Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate 2019

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.

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 a 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 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. In general, if an examiner is in any doubt whether 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 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.

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:

  List: Charolais Friesian Simmental Jersey Hereford

  Marking scheme: Friesian/ Jersey/ Simmental **Any two 2(1)**

  Answer: Friesian, Jersey, and Hereford.

  The surplus answer (Hereford) 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(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 three 3-mark units, write: 3
  3
  3 in the first column in the right-hand margin of the answer book.
- 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 allocated to the question. The marking scheme might be as follows: **6 + 3 + 3**. This means that any first correct answer is awarded 6 marks and each subsequent correct answer is awarded 3 marks.
- Square brackets and/ or *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.

SECTION ONE Six questions to be answered Each question carries 20 marks

Q 1

(a) (i) *Phylum:*
Annelida

(ii) B*eneficial effects of earthworms:*
Improve drainage/ improve aeration/
break down organic matter or create humus/ break down soil/ mix soil layers/
improve soil structure/ (waste products) increase soil fertility ***Any two***

(b) (i) S*etting up a wormery:*
Layer of soil/ layer of sand/ layer of chalk/ leaves or organic matter on top/
add worms/ keep moist/ keep in darkness/ cool place/ leave for at least a week
Any four

(ii) S*ign of earthworm activity:*
Mixed layers **or** tunnels (or holes) through layers **or** worm casts **or** leaves not present on top

2(4) + 6(2)

Q 2

	Name:	*Function:*	
B:	(Rotary) tedder or hay bob	Shaking out grass (to allow it to dry) **or** making rows of hay **or** gathers hay	**2(2)**
C:	Creep feeder	Allows lambs access to feed (but excludes ewes) **or** to feed meals to lambs	**2(2)**
D:	Shear grab or silage grab	Transports silage (from pit to feeders)	**2(2)**
E:	(Grain) silo	Storing grain (or animal feed)	**2(2)**
F:	Combine (harvester)	Harvesting cereals (or named cereal)	**2(2)**

Q 3

(a)	*A gilt is a young female pig:*	**T**	**10(2)**
(b)	*Benedict's or Fehling's solution is used to test a food for starch:*	**F**	
(c)	*Ground limestone is used to raise soil pH:*	**T**	
(d)	*Plants make carbon dioxide during photosynthesis:*	**F**	
(e)	*Urea is a fertiliser which has a high content of nitrogen:*	**T**	
(f)	*Pigs have a ruminant stomach*:	**F**	
(g)	*Crop rotation helps to reduce the incidence of crop pests:*	**T**	
(h)	*Chlorophyll is a pigment in grass:*	**T**	
(i)	*Dairy cows are usually dried off for five months each year:*	**F**	
(j)	*Pollen is produced by the carpels in a flower:*	**F**	

Q 4

	Description:	*Name of breed:*	**5(4)**
	Cow with a high butterfat content in milk:	Jersey	
	Beef breed of cattle:	Belgian Blue	
	Pig breed with a lean carcass:	Landrace	
	Sheep breed with good conformation:	Suffolk	
	Dairy breed with a high milk yield:	Holstein-Friesian	

Q 5

(a)	*Cereal A:* Barley *Cereal B:* Oats *Cereal C:* Wheat	**2(4)** **+** **6(2)**
(b)	*When cereal A ready for harvest:* Seed-head (or ear) lies parallel to stem/ grain hard/ grain dry/ flag leaf withers/ grain falling off seed-head/ crop is bleached in appearance/ ***Any two***	
(c)	*Features of certified seeds:* Minimum 85% germination rate/ minimum 98% purity/ free from wild oats/ seed is treated (with fungicide and pesticide) or is disease free/ true to type ***Any three***	

Q 6

(a)	*Spraying potatoes with fungicide:* To prevent (or to control) fungal disease(s) or named fungal disease	**5(4)**
(b)	*Housing beef animals in winter:* To provide shelter (from harsh weather) **or** higher live-weight gain **or** easier to feed **or** easier supervision **or** prevents poaching **or** more grass in spring **or** lack of grass outdoors in winter **or** allows higher stocking rates	
(c)	*Paring sheep's hooves:* To treat foot-rot **or** to prevent lameness **or** to remove infected growth **or** allows oxygen to circulate between hooves	
(d)	*Agitating slurry:* To break hard crust **or** to mix the solids and liquid **or** to allow gases to escape **or** easier to spread	
(e)	*Planting shelter belts:* To prevent damage to buildings **or** to keep animals warm **or** to protect crops **or** to increase soil temperature **or** habitat for wildlife **or** natural boundaries **or** improved crop growth (on sheltered side) **or** reduces soil erosion	

Q 7		
(a)	(i) *Clover family:* Leguminosae **or** Fabaceae **or** Papilionaceae **or** legumes (ii) *In root nodules:* Bacteria (iii) *Role of nodule bacteria:* To fix nitrogen (or described) (iv) *Plant in same family as clover:* Peas **or** beans **or** vetch **or** gorse (furze, whin)	**3(4) + 4(2)**
(b)	*Beneficial effects of clover in grassland seed mixture:* Reduces amount of artificial N-fertiliser needed/ palatable/ productive/ digestible/ rich in protein/ used in organic farming/ increases grass growth/ fixes nitrogen or increases soil fertility/ good ground cover or controls weeds/ rich in minerals or named mineral/ meets REPS requirements ***Any three***	

SECTION TWO Three questions to be answered Each question carries 60 marks

Q 8

(a) (i) *Pig housing features:*
Well insulated/ draught free/ low roof/ warm/ well ventilated/ adequate space/ (clean) water supply/ good hygiene ***Any two*** **2(4)**

(ii) *Importance of any feature given in (i):*

Feature:	*Importance:*
Well insulated	Reduces heat loss **or** prevents over-heating (in summer)
Draught free	Reduces chill **or** prevents disease(s)
Low roof	Easier to heat
Warm	Increases live-weight gain **or** lowers FCR
Well ventilated	Prevents disease(s) **or** removes stale air **or** removes gases
Adequate space	Reduces spread of disease(s) **or** animal welfare
(Clean) water	Prevents dehydration
Good hygiene	Prevents disease(s)

4

(iii) *Why farrowing crate:*
Allows bonhams to suck/ allows bonhams access to a creep area/ restricts movement of sow (or prevents bonhams being crushed or reduced mortality rates in bonhams) ***Any two*** **2(4)**

(b) (i) *Length of gestation for sow:* 3 months + 3 weeks + 3 days (or 110 – 118 days)
(ii) *Average litter size:* 9 – 12 (bonhams)
(iii) 1. *Why iron injection:* To prevent anaemia **or** sow's milk is low in iron
2. *Why lysine in diet:* Pigs are not able to make their own **or** it is an essential amino acid
3. *Why creep area:* Allows bonhams access to high temp (or 30 °C) **or** keeps bonhams warm **or** prevents bonhams being crushed **or** allows creep feeding **5(4)**

(c)

	Hill (mountain) sheep production	**or**	Lowland sheep production
(i)	*Grass quality:* Rough grazing or named example(s)	**or**	*Grass quality:* Good quality grazing or named example(s)
(ii)	*Method of grazing:* Extensive or described	**or**	*Method of grazing:* Intensive or described
(iii)	*Number of lambs:* One lamb per ewe	**or**	*Number of lambs:* Ewes may have twins or triplets
(iv)	*Stocking rate:* Low stocking rate or example	**or**	*Stocking rate:* High stocking rate or example
(v)	*Labour:* Low labour input	**or**	*Labour:* High labour input

5(4)

Q 9

(a) (i) *Reasons for reseeding grassland:*

Poaching damage/ poor quality grass(es)(in old sward)/
weed infestation (in old sward)/ to increase productivity or yield/
to improve digestibility/ to improve palatability/ to improve stocking rates/
to introduce clover into sward/ to increase silage yields (IRG) ***Any two*** **2(3)**

(ii) *Species commonly used:*

Perennial rye grass (or PRG)/ Italian rye grass (or IRG)/ Timothy/ hybrid ryegrass
Any two **2(3)**

(iii) *Reason for any one from (ii):*

PRG	Palatable **or** productive **or** digestible **or** persistent **or** long growing season
IRG	Palatable **or** productive **or** digestible **or** long growing season **or** short term ley
Timothy	Palatable **or** productive **or** digestible **or** suitable for hay
Hybrid ryegrass	Combines desirable characteristics of PRG and IRG **or** palatable **or** productive **or** digestible **or** persistent **or** long growing season

3

(iv) *Why grassland topped:*

Increases tillering/ weed control/ encourages leafy growth/ increases yield of grass/
removes stemmy growth (or undigestible parts of grass) or increases digestibility
Any two **2(3)**

(b) (i) *Making pit silage:*

Close off field for at least six weeks/ fertilise (or spread slurry)/ cut in afternoon/
cut at correct growth stage/ allow grass to wilt/
use a precision or double-chop harvester/ roll the pit/ use additive/ seal pit
Any four **4(3)**

(ii) *Importance of above steps:*

Step:	*Importance:*
Close off field for at least six weeks	Gives time for grass to grow
Fertilise (or spread slurry)	Provides the nutrients for growth
Cut at the correct growing stage	Higher DMD **or** grass more leafy (or less stemmy)
Cut grass at mid-day	Higher concentration of sugar (or carbohydrates)
Allow grass to wilt	Increases dry matter content **or** less effluent
Use a precision or double chop harvester	Better fermentation **or** sugar released
Roll the grass thoroughly	Creates anaerobic conditions (or eliminates air)
Use additive (or named additive)	Better fermentation **or** lowers pH
Seal pit tightly	Anaerobic conditions **or** prevents rotting of grass

Any two **2(3)**

(iii) *DMD:* Dry matter digestibility **or** the % of dry matter that can be digested **3**

(iv) *DMD of good silage:* 70% or greater **3**

Q 9 (c)	(i) *Catch crop:* Crop grown after one main crop and before another [*allow* between main crops] (ii) *Example of catch crop:* Kale **or** rape **or** fodder beet **or** stubble turnips **or** any other correct (iii) *How to feed catch crop to animals:* In situ (or described)/ strip graze (or described)/ zero graze (or described)/ ensile ***Any two*** (iv) *Why grow catch crops:* Fast growing/ high yield/ winter feed/ feed in early spring/ high protein content/ less silage (or concentrates) needed/ prevents nitrogen leaching/ extra feed during fodder shortage ***Any two***	**4(3)** **+** **2** **+** **1**

Q 10		
(a)	(i) *Gamete:* A sex cell [*allow* a sperm (cell) or an egg (cell)] (ii) *In-breeding:* Mating or crossing two closely related (species of) plants or animals (iii) *Clone:* A group of genetically identical organisms **or** a group of asexually produced offspring from the same parent [*allow* an asexually reproduced individual]	**4** **+** **2(3)**
(b)	*Cross 1* *Gametes:* (P) × (p) *Offspring genotype:* (Pp) *Offspring phenotype:* <u>Polled</u> (or no horns)	**2(4)** **4** **4**
(c)	*Cross 2* *Parents' genotypes:* (Pp) × (Pp) *Possible gametes:* (P) (p) × (P) (p) *Offspring genotypes:* (PP) (Pp) (pp) *Offspring phenotypes:* <u>Polled</u> <u>Horned</u>	**2(2)** **4(2)** **3(2)** **2(2)**
(d)	(i) *Advantages of AI:* Can select superior bulls or better choice/ bulls have been performance tested/ bulls have been progeny tested/ can use sexed semen/ easier to transport/ less chance of sexually transmitted diseases/ cheaper than keeping a bull/ choose bulls with lower calving difficulty history/ don't have to keep a dangerous animal ***Any two*** (ii) *Disadvantages of AI:* Need for accurate heat detection/ semen must be stored properly/ lower conception rate/ more labour intensive/ must be carried out by trained personnel/ may also have to keep a bull ***Any two***	**2(3)** **2(3)**

Q 11

(a) (i) 1. *Sedimentary:* Sandstone **or** limestone **or** shale **4**

2. *Metamorphic:* Marble **or** slate **or** quartzite **4**

3. *Igneous:* Basalt **or** granite **4**

(ii) *Weathering:* The breaking down of rock (into small particles) **4**

(iii) *How weathered:*
Water in cracks in rock freezes and expands/ acid in rain dissolves rock/
heating and cooling causes rock to expand and contract/
roots grow into cracks and split the rock/ sea waves break up rock/
animals break rocks by digging or burrowing or trampling/ glaciers crush rock/
oxidation-reduction reactions decompose rock/ quarrying breaks rock/
farm cultivation can break rock/ hydration can decompose rock minerals/
water can dissolve minerals in rocks ***Any two*** **2(2 + 2)**

(b)

		Sandy soil	**or**	*Clay soil*	
(i)	*How the soil feels:*	Coarse or rough	**or**	Fine or smooth	**4**
(ii)	*Particle size:*	Large	**or**	Small	**4**
(iii)	*Fertility:*	Poor	**or**	Good	**4**
(iv)	*Suitability for tillage:*	Suitable **or** easily tilled	**or**	Not suitable **or** difficult to till	**4**

(c) (i) *Why organic matter important in soil:*
Increases soil fertility or provides nutrients/ retains water/ improves soil structure/
increases number of earthworms/ binds the soil/ improves soil aeration/
creates humus (when decomposed) ***Any two*** **2(4)**

(ii) *How OM added to soil:*
Spreading farmyard manure/ spreading slurry/ green manure (or described)/
adding seaweed/ crop rotation/ animal dung when grazing/ topping grassland
ploughing in stubble ***Any two*** **2(4)**

(iii) *Why plants survive better in clay than in sandy soils in drought:*
Clay soils retain more water **or** more water lost by drainage in sandy soils
or small soil particles in clay hold more water than larger sand particles
or clay soils have better capillarity **or**
clay soils are able to bring up water from deeper in the soil **4**

Q 12

(a)	*Dairy calves* (i) *Care at birth:* Feed colostrum/ clear mucus from nose and mouth/ spray navel with iodine/ adequate supervision or have experienced person at hand/ call vet if necessary/ clean bedding/ dry calf or ensure cow licks calf ***Any two*** (ii) *Changes in diet:* Colostrum/ cow's milk/ milk replacer/ concentrates/ hay (or roughage) ***Any two*** (iii) *Housing:* Straw bed or dry bed/ good hygiene or disinfect house/ good ventilation/ draught free/ water supply/ adequate space/ lighting ***Any two*** (iv) *Disease control:* Good hygiene/ vaccination/ monitor health or good supervision/ colostrum/ calving box/ isolate sick animal(s)/ good feeding practices/ call vet ***Any two***	**2(3)** **2(3)** **2(3)** **2(3)**
(b)	(i) 1. *Cause of mastitis:* Bacteria 2. *Symptoms of mastitis:* Swollen udder or lumps on udder or on teats/ tender udder/ redness in udder/ cow irritable/ watery milk or yellowing of milk/ bloody or curdled milk/ high cell count ***Any two*** (ii) *Another reason why milking parlour hygiene important:* To prevent spread of disease **or** to keep a low bacterial count in the milk **or** to ensure milk is not contaminated from dirty equipment **or** to ensure operator does not transfer infection from one cow to another **or** to ensure milk is not contaminated by dirt on cow's udder **or** to avoid penalties for dirty milk (iii) *How hygiene maintained:* Clean housing (e.g. lime and/or sawdust on floor of cubicles)/ sterilised equipment/ milker hygiene/ clean milking parlour/ teat dips used/ udder hygiene/ fly control/ milk is filtered/ milk is refrigerated/ clean bulk tank ***Any three***	**3** **2(3)** **3** **3(3)**
(c)	*To compare hygiene quality of two milk samples:* Two sterile test tubes/ equal amount of different milk sample into each test-tube/ add resazurin (or methylene blue) solution to each/ record colour of each at start/ kept at 37 °C/ in water-bath/ for 15 minutes/ change to blue is good quality/ change to white is poorest quality/ pink or mauve is intermediate quality (for resazurin) ***Any five*** **or** Two sterile nutrient agar plates/ two different milk samples/ inoculating loop/ flame loop/ transfer milk from each sample onto each dish or method of transfer/ invert dishes/ incubate at 25 °C/ suitable time/ count the colonies in each dish/ staler milk will have more bacteria colonies than fresher milk ***Any five*** [*maximum of 12 marks if no result given*] [*all points above may be obtained from labelled diagram*] [*maximum of 3 marks for unlabelled diagram*]	**5(3)**

Q 13	Any two of (a), (b), (c), (d) to be answered	(30, 30)
(a)	(i) *Maincrop potato varieties:* Rooster/ Kerr Pinks/ Golden Wonder/ Cara/ Record (ii) *Growing maincrop potatoes* 1. *Soil preparation:* Plough (or dig) **or** remove stones **or** rotavate **or** harrow **or** rake soil 2. *When to plant:* March – April 3. *Weed control:* Spray **or** apply herbicide (or weed-killer) or mechanical (or explained) **or** pull by hand **or** crop rotation **or** burning **or** shading action **or** earthing up 4. *Harvesting method:* Elevator digger **or** potato harvester **or** complete harvester **or** by hand 5. *Expected yield:* 30 – 40 tonnes per hectare 6. *Storage:* Cool (or refrigerated store) **or** dry **or** pest free **or** well ventilated shed **or** in darkness **or** frost free **or** high humidity	**7(4)** **+** **2**
(b)	(i) *A:* = Pulmonary artery *B:* = Vena cava *C:* = Left atrium *D:* = Left ventricle (ii) *How blood changes through lungs:* Loses carbon dioxide **or** picks up oxygen (or is oxygenated) (iii) *Types of blood cells:* Red blood cells/ white blood cells/ platelets ***Any two*** *Function of blood cells* *Red blood cells:* Carry oxygen *White blood cells:* Produce antibodies **or** fight disease **or** fight infection *Platelets:* (Blood) clotting ***Any two*** (iv) *Liquid part of blood:* Plasma	**5(4)** **+** **5(2)**
(c)	(i) *Why mainly conifers in Irish plantations:* Can withstand harsh climatic conditions (or named harsh condition)/ flexible (or do not break easily in the wind)/ have shallow root system (for shallow soils in the mountains)/ grow well in poorer-quality soils/ snow falls off them easily / fast growing/ easy to grow ***Any two*** (ii) *Common Irish conifer:* Spruce **or** fir **or** pine **or** larch **or** juniper (iii) *Why thinning:* Removes diseased (or damaged) trees **or** improves quality of remaining trees **or** increases size of remaining trees or reduces competition (or named example) **or** improves access **or** thinnings provide income **or** useful products made from thinnings (iv) *Beneficial effects of forestry:* Produces oxygen/ consumes carbon dioxide/ reduces noise/ provides habitat for wildlife/ provides shelter/ aesthetic/ prevents soil erosion/ natural amenity ***Any two***	**2(5)** **5** **5** **2(5)**

Q 13		
(d)	(i) *Transpiration:* Loss of water vapour through (stomata of) leaves (ii) *Factors affecting transpiration rate:* Air temperature/ air movements/ relative humidity/ light intensity/ availability of soil water/ presence or absence of a cuticle ***Any two*** (iii) *Importance of transpiration:* Cools the plant **or** brings water through the plant **or** brings minerals through the plant (iv) *To demonstrate transpiration:* Potted plant/ water well/ soil covered with plastic/ plant enclosed in a plastic bag (or bell jar)/ leave in a bright place/ for suitable time/ drops of liquid form on the inside of plastic bag (or bell jar)/ test liquid with anhydrous copper sulfate/ colour change from white to blue indicates liquid is water ***Any five*** **or** Cut leafy shoot (at an angle)/ under water/ fill potometer with water/ by submerging/ place shoot in the potometer/ seal shoot in potometer/ introduce bubble into potometer/ place potometer in front of a lamp or in bright place/ record position of bubble/ leave for suitable time/ movement of bubble indicates transpiration ***Any five*** **or** Celery/ cut under water/ place in coloured dye/ leave for suitable time/ presence of dye in leaves (or in upper part(s) of stem or in xylem vessels) indicates transpiration or upward movement of water (by transpiration) ***Any five*** [*maximum of 12 marks if no result given*] [*all points above may be obtained from labelled diagram*] [*maximum of 3 marks for unlabelled diagram*]	**6** **+** **8(3)**

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