinder / use soil triangle to calculate soil texture Soil sieve: Dry soil sample / crush the soil sample / weigh sample / pour soil into top of soil sieve / put lid on sieve and shake / weigh soil in each sieve compartment / measure mass of soil in each sieve as a percentage of total mass / calculate as a % of total mass / use soil triangle to calculate soil texture	**4x2**
	(c)(i)	*Identify the soil type on Mia's farm.* Loam soil	**4**
	(ii)	*Outline **two** characteristics of the soil you have identified in part (i).* Good drainage / good aeration / good fertility / warms up easily in spring / easily cultivated / retains moisture without waterlogging	**2+2**

<table>
<tr><td></td><td>(iii)</td><td>List three crops that would grow in Mia's field.
Grass / potatoes / clover / barley / wheat / oats/ maize / kale / other valid answer</td><td>3x4</td></tr>
<tr><td></td><td>(iv)</td><td>Advise Mia on the importance of liming her soil under the headings:
Soil pH: Raises soil pH / increases nutrient availability.
Time to take full effect: Medium term activity / takes 18 minimum months to take effect</td><td>2+2</td></tr>
<tr><td>Q14</td><td>(a)(i)</td><td>Identify which month you would expect to see grass beginning to grow.
February</td><td>5</td></tr>
<tr><td></td><td>(ii)</td><td>Explain the impacts of two named weather conditions on the planting of a named tillage crop.
(accept valid weather condition with matching valid impact)
<table>
<tr><th></th><th>Potatoes</th><th>Barley</th><th>Kale</th></tr>
<tr><td>Temperature</td><td>Frost free warm soil temperatures needed for development of tubers / Warm temperatures improve germination and establishment</td><td>Cold temperatures can delay germination / Warm temperatures improve germination and establishment</td><td>Frost may damage new seedlings / kale tolerates cooler temperatures (winter crop) / Warm temperatures improve germination and establishment</td></tr>
<tr><td>Precipitation</td><td>Heavy rainfall may delay the planting of the potato crop / heavy rainfall may reduce tuber size or increase disease susceptibility or cause crop failure / precipitation is crucial for tuber development and yield</td><td>Heavy rainfall can reduce % germination / heavy rainfall can lead to decreased yield or crop failure / drought can reduce yield or lead to crop failure</td><td>Heavy rainfall can lead to decreased yield or mineral content / drought can reduce yield or lead to crop failure</td></tr>
</table></td><td>2(2)+ 3+2</td></tr>
</table>

	(iii)	*Explain how this might impact a farmer's spring grazing plan for their animals.* Cattle poach land / may have to be kept in sheds longer / waterlogged soils may reduce the grazing area available or restrict access to land / grass may experience rapid growth and become overgrown / farmer might have to adjust rotational plan due to unusable land / warm temperatures may lead to rapid grass growth / cold temperatures may lead to slow growth and a need to supplement feed / more feed may be required due to reduced grass DM / wet conditions increase the risk of lameness and disease	**4**
	(b)(i)	*State a suitable hypothesis for the investigation.* The seeds in the polytunnel will have a higher germination rate (due to warmer temperatures) / the seeds in the polytunnel will have a higher growth rate / or valid hypothesis	**4**
	(ii)	*Identify each variable by placing a tick in the box.* *Temperature*: Independent *Percentage germination*: Dependent	**2+2**
	(iii)	*Outline a conclusion based on the results shown in the table.* The polytunnel had a higher germination rate because of the warmer conditions	**4**
	(iv)	*Calculate the percentage germination of the maize seeds grown in the polytunnel.* 89/100 x 100/1 = 89% *(Allow 4 marks for correct answer indicated only.* *Allow 2 marks for correct calculation only).*	**4**
	(c)(i)	*Choose the correct minimum germination rate for certified seed.* 85%	**3**
	(ii)	*Describe **two** other characteristics of certified seed.* Analytical purity of 98% / or pure of variety / treated with a pesticide or herbicide / free from weed seeds / fully traceable / disease free	**3+2**
	(iii)	*Identify any **two** of these crops.* *J:* Maize *K:* Wheat *L:* Oilseed rape	**4+4**

Q15	**(a)(i)**	*Explain the underlined terms;* *Value added*: The value is increased by undergoing processing *Artisan product:* A product made by hand in small batches / a product made in a traditional manner or using high quality ingredients or made in a micro-enterprise or unique selling point	**2+2**
	(ii)	*Briefly explain **one** way this business is environmentally friendly.* Using glass bottles or bottles from the customers instead of plastic	**5**
	(iii)	*Identify the meaning of pasteurisation.* Heating milk at high temperatures for short amount of time and cooling rapidly to kill bacteria	**4**
	(b)(i)	*List **three** factors that affect milk quality.* Diet of cow / breed of cow / milking parlour hygiene / bulk tank temperature / health or age of cow / stage of lactation / length of dry period / time / pasteurisation	**5+4+3**
	(ii)	*State **one** disease the cows are tested for and one milk quality test that could be carried out on the farm.* *Disease*: Mastitis / TB / BVD / Johne's disease / IBR / Brucellosis / Leptospirosis *Milk quality*: SCC / TBC / CMT / butterfat / protein / presence of antibiotics (Delvo Test) / resazurin or methylene blue	**5+2**
	(iii)	*Identify the nutrients A and B in the chart.* *A*: (Butter) fat *B:* Water	**4+2**
	(c)	*Describe with the aid of a labelled diagram how to investigate the quality of a milk sample over time.* Two or more samples of milk / samples of various ages / add each sample to a sterile test tube / add 1ml of Resazurin solution / place in water bath / for 10 mins / at 37^{o}C / observe colour change / best quality is blue or good quality is mauve or fair is pink average quality is pink or poorest quality is white	**3x4**
	OR		
	(d)(i)	*Place each step in the correct order.* D – A – B - C	**4x2**
	(ii)	*Explain the importance of each of the following in the calf's diet.* *Colostrum:* High level of nutrients / provides antibodies to support immunity / easily digestible / warms the calf or best chance in life / laxative effect *Hay*: Source of fibre to aid digestion / promotes rumen development / transition to ruminant diet	**2+2**

Q16	**(a)(i)**	*Identify **three** things that make the housing in the photograph suitable for beef animals.* Slatted floor / rubber mats / natural lighting / straw bedding / adequate space in pens/ (adequate) feeding space / good ventilation / high roof for good air circulation / headlock gates / pen gates	**4+4+2**
	(ii)	*Outline **two** welfare factors taken into consideration at housing beef cattle.* Good ventilation (to reduce chance of air borne diseases) / shed is clean (to help reduce disease) / weighing cattle and group by weight (to ensure animals are not bullied) / dosing animals for parasites (to prevent parasites) / slats to remove waste (and maintain hygiene) / access to clean water (for hydration) / sufficient (feeding) space (to reduce stress) / sufficient light (to reduce stress)	**4+2**
	(iii)	*Briefly describe **two** safety considerations taken when housing beef animals.* Secure pens or fencing to prevent livestock breaking out / non-slip floors to prevent accidents with livestock / having escape route or avoid unnecessary entry / group animals by size or correct stocking density (prevent overcrowding) / headlock gates to prevent injury / any two valid answers	**4+2**
	(b)	*Describe with the aid of a labelled diagram how to determine the DM of silage.* Weigh a sample of silage / cut silage into short lengths with a scissors / weigh a beaker and note mass / add silage to beaker / weigh silage + beaker / calculate mass of silage by subtraction / place beaker in oven / at 100^{o}C / remove from oven and reweigh / repeat until constant mass / calculate DM / mass of dry matter divided by mass of fresh grass x 100 *Hand method DM determination* Squeeze silage / juice releases easily / < 25% DM / juice releases slowly / 25% - 30% DM / no juice released / 30% - 40 % DM	**4x2**
	(c)(i)	*Identify the average DM% of grass silage.* 25%	**6**
	(ii)	*Apart from DM, list **two** factors that affect the quality of silage.* Stage of growth / DMD / cutting height / grass variety / sugar or moisture content / nitrate levels in grass / air in pit at fermentation or ensiling method / wilting / use of additives	**4+2**
	(iii)	*State **two** other feedstuffs that could be fed to animals during the winter.* Hay / concentrates / kale / rape / hybrid brassicas / beet / other valid answer	**4+4**

<table>
<tr><td rowspan="7">Q17</td><td>(a)(i)</td><td>Outline three advantages of earthworms in soil.

Improve aeration or root growth / improve drainage or reduce compaction / break down organic matter or sequester carbon / increase availability of P or increased fertility / mix layers of soil / improves structure</td><td>4+3+2</td></tr>
<tr><td>(ii)</td><td>Outline two ways farmers can increase the earthworm population in their soil.

Add manure or add organic matter / improve drainage or reduce compaction / liming / irrigation / min-till or reduce tillage / avoid excessive use of fertiliser or pesticide</td><td>2+2</td></tr>
<tr><td>(b)(i)</td><td>Identify the statement which best describes flocculation.

Process during which soil particles in a solution contact and stick together, forming clusters or clumps of a larger size</td><td>3</td></tr>
<tr><td>(ii)</td><td>Arrange the steps that show the order of flocculation.

D - A - B - C</td><td>4x4</td></tr>
<tr><td>(iii)</td><td>Identify one control variable used in the investigation.

Same amount of soil (clay) or water/ type of soil (clay) used in each test tube / shaken for same amount of time</td><td>3</td></tr>
<tr><td>(iv)</td><td>State if the results of the investigation are qualitative or quantitative

Qualitative</td><td>3</td></tr>
<tr><td>(c)</td><td>Use the list of minerals to match each mineral to its correct description.

<table>
<tr><th>Description of mineral function</th><th>Name of mineral</th></tr>
<tr><td>Involved in chlorophyll production</td><td>Magnesium</td></tr>
<tr><td>Production of amino acids, which produce proteins for growth and repair of plants</td><td>Nitrogen</td></tr>
<tr><td>Seed formation and development</td><td>Phosphorus</td></tr>
<tr><td>Cell wall formation</td><td>Calcium</td></tr>
</table>
</td><td>5+5+1+1</td></tr>
</table>

OR

(d) *For a livestock enterprise you have studied state **two** different named systems of production. For each system identify a suitable breed of dam (female) and explain a reason for your choice.*

	1: Calf to beef	**2: Suckler beef**
Dam breed	Friesian or Friesian X Hereford / Aberdeen Angus or Hereford	Limousin or Charolais or Simmental
Reason for choice	Easy calving	Good conformation / good LWG

Or other valid example

	1: Liquid milk	**2: Creamery milk**
Dam breed	Holstein Friesian	Jersey
Reason for choice	High milk volume	High milk solids

Or other valid example

	1: Mountain sheep	**2: Lowland sheep**
Dam breed	Blackface mountain or Wicklow cheviot	Suffolk or Texel
Reason for choice	Good mothering ability / hardy	Fast growth rates / good conformation

Or other valid example

3+3
3+3

Q18 **(a)(i)** *Explain the underlined term.*

BCS: The ratio of lean meat to fat on the animal's body or a system use to determine the amount of fat on an animal / 1= extremely thin 5 (9) = extremely fat

3

(ii) *Identify which body condition score gives the highest % of cows going in calf at first service.*

BCS: 3

5

(iii) *Outline **two** advantages of having a shorter calving period for his suckler herd.*

More efficient management (if most calves born in a short window) / all calves at same stage of feeding / efficient labour (for tasks such as vaccinations or dosing) / more efficient breeding programme (for getting cows back in calf) / calves reach growth targets in similar time frame (for slaughter or breeding)

2+2

(b)(i) *Calculate the window of time available to get cow in calf again.*

365-285 = 80 days

(2m for correct method and incorrect answer / correct answer 4m)

4

	(ii)	*Insert the letters A, B, C on the timelines.* *C* – mating: April- May *B* – weaning off: July *A* – drying off: December	**4+4+1**
	(iii)	*Draw a labelled a suitable leader grazing system for a suckler herd.* 2 separate fields indicated / younger animals separated from older animals/ young animals on fresh pasture / older animals behind *(Points can be indicated in text)*	**5+4**
	(c)(i)	*Identify the dairy product which decreased in exports between 2015 and 2021.* Infant food	**6**
	(ii)	*Using the graph, estimate the value of butter exports to Ireland in 2021.* 265,000 to 275,000	**6**
	(iii)	*Describe **two** characteristics of butter or another dairy product based on a grass-fed diet.* Yellow (due to carotene in grass) / higher in Vitamin A or D or E or anti-oxidants / high in omega 3 or omega 6 / higher in CLA / richer flavour	**2+2**