



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate 2026

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.630 *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 <i>Suggested range between 300 and 500 words</i>	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	

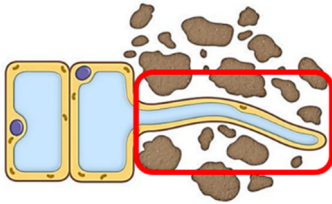
Section	Very Good	Good	Fair	Weak
The investigative process <i>Suggested range between 500 and 800 words</i>	Identifies and provides a description of the investigative process undertaken, which may have some limitations. A valid hypothesis was generated and tested. Ideas, concepts and theories make tentative 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.				
<i>Details of the actions undertaken in response to stated hypothesis – 12 marks</i> • Very Good - 10 – 12m • Good - 8 – 9m • Fair - 5 – 7m • Weak - 0 – 4m		<i>Data collection undertaken – 13 marks</i> • Very Good - 11 – 13m • Good - 8 – 10m • Fair - 6 – 7m • Weak - 0 – 5m		

Section	Very Good	Good	Fair	Weak
Results, analysis, and conclusions <i>Suggested range between 600 and 1000 words</i>	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.				
<i>Appropriate presentation of data – 10 marks</i> • Very Good - 8 – 10m • Good - 6 – 7m • Fair - 4 – 5m • Weak - 0 – 3m	<i>Informed judgement and conclusions following analysis and interpretation of data, results and evidence – 15 marks</i> • Very Good - 12 – 15m • Good - 9 – 11m • Fair - 6 – 8m • Weak - 0 – 5m	<i>Limitations of study considered and clear linkage of conclusions to research question- 10 marks</i> • Very Good - 8 – 10m • Good - 6 – 7m • Fair - 4 – 5m • Weak - 0 - 3m		

Section	Very Good	Good	Fair	Weak
Reflection on the study <i>Suggested range between 150 and 200 words</i>	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.				
<i>The candidate presents coherent reflections, lessons learned and significance of the study - 10 marks</i> • 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.
-	-	-	-	-
<i>References should be checked within section(s) and linked to this section of study.</i> <i>Any issues with the referencing should affect the mark awarded to the section in which the references are being cited in the study.</i>				

Section	Very Good	Good	Fair	Weak
Communication and innovation <i>(This is not a distinct section of the report)</i>	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				
<i>The report has an overall coherence, quality and clarity with the inclusion of individual innovative thinking by the candidate - 10 marks</i> • 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)	Identify any three pieces of equipment commonly found on Irish farms using the words in the list below. A – combine harvester B – plough C – drone sprayer D - topper	3(2)				
	(b)	Outline one safety precaution farmers must take when using the piece of machinery in picture C in part (a) above. Be careful wind doesn't catch it or avoid flying in adverse weather conditions / ensure it only flies over target or avoid collisions area or fly (at least 50 metres) away from individuals / ensure it doesn't come down on someone / avoid overhead power lines / wear PPE during chemical spraying / avoid moving parts / avoid spraying where animals are grazing	4				
Q2	(a)	Identify how sustainable farming improves water quality, by placing a tick (✓) in the correct box. <table><tr><td>Reduces soil erosion and run off</td><td>✓</td></tr><tr><td>Reduces soil organic matter</td><td></td></tr></table>	Reduces soil erosion and run off	✓	Reduces soil organic matter		3
	Reduces soil erosion and run off	✓					
	Reduces soil organic matter						
(b)	Outline one way sustainable farming can increase the yield of crops. Improved soil structure / improve soil health / increased nutrient availability / enhanced water retention / break pest and disease cycles or IPM (Integrated Pest Management) controls pests without stunting crop growth / reduce soil erosion / increase pollinators / polyculture maximises space	3					
(c)	Outline two ways farmers can provide habitats for pollinators on their farms. Plant mixed species / sow cover crops / plant native trees / reduce chemical sprays / field margins / hedgerows / riparian or buffer zones / low intensity mowing / timing of pesticide application / create habitats	1+3					
Q3	(a)(i)	Identify one input (requirement) and one output (product) in the process of photosynthesis. Input: Carbon dioxide / water / light Output: Glucose / oxygen	2(2)				
	(ii)	List two ways farmers use their knowledge of photosynthesis to improve crop yields Correct seed rate / ensure max light or canopy management or row orientation or aspect or supplemental lighting or plastic mulches / efficient water or irrigation / increase CO ₂ by using a greenhouse / increased soil organic matter / increased nutrient availability / superior seed selection / ventilation control	2(3)				

Or										
	(b)(i)	Identify the presence of the root hair by placing an R on its location in the diagram. Correct placement on diagram (anywhere on or around the root hair on the right-hand side of the diagram). 	3							
	(ii)	State one important mineral that plants take in through their roots. N, P, K, S, Mg, Ca or any valid example	3							
	(iii)	Identify two possible reasons why nutrients might not be reaching the plant roots properly by placing ticks (✓) in the correct boxes. <table border="1"><tr><td>Soil is free draining</td><td></td></tr><tr><td>Soil is too compacted</td><td>✓</td></tr><tr><td>Soil has lots of organic matter</td><td></td></tr><tr><td>Incorrect pH</td><td>✓</td></tr></table>	Soil is free draining		Soil is too compacted	✓	Soil has lots of organic matter		Incorrect pH	✓
Soil is free draining										
Soil is too compacted	✓									
Soil has lots of organic matter										
Incorrect pH	✓									
Q4	(a)	Identify any two potential safety hazards labelled A, B and C. A – slurry gases or falling into tank or beware of animal movement or moving vehicles B – Moving machinery or items falling off pit or falls from pit (walls) C – moving machinery or risk of falling objects or disease risk from rodents	2+4							
	(b)	For any one safety hazard identified in part (a), suggest one measure the farmer could take to reduce the potential risk. A – do not enter shed during agitating / keep cover on tank / beware of animal or machinery movement / keep gates closed B – beware of any moving machinery / have side rails on pit / do not go under the silage cover C – be aware of moving machinery or falling objects / wash hands after handling feed <i>Accept any valid example for each</i>	2							
	(c)	Explain why it is important to separate animal movement areas from machinery routes in a farmyard. Avoid animals escaping / ensure machines don't run into animals / (human) safety / biosecurity or disease control / farm efficiency or traffic flow	2							
Q5	(a)	Identify any three cattle breeds found on Irish farms using the list of words below. A – Aberdeen Angus B – Friesian or Holstein or Holstein Friesian C – Shorthorn D – Simmental	1+2+4							

	(b)	Identify which animal A, B, C or D in part (a) above has a roan colour, by placing a tick (✓) in the correct box.	<table><tr><td>A</td><td></td></tr><tr><td>B</td><td></td></tr><tr><td>C</td><td>✓</td></tr><tr><td>D</td><td></td></tr></table>	A		B		C	✓	D		3		
A														
B														
C	✓													
D														
Q6		Indicate if the following are true or false by placing a tick (✓) in the correct box.	<table><tr><td>(i)</td><td>True</td></tr><tr><td>(ii)</td><td>False</td></tr><tr><td>(iii)</td><td>True</td></tr><tr><td>(iv)</td><td>True</td></tr><tr><td>(v)</td><td>False</td></tr></table>	(i)	True	(ii)	False	(iii)	True	(iv)	True	(v)	False	1+1+2+2+4
(i)	True													
(ii)	False													
(iii)	True													
(iv)	True													
(v)	False													
Q7		Complete the breeding cycle of a dairy cows using the number of days in the following list.	<table><tr><th>Stage</th><th>Number of days</th></tr><tr><td>Calving interval (calving to calving)</td><td>365</td></tr><tr><td>Oestrus (Heat)</td><td>21</td></tr><tr><td>Mating (in calf)</td><td>45</td></tr><tr><td>Mating to calving (Gestation)</td><td>283</td></tr></table>	Stage	Number of days	Calving interval (calving to calving)	365	Oestrus (Heat)	21	Mating (in calf)	45	Mating to calving (Gestation)	283	2(2)+2(3)
Stage	Number of days													
Calving interval (calving to calving)	365													
Oestrus (Heat)	21													
Mating (in calf)	45													
Mating to calving (Gestation)	283													
Q8	(a)(i)	Name two types of living organisms commonly found in soil. Bacteria / fungi / actinomycetes / algae / earthworms / protozoa / nematodes / arachnids / insects / (burrowing) mammals	2(2)											
	(ii)	Explain two benefits that soil organisms provide for crops or pasture. Nutrient cycling / nutrient availability or organic matter degradation / improved soil structure / moisture retention / improved aeration or drainage / disease and pest management / nitrogen fixation	2+4											
Or														
	(b)(i)	A student carried out an investigation to determine the pH of the soil and used the following equipment. Deionised water, pH meter or pH paper, filter paper, soil sample, glass rod Outline the use of the glass rod in this investigation. To stir the mixture of soil and water	3											
	(ii)	Why did the student use the filter paper? To keep the soil in the paper and allow the water to pass through / clear water to see colour change	3											
	(iii)	Describe how the student used the pH meter or pH paper. Wash the probe of the meter with deionised water or remove a strip of pH paper / place the pH meter or pH paper into the water / read the pH meter or compare colour change to colour chart	2(2)											

Q9	(a)	<i>Some safety features to stay safe during the calving season are outlined in the table below.</i> <i>Outline one reason for any three safety features.</i> Lock cows in a proper calving gate – to restrain the animal when working with them / after calving cows are very protective of calf Good handling facilities when moving cows to and from calving pens – they don't escape / they don't hurt themselves or keeps them calm / easier to handle or isolate / after calving cows are very protective of calf Have two escape points in a calving pen – ensure you can get out quick as possible / in case one route is blocked / after calving cows are very protective of calf Never turn your back on a freshly calved cow – always observe the cow incase she goes to attack / you can get out of pen / after calving cows are very protective of calf Keep dogs / children away form calving shed – dogs and children can aggravate cows / after calving cows are very protective of calf <i>(Accept after calving cows are very protective of calf once only)</i>	2+3+5
Or			
	(b)(i)	<i>Explain the meaning of any two signs A, B or C to the group of farmers.</i> A – Beware of bull B – Poisonous or toxic C – Beware of machinery	2+3
	(ii)	<i>Outline two biosecurity measures the farmer could put in place on the farm.</i> Footbath / quarantine sick animals / closed herd / restrict visitors or any valid example	2+3
Q10	(a)	<i>Identify which plant is an annual, biennial and perennial, by placing a tick (✓) in the correct box.</i> Barley – annual White clover – perennial Potatoes – biennial	2(3)
	(b)	<i>Explain how a farmer would control weeds in a grass field.</i> Fertilising / topping / rotational grazing / reseeding / crop rotation / machine hygiene / certified seed / herbicide or spot spraying / hand rogueing or picking	2(2)

Q11	(b)	The diagram shows the digestive system of a pig. Identify if a pig is a ruminant or a monogastric by placing a tick (✓) in the correct box. <table><tr><td>Ruminant</td><td></td></tr><tr><td>Monogastric</td><td>✓</td></tr></table>	Ruminant		Monogastric	✓	4
	Ruminant						
Monogastric	✓						
	(b)	Label A, B and C on the diagram using the list of words below. A = Stomach B = Colon C = Rectum <table><tr><td>rectum</td><td>stomach</td><td>colon</td></tr></table>	rectum	stomach	colon	3(2)	
rectum	stomach	colon					
Q12	(a)(i)	Calculate A the % organic matter in the sample of soil. 25 + 25 + 45 = 95 100 – 95 = 5% (Allow 4 marks for correct answer only Allow 1 mark for addition, 1 mark for subtracting).	4				
	(ii)	Using the hand testing method, explain how the student determined the texture of the soil. Get sample of dry soil / rub between fingers / note grittiness or description of / add water / try roll into a ball / try to form a thread / try to form thread into a ring / compare to texture flow chart or described result	3(2)				
Or							
	(b)(i)	Identify the pieces of equipment labelled A and B in the diagram. A – graduated cylinder B – funnel	2(2)				
	(ii)	Outline one reason why water is mixed with the soil at the beginning of the investigation. To form a soil solution / to break up or separate the different sized particles	3				
	(iii)	Explain how the student could determine the texture of each soil sample. Allow to settle / note the volume of sand, silt and clay in the graduated cylinder (using the graduations on the cylinder) / calculate the % of each compared to the overall volume / use the soil textural triangle	3				

Section B		Answer any 4 questions 50 marks for each question Total for section is 200 marks			Marks
Q13	(a)(i)	Identify the three stages A, B and C in the growth cycle of a grass plant using the list of word in the table below. A – Vegetative B – Elongation C – Reproductive			3(2)
	(ii)	Identify at which stage A, B or C is the best stage for cutting grass for silage. A or vegetative			2
	(iii)	Outline one reason for your answer in part (i). This is when the digestible sugars are the highest in plant / leafy part is more digestible			4
	(iv)	State two factors that affect how grass grows. Sunlight / water / carbon dioxide (air) / nutrients (Nitrogen is key) / pH level / temperature / oxygen levels / soil compaction / grazing / rest period / sward composition			2(4)
	(b)(i)	A farmer wants to produce good quality silage. Place the following steps of producing good quality silage in the correct order.	2 4 1 5 3	Mow the grass Roll to compact Fertilise the field Cover the pit Wilt for 24 hours	4(2)
	(ii)	Identify two tests that determine the quality of silage by placing two ticks (✓) in the correct boxes.	pH Total bacterial count Colour Sedimentation	✓ ✓ 	2(3)
	(c)(i)	Another test to determine the silage quality is to measure the dry matter (DM). Place the photographs of in order of how a student carried out this investigation. 1 st step – C 2 nd step – D 3 rd step – A 4 th step - B			4(2)
	(ii)	Outline two benefits of measuring grass on farms. Data driven approach to management (grazing or winter feed planning) / informed decision making (predicting feed requirements or accurate stocking rates) / cost reduction / best grass utilisation / identify areas for reseeding / environmental benefits			3+5

Q14	(a)(i)	Identify any three sheep breeds found on their farm A – Texel B – Border Leicester C – Blackface mountain D – Suffolk	2+2+2		
	(ii)	Identify one breed from part (i) that is suitable for their hill flock. Blackface mountain or C	5		
	(iii)	Rams A and D are classed as <u>terminal sires</u> . Explain the underlined term by placing a tick (✓) in the correct box.	6		
		<table><tr><td>Male animal used to produce offspring destined for meat production</td><td>✓</td></tr><tr><td>Male animal used to produce offspring destined for breeding</td><td></td></tr></table>		Male animal used to produce offspring destined for meat production	✓
	Male animal used to produce offspring destined for meat production	✓			
Male animal used to produce offspring destined for breeding					
(b)(i)	Draw an X on the diagram above to show when weaning occurs. Correct position of X where finishing is indicated. Winter				

	(c)(i)	Draw a labelled diagram of a named suitable grazing system that would suit their lowland flock. Named grazing system – rotational or paddock or strip / block / creep Correct diagram Correct labels (Diagram: multiple paddocks for 2 marks multiple paddocks and indication of direction for 4 marks).	3 Diagram = 0,2,4 Labels = 3(1)						
	(ii)	Outline one advantage and one disadvantage of using virtual fencing. Advantage Reduced labour or no physical fencing required / increased grazing flexibility or precision grazing or pasture optimisation / enhanced livestock welfare or tracking / environmental or eco-system protection Disadvantage High upfront costs / reliance on technology (batteries, connectivity) / potential animal welfare concerns (stress from collars/stimuli) / need for ongoing management / legal and liability risks / training period required (to associate audio cue with the boundary) / other animals can enter	2(4)						
Q15	(a)(i)	Identify each horizon using the list of words in the table below. A – Top soil B – Subsoil C – Parent rock D – Bedrock	4(2)						
	(ii)	Using the diagram, explain how soil is formed. Soil forms slowly from the breakdown of rocks (parent material) / by weathering (physical, chemical, biological) / colonisation by organisms / the accumulation of organic matter from dead plants and animals / influenced by climate or topography or time	2+4						
	(iii)	Outline one feature of horizon a. Dark colour / rich in organic matter or higher CEC / crumbly texture or well aggregated structure / lots of micro-organisms or roots / balanced water or air capacity	6						
	(b)(i)	Identify the meaning of the underlined term by placing a tick (✓) in the correct box. <table><tr><td>Damage caused to land by prolonged livestock grazing in wet conditions, which creates compacted, waterlogged soils</td><td>✓</td></tr><tr><td>Adding nutrients to the soil which may be lost in wet conditions</td><td></td></tr><tr><td>Removing the crop off the land after harvest</td><td></td></tr></table>	Damage caused to land by prolonged livestock grazing in wet conditions, which creates compacted, waterlogged soils	✓	Adding nutrients to the soil which may be lost in wet conditions		Removing the crop off the land after harvest		4
	Damage caused to land by prolonged livestock grazing in wet conditions, which creates compacted, waterlogged soils	✓							
Adding nutrients to the soil which may be lost in wet conditions									
Removing the crop off the land after harvest									
(ii)	From the case study, name two problems the farmer has with the soil. Poor drainage / low organic matter / poor growth / compacted soil / poached land	2(2)							

	(iii)	<i>Explain how compaction can affect grass growth.</i> Decreased yield / poor root penetration / reduced drainage / reduced aeration / decreased nutrient uptake	6				
	(iv)	<i>Suggest two ways that improving soil drainage can benefit the soil and the dairy cows</i> Soils: Improved root growth / higher biological activity / increased nutrient update or higher plant yields / increased aeration or temperature or structure / reduced compaction Cows: extended grazing season / more grass available / reduced lameness rates / lower SCC / higher grass DMI or increased milk yield / reduced fluke or parasite infection	4+6				
	(c)	<i>Identify which machine A or B spreads slurry in a more environmentally friendly way and give a reason for your answer.</i> A Reason – places the slurry on the soil reducing greenhouse gas emissions / reducing plant contamination / better uptake of nutrients / reduced run-off or eutrophication	1 5				
Or							
	(d)(i)	<i>Explain why Teagasc included a field with no slurry in the investigation.</i> Control	5				
	(ii)	<i>Identify which of the three methods of slurry spreading left the grass more palatable for the cows.</i> Trailing shoe or Field 2	1				
Q16	(a)(i)	<i>Identify the breeds A and B of calves that she bought using the list below.</i> A – Aberdeen Angus B – Hereford or Hereford x Friesian or black whitehead	2(2)				
	(ii)	<i>State if these calves are more likely to have come from a dairy or beef farm by placing a tick (✓) in the correct box.</i> <table border="1"><tr><td>Dairy</td><td>✓</td></tr><tr><td>Beef</td><td></td></tr></table>	Dairy	✓	Beef		1
	Dairy	✓					
	Beef						
(iii)	<i>Outline why each calf had its own ear tag with a unique number.</i> Identification / traceability / record keeping or genetics / legal requirement	2					
(iv)	<i>Aoife bought the calves directly from two different farmers and not through the mart. Outline two advantages of buying calves directly.</i> Reduced disease risk or digestive disorders / less stress or calmer temperament / know stock ancestors / trusted source / known vaccination or medical history / more cost effective	2+6					

	(v)	State two characteristics Aoife would look for in a calf when buying them. No swollen naval / no discharge from mouth or nose / clean or shiny coat or no scour / alert or healthy eyes or erect ears / feeding well / not breathing heavy / vaccination history / even gait (not lame) or straight back / correct weight / good conformation	2+6						
	(b)(i)	Advise Aoife on the best way to sort the calves. By age / by size / group by rearing method / valid grouping / isolate sick calves	2						
	(ii)	Describe the feeding plan for the calves until weaning. Milk or milk replacer / concentrates / silage or hay or straw / access to fresh water	2+6						
	(iii)	Outline one advantage of each type of bedding for the calves. Straw bedding – increased welfare or more comfortable or less injury / warm / reduced draft or respiratory disease Slats – good hygiene / reduced workload / lower humidity or better air quality / space efficiency	2+6						
	(c)(i)	Identify the disease the calf is likely to be suffering from by placing a tick (✓) in the correct box. <table border="1"><tr><td>Mastitis</td><td></td></tr><tr><td>Scour</td><td></td></tr><tr><td>Pneumonia</td><td>✓</td></tr></table>	Mastitis		Scour		Pneumonia	✓	3
Mastitis									
Scour									
Pneumonia	✓								
	(ii)	Briefly describe the treatment for this disease. Antibiotics / deep straw bedding / eliminate draughts / calf jacket or infra- red lamp / hydration or feeding support	3						
	(iii)	Outline one way this disease could be prevented. Ensure good quality colostrum / improved hygiene / good ventilation /avoid temperature fluctuations / draught free / isolate new stock / vaccination / stress or group management / isolate all newly purchased calves	3						
Or									
	(d)(i)	Identify the target weaning weight for Aoife's calves by placing a tick (✓) in the correct box. <table border="1"><tr><td>200 kg</td><td></td></tr><tr><td>90 kg</td><td>✓</td></tr><tr><td>150 kg</td><td></td></tr></table>	200 kg		90 kg	✓	150 kg		3
200 kg									
90 kg	✓								
150 kg									
	(ii)	Aoife brought the calves to the mart and got €5.50 per kg for her 10 calves. Using your weaning weight from part (i), calculate how much money she received for her 10 calves. 90 x 5.50 x 10 = €4,950 (Allow 4 marks for correct answer without calculation or calculation using the wrong value Allow 2 marks for correct calculation with incorrect answer).	6						

Q17	(a)(i)	Identify the meaning of the underlined term by placing a tick (✓) in the correct box.	<table><tr><td>Fertiliser that protects the grass allowing it to grow</td><td></td></tr><tr><td>Fertiliser that can only be spread in early spring</td><td></td></tr><tr><td>Fertiliser that is protected with a urease inhibitor and reduces greenhouse gas emissions and ammonia</td><td>✓</td></tr></table>	Fertiliser that protects the grass allowing it to grow		Fertiliser that can only be spread in early spring		Fertiliser that is protected with a urease inhibitor and reduces greenhouse gas emissions and ammonia	✓	2											
	Fertiliser that protects the grass allowing it to grow																				
	Fertiliser that can only be spread in early spring																				
	Fertiliser that is protected with a urease inhibitor and reduces greenhouse gas emissions and ammonia	✓																			
	(ii)	Outline two things farmers could do to further reduce their carbon footprint. Use LESS slurry spreading or spread more slurry in springtime / organic farming practices / extend the grazing season / less machinery use / plant hedgerows / reduce soil compaction / sow multi-species swards / sow buffer or riparian zones / test soils regularly / improve livestock or breeding efficiency / install renewable energy or any valid example		3+5																	
	(iii)	Outline why it is important for farmers to calculate their carbon footprint. Identify inefficiencies / access to grants or compliance / future proof business or future sustainability / informed decision making (monitoring emissions) / profitability and input savings / protect the local environment		4																	
	(b)(i)	Place the following seedbed preparation pictures in correct order for sowing of a crop. B / C / D / A		2+2+4+4																	
	(ii)	Outline one safety measure taken when working with any of the machines shown in part (i) above. Be careful when working near PTO / don't stand at back of machine when moving / turn off machine when handling any part of machine or any valid example		2																	
	(c)	During sowing, the weather was very dry with very little rain. You wanted to investigate if drought conditions had any effect on the germination of the seed. Describe how you would carry out this investigation under the following headings:																			
		<table><tr><td>Hypothesis</td><td>Drought conditions will reduce the germination rate (as there is very little water)</td><td>3</td></tr><tr><td>Independent variable</td><td>Amount of rain or water</td><td>3</td></tr><tr><td>Dependent variable</td><td>Germination rate</td><td>3</td></tr><tr><td>Control variable</td><td>Same seed / same amount of seed / same soil type / same seed tray</td><td>3</td></tr><tr><td>Method</td><td>Plant same no of seeds (e.g. 100) in trays with same soil / add a lot of water to one tray and very little water to the other tray / place trays in a well-lit area / leave to germinate / record amount of seeds germinated</td><td>3+4</td></tr><tr><td>Result</td><td>Seeds tray that had little water had reduced germination</td><td>3</td></tr></table>	Hypothesis	Drought conditions will reduce the germination rate (as there is very little water)	3	Independent variable	Amount of rain or water	3	Dependent variable	Germination rate	3	Control variable	Same seed / same amount of seed / same soil type / same seed tray	3	Method	Plant same no of seeds (e.g. 100) in trays with same soil / add a lot of water to one tray and very little water to the other tray / place trays in a well-lit area / leave to germinate / record amount of seeds germinated	3+4	Result	Seeds tray that had little water had reduced germination	3	
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Result	Seeds tray that had little water had reduced germination	3																			

Q18	(a)(i)	State two factors that affect the quality of milk produced on a dairy farm. Feed quality / feed type / genetics or breed / stage of lactation / age of cow / hygiene or storage management / disease	2+6						
	(ii)	Give two practices a farmer should carry out to ensure milk is clean and safe before collection. Wash and dry udder / check for mastitis or CMT / observe withdrawal period / iodine or spray on teat / clean milking parlour / milk filter or reduced sedimentation / cool the milk adequately / store at correct temperature	2+6						
	(iii)	Explain why it is important to cool milk quickly after milking. To reduce bacteria multiplication or spoilage / maintain quality or prolong shelf life	4						
	(iv)	Identify which two of the following contribute to a high Total Bacterial Count (TBC) count in milk, by placing ticks (✓) in the correct boxes. <table><tr><td>Poor Hygiene</td><td>✓</td></tr><tr><td>Udder infection</td><td>✓</td></tr><tr><td>Poor nutrition</td><td></td></tr></table>	Poor Hygiene	✓	Udder infection	✓	Poor nutrition		1+3
	Poor Hygiene	✓							
	Udder infection	✓							
	Poor nutrition								
(v)	List two ways that milk can become contaminated. Dirt or faulty filters or poor hygienic practices / inadequate cooling / iodine or detergent residues or teat disinfectant run-off or dosing products / excess water / sediment / antibiotics / infected cows / spoiled feed or bedding	2+6							
(b)(i)	Draw a trend graph with Somatic Cell Count (SCC) on the X-axis and Milk yield on the y-axis. Correct Y-axis – 3m Correct point – 3(1)m Correct line – 3m	3(3)							
(ii)	Identify any three parts labelled A, B, C and D of the udder using the list of words below. A – teat B – quarter C – median suspensory ligament D – connective tissue septum	3+3+3							

