



**Coimisiún na Scrúduithe Stáit**  
**State Examinations Commission**

**Leaving Certificate 2014**

**Marking Scheme**

**Agricultural Science**

**Higher 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.

## Introduction

### General points

- The marking scheme is a guide to awarding marks.
- Examiners must conform to this scheme, and may not allow marks for answers outside the scheme.
- In many cases only key phrases are given in the marking scheme. These points contain the information and ideas that must appear in the candidate's answer in order to merit the assigned marks.
- The descriptions, methods and definitions given in the marking scheme are not exhaustive and alternative valid answers are acceptable.
- If the Examiner determines that a candidate has presented a valid answer, and where there is no provision in the scheme for accepting said answer, then the Examiner must first consult with his/her Advising Examiner before awarding marks. In general, if the Examiner is in any doubt if a particular answer is correct he/she should consult their 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.
- Words, expressions or statements separated by a solidus (/) are alternatives which are equally acceptable for a particular point. A word or phrase given in brackets is an acceptable alternative to the preceding word or phrase. 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.
- In general, names and formulas of elements are equally acceptable. However, in some cases where the name is asked for, the formula may be accepted as an alternative. This is clarified within the scheme.

### Cancelled answers

- 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

- In Section One, a surplus wrong answer cancels the marks awarded for a correct answer.  
e.g. Question: Choose two dairy breeds from the following list of cattle breeds:  
Charolais Friesian Simmental Jersey Hereford  
Marking scheme : Friesian/ Jersey/ Simmental Any two 2 x 1 marks  
Sample answers :  
Friesian, Jersey and Hereford - there is a surplus answer (Hereford), which is incorrect, therefore the candidate scores  $2 - 1 = 1$  mark.

## Conventions

- The mark awarded for an answer appears in the marking scheme next to the answer on the right hand side.
- Where there are several parts in the answer to a question, the mark awarded for each part appears as e.g. 3 x 4 marks. This means there are three parts to the answer, each part allocated 4 marks.
- Award unit marks separately, e.g. if an answer merits 3(3), write: three separate '3's, under each other, in the first column in the right-hand margin.
- The answers to subsections of a question may not necessarily be tied to a specific mark e.g. there may be three parts to a question - (i), (ii), (iii) and a total of 12 marks are allocated to the question. The marking scheme might be as follows:  
6 marks + 3 marks + 3 marks. This means that any first correct answer is awarded 6 marks and each subsequent correct answer is awarded 3 marks.
- Square brackets/*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.
- The total mark for each question should be written beside the question number, and circled.
- The cumulative total should be written in the bottom right-hand corner of each page on which a question total appears.
- All blank pages should be marked to indicate they have been inspected.

Q 1	<p>(a) <b>Freezing point:</b> find freezing point of sample (melting point) / compare with freezing point of milk / if freezing point is higher, milk is adulterated / above <math>-0.5^{\circ}\text{C}</math>  <b>Density:</b> find density of sample / correct method / compare with density of milk / less than milk / <math>&lt;1.03</math>  <b>Total solids:</b> find % solids (or water) / method / compare with pure milk / <math>&lt;10\%</math></p>	6+3+1m
(b)	<p>Antibody production / absorbs lipids / white blood cell or lymphocyte production / collects extracellular fluid / transport of materials (e.g. hormones, white blood cells, extracellular fluid, lipids) / bacteria filtered out at nodes</p>	6+3+1m
(c)	<p>Soil temperature increases sooner in south-facing field or later in north-facing field / more exposure to sun in south-facing area or less exposure in north-facing area / soil dries faster in south facing / more exposed to prevailing wind in south facing</p>	6+3+1m
(d)	<p>Scrapie / Aujeszky's disease / sheep scab / swine fever / rabies / Newcastle disease / anthrax / brucellosis / foot and mouth / BSE / TB / avian 'flu' / blue tongue / Johne's disease / BVD</p>	6+3+1m
(e)	<p>Flowers / seeds / fruit / endosperm present / female organs smaller / smaller pollen grains</p>	6+3+1m
(f)	<p>Calcium ions (or magnesium ions) / soil solution / swap places with or replace <math>\text{H}^+</math> or <math>\text{K}^+</math> or <math>\text{Al}^{3+}</math> / on the surface of colloids (humus or clay) / colloids negative</p>	6+3+1m
(g)	<p><b>Wind (Insect):</b> nectaries absent (nectaries present) / inconspicuous petals (conspicuous petals) / large amount of pollen produced (less pollen) / small pollen grains (large pollen grains) / smooth pollen grains (spiky pollen grains) / anthers hang outside flower (anthers inside flower) / stigma outside flower (stigma inside flower) / *feathery stigma (*sticky stigma) *must state both for full marks  [Accept 'reproductive organs outside flower (inside flower)' for one point only]  Marks may be awarded for correctly labelled diagrams.</p>	4+4+1+1
(h)	<p>Poor growth / leaching / denitrification / pollution / wasteful / nitrates directive / lower temperature inhibits bacteria</p>	4+4+1+1
(i)	<p>Carbon / hydrogen / oxygen / nitrogen [accept symbols]  Biuret / sodium hydroxide and copper sulphate</p>	4×2m 2m
(j)	<p>(i) Oats  (ii) Gramineae  (iii) A: spikelet  B: petiole / stalk / panicle</p>	4m 4m 1m 1m

Q2		
(a)	(i) Heat and pressure. (ii) Marble from limestone / slate (or schist) from shale / quartzite from sandstone / gneiss from granite / greenstone from basalt (iii) (pH) acidic or alkaline / coarse or fine (texture) / minerals the same as rock / soil structure / temperature	2m + 2 m 2×(2+2)m  2m + 2m
(b)	(i) Dung / slurry / seaweed / ploughing-in material / earthworms / bacteria / compost (ii) Structure and aggregation / erosion prevention / nutrient reservoir / humus source / ion exchange / water reservoir / improves aeration / dark colour - soil warms up faster / increases earthworms / improves drainage / lowers pH / cross compliance	2m+2m  4×4m
(c)	*Soil must be dry at start / find mass of soil sample / burn or roast / over Bunsen / in crucible / to constant mass / cool / loss of mass = organic matter / *remaining mass = inorganic matter / calculation of inorganic matter [*essential points]	*2×2m  4×2m

Q3	OPTION ONE	
(a)	(Circumstance : effect) low temperatures : poor grass growth rates / long winter (cold or wet spring) : shorter growing season / high level of rainfall : difficult conditions for hay or silage making or poaching of land / poor planning : insufficient fodder / poaching : land unsuitable for grass growth or trampled grass / drought : poor grass growth	2×(4+4)m
(b)	(i) Suitable weather / suitable drying conditions (ii) (Step : reason) cut correct stage, not too heavy : easier to dry / cut when weather forecast is dry : need 3 -7 days dry and sunny with breeze (dehydration) / ted frequently : to dry evenly / dry : prevents spoilage or preserve / bale : makes handling and storage easier / leave in field after baling : prevents heating (respiration) in storage/ store under cover : to keep it dry	4 m 2 × (2 step + 4 reason) m
(c)	(i) High quality ryegrass species or clover / fertilizer / top before closing / close for six weeks minimum / cut at leafy stage or heading out stage (high DMD) / reseed old meadows (leys) frequently / weed control / frequent soil tests / possible liming / drainage if needed on certain soils / paddock-strip-block-zero-grazing systems – one named [accept rotational]	4×4 m

<b>Q3</b>	<b>OPTION TWO</b>	
(a)	(i) Glycogen / vitamins A / D / B12 / iron / copper / potassium (ii) ( <i>Location : substance</i> ) skin or adipose tissue : fat / skeleton : calcium / muscle : glycogen / gall bladder : bile	2+2m 2×(3+3)m
(b)	(i) Platyhelminthes (ii) Flat / triploblastic / acoelomate / bilateral symmetry / hermaphrodite / single gut opening (iii) <i>Diagram:</i> <i>Labels:</i>	2m 2x3m 5, 3, 0m 3×1
(c)	Adult attached to bile duct / of primary host (cow or sheep) / fertilised eggs / in faeces / miracidium / into mudsnail / secondary host / sporocysts / redia / cercaria / cysts on grass (metacercaria) / eaten by primary host [N.B. No diagram => max 6x2m]	6×2m Diagram 4,2,0

<b>Q4</b>	<i>Effect of lime on growth of oats</i>	<b>6×4m</b>
(a)	Prepared growth media (or field areas) at same pH / leave one unlimed (as a control) / apply lime at different rates to the others / record pH / have same growth conditions for all / same seeding rate of oats / same variety / growth of oat plants recorded at intervals or compare final yields / results stated (must be correctly related to pH)	
(b)	<i>Effect of sprouting on the yield of early potatoes</i> Named early variety / select groups of tubers that have not been sprouted (control) / select groups of tubers that have been sprouted / same day planting / cultivated under same conditions (e.g. fertilizers, blight sprays, earthing up, weed control) / allow to grow for stated period of time (not less than two months) / same day harvest dig / weigh the amount of potatoes in each plot area / results stated	<b>6×4 m</b>
(c)	<i>Butterfat % of a sample of fresh milk</i> Milk sample in water bath at 20 °C / butyrometer (Gerber test) / add 10 cm <sup>3</sup> of sulphuric acid / add milk sample / add 1cm <sup>3</sup> of amyl alcohol / stopper / centrifuge / heat to 65 °C in water bath / adjust with stopper to butterfat line at zero / read % fat or result 3-5% fat	<b>6×4 m</b>
(d)	<i>To show that germinating seeds release heat energy</i> Two thermos flasks / named seeds / thermometers / flasks and seeds disinfected / boil half as a control / invert flasks / record initial temperatures / record the temperatures daily / result stated	<b>6×4 m</b>

Q5 (a)	Named plant (with tap root) Photosynthesis / sugars / the green part of plant / translocation / phloem / stored as sugar or starch in the root [ <i>maximum of 2 points for correct chemical equation for photosynthesis</i> ]	2m 4x4m
(b)	(i) <i>Field capacity</i> : amount of water held in the soil after gravitational (excess) water has drained away	4m
	(ii) <i>Permanent wilting point</i> : when all the capillary water is used or plant is unable to extract any more water from the soil (and dies)	4m
	(iii) <i>Available water</i> : The portion of water held in soil that may be absorbed by plants / field capacity minus permanent wilting point ((i) minus (ii))	4m
(c)	Poor development / low yield / available water problem / drought stress / osmosis problem / mineral uptake problem / poor leaf development / reduced transpiration / less photosynthesis / root yield decrease / leaf yield decrease with consequent effect on taproot / lack of turgidity (plant wilts)	3x4m
(d)	(i) B (ii) most available water	2m 4m

Q6 (a)	Good feet / healthy udder / four teats / good conformation / healthy (disease free) / good condition (BCS 3.25) / suitable breed / shiny coat / alert	4x3m			
(b)		Target weight	Nutrition	Housing	4x(2+2+1)
	(i) Newborn	35-45 kg	Colostrum / whole milk / milk replacer / concentrates / hay	In pens / on straw	
	(ii) Weanling (6 weeks - 12months)	55-280 kg	Hay / silage / grass / concentrates	Out on grass (to 1 <sup>st</sup> November) On straw or slats (November - March)	
	(iii) Yearling	280-300 kg	Silage ad lib / meals / early grazing	Housed on slats or straw or cubicles / out on grass	
	(iv) Mating stage	290-340 kg	Grass	Out on grass	
(c)	(i) ( <i>Secretion : organ</i> ) bile : liver or gall bladder / amylase or saliva : salivary gland / pancreatic juice or named enzyme : pancreas / succus entericus or named enzyme : small intestine / gastric juice or named component : stomach (ii) <i>Diagram</i> : <i>Avian system labels</i> : beak / crop / proventriculus / gizzard / cloaca	2x(2+2)m  4,2,0 4x1m			

<p><b>Q7</b> <b>(a)</b></p>	<p><b>(i) Chromosomes</b> <b>(ii) Parents: XX Female    XY Male</b> <b>Gametes: X            ×            X, Y</b> <b>F1:            XX    XY</b></p>	<p><b>2m</b> <b>2+2</b> <b>2+2</b> <b>2m</b></p>								
<p><b>(b)</b></p>	<p><b>Cloned:</b> exact copy of the cell or organism / genetically identical organisms <b>Genetically modified:</b> altering the genetic make-up of an organism / placing a gene from one species into another <b>Mutations:</b> changes in the DNA sequence or structure of a gene / gain or loss of part of or a whole chromosome</p>	<p><b>3×4m</b></p>								
<p><b>(c)</b></p>	<p><b>(i) Parents genotype: NnRr (× NnRr)</b></p> <p><b>(ii)</b></p> <table border="0" style="width: 100%;"> <tr> <td style="width: 80%;">1. Crinkly leaves</td> <td style="text-align: right;"><b>40</b></td> </tr> <tr> <td>2. Regular leaves</td> <td style="text-align: right;"><b>120</b></td> </tr> <tr> <td>3. Normal size and regular leaves</td> <td style="text-align: right;"><b>90</b></td> </tr> <tr> <td>4. Pigmy size and regular leaves</td> <td style="text-align: right;"><b>30</b></td> </tr> </table> <p><i>[Accept correct fraction, decimal or percentage for half marks in each case]</i></p>	1. Crinkly leaves	<b>40</b>	2. Regular leaves	<b>120</b>	3. Normal size and regular leaves	<b>90</b>	4. Pigmy size and regular leaves	<b>30</b>	<p><b>4m</b></p> <p><b>4×4m</b></p>
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<p><b>(d)</b></p>	<p><b>Health &amp; safety / to stop inbreeding on farms (keep best animals for mating only) / strong taste on meat (boar-taint) / small market for bull beef / unwanted mating / less fencing</b></p>	<p><b>2×2m</b></p>								

<p><b>Q8</b></p> <p>(a)</p>	<p>Sow in farrowing house at 20°C / in farrowing crate / suckling sow / colostrum / treat the navel with iodine(solution) / creep feeding / creep ration 21% protein (or lysine) / water available / iron injection / temperature 30°C creep area / infra-red lamp / castration or ear notching / cutting teeth / tail clipping / weaning at four to six weeks (at 9 kg)</p>					<p>3×6m+3×2m</p>																																		
<p>(b)</p> <p>(i)</p> <p>(ii)</p> <p>(iii)</p> <p>(iv)</p> <p>(v)</p> <p>(vi)</p>	<table border="1"> <tr> <td></td> <td><b>Barley</b></td> <td><b>Wheat</b></td> <td><b>Oats</b></td> <td><b>Maize</b></td> </tr> <tr> <td>Soil suitability</td> <td>pH 6-6.5 / deep, fertile, medium to light or sandy loam / brown earth or grey brown podzolic</td> <td>pH 5-7 / as for barley</td> <td>pH 5.5 / as for barley</td> <td>pH 6.6-7.0 / as for barley</td> </tr> <tr> <td>Preparation of seed bed</td> <td>Plough / depth 12-20cm / harrow / rotavate / produce fine seed bed</td> <td>As for barley</td> <td>As for barley</td> <td>As for barley</td> </tr> <tr> <td>Sowing the seed</td> <td>Winter barley: Sept. – Oct. or Spring barley: Feb. - Apr. / Rate 140-220 kg per ha or correct seeding rate per m<sup>2</sup> / tramlines / combine drill / post-sowing rolling</td> <td>As for barley</td> <td>As for barley</td> <td>20-30 kg / Mar. - May / precision seeder</td> </tr> <tr> <td>Use of fertilizer</td> <td>10:10:20 or 18:6:12 (NPK)</td> <td>As for barley</td> <td>As for barley</td> <td>As for barley</td> </tr> <tr> <td>Harvesting</td> <td>Combine harvester / July - September</td> <td>Jly-Sp</td> <td>Jly-Sp</td> <td>Sept-Oct</td> </tr> <tr> <td>Straw yield</td> <td>3-4 tonne per ha</td> <td>3-4 t per ha</td> <td>4-4.5 t per ha</td> <td>No straw</td> </tr> </table>		<b>Barley</b>	<b>Wheat</b>	<b>Oats</b>	<b>Maize</b>	Soil suitability	pH 6-6.5 / deep, fertile, medium to light or sandy loam / brown earth or grey brown podzolic	pH 5-7 / as for barley	pH 5.5 / as for barley	pH 6.6-7.0 / as for barley	Preparation of seed bed	Plough / depth 12-20cm / harrow / rotavate / produce fine seed bed	As for barley	As for barley	As for barley	Sowing the seed	Winter barley: Sept. – Oct. or Spring barley: Feb. - Apr. / Rate 140-220 kg per ha or correct seeding rate per m <sup>2</sup> / tramlines / combine drill / post-sowing rolling	As for barley	As for barley	20-30 kg / Mar. - May / precision seeder	Use of fertilizer	10:10:20 or 18:6:12 (NPK)	As for barley	As for barley	As for barley	Harvesting	Combine harvester / July - September	Jly-Sp	Jly-Sp	Sept-Oct	Straw yield	3-4 tonne per ha	3-4 t per ha	4-4.5 t per ha	No straw				<p>Name 3m</p> <p>5×(3+1)m</p> <p>Yield 1m</p>
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<p>(c)</p>	<p>(i) <i>Glaciation</i>: alteration of any part of the earth's surface / by passage of a glacier / chiefly by glacial erosion or deposition / slow movement downwards by gravity / glacial drift / glacial till</p> <p><i>Gleisation</i>: soil forming process / high water table or impermeable nature of soil / poor drainage and aeration / waterlogging / anaerobic conditions / low bacterial activity / low level of decomposition / reduction of iron / giving grey-blue colour in subsoil or with red mottling after reoxidation process / high rainfall / peat accumulation on top</p> <p>(ii) <i>Epidermis</i>: outermost layer of cells / tissue in an organism / protection / protects against water loss / skin</p> <p><i>Epididymis</i>: location testes or scrotum / long convoluted tube / part of spermatic cord / sperm stored or sperm mature / leads into the vas deferens</p> <p>(iii) <i>Antibodies</i>: proteins / produced by body / response to antigen or infection / colostrums / immunoglobins / resistance to diseases / made by white blood cells</p> <p><i>Antibiotics</i>: produced by micro-organisms / kill other organisms / stop growth of other organisms / e.g. penicillin, streptomycin etc. / control bacterial or fungal diseases / no effect on viruses</p> <p>(iv) <i>Earthing up</i>: piling up soil around the base of a plant crop (e.g. potatoes) / prevents greening / prevents formation of solanine or alkaloids / prevents blight infection / improves yield / controls weeds / pest control / frost protection / supports the stems</p> <p><i>Steaming up</i>: (process farmers use towards) end of gestation period / gradual increase in feeding of meals during last six-eight weeks / prevents twin lamb disease in sheep enterprise / increases milk yield / improves body condition score or build up energy reserve</p>					<p>3×2x(3+1)m</p>																																		

<b>Q9 (a)</b>	<b>Ruminant / rumen developed / lack of bacterial activity in rumen before / cellulose or hay or straw present (scratch factor) / concentrates (and water) / takes up to 3 weeks / increasing numbers of microbes stimulate growth and development of rumen</b>	<b>10+1+1m</b>
<b>(b)</b>	<b>Break iron pan or hard pan / recover some nutrients / improve drainage / improve aeration / to prevent peat formation / to loosen soil or help root penetration</b>	<b>10+1+1m</b>
<b>(c)</b>	<b>Reduce wind speed / higher temperatures for crop growth or earlier growth or higher yield / better FCR for farm animals / protection for animals from extreme conditions or prevents hypothermia / biodiversity or habitat / reduces heat loss from buildings or protect them from damage / aesthetic</b>	<b>10+1+1m</b>
<b>(d)</b>	<b>Improves condition prior to mating / more eggs at ovulation / more twins / fewer barren ewes / fewer repeat ewes / increased conception rates / better implantation to the uterine lining / more regular oestrus cycles</b>	<b>10+1+1m</b>
<b>(e)</b>	<b>Red water fever / Babesia / spread by tick / red blood cells burst / haemoglobin released in urine (or blood in urine) / incubation period in animal is 10 – 20 days therefore infected on farm / effect of eating kale (for one point only)</b>	<b>10+1+1m</b>

