Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate 2020

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.

Marking scheme Agricultural Science 2020 Higher Level

Q 1	**Any six parts to be answered**	**6(10)**
(a)	(i) *Noxious weed:* Physical or economic damage/ legally required to control/ may be poisonous/ difficult to control/ highly competitive or may be persistent ***Any two*** (ii) *Examples of noxious weeds:* Ragwort/ (creeping) thistle/ wild oat/ dock/ (common) barberry/ (male) wild hops ***Any two***	**2(3)** **2(2)**
(b)	(i) *Incomplete metamorphosis:* Egg-nymph-adult/ grow by moulting/ instars/ nymph resembles adult/ no larval stage ***Any two*** (ii) *Example of incomplete metamorphosis:* Aphid/ dragonfly/ cockroach/ or other example	**2(3)** **4**
(c)	*Reasons for thinning forestry trees:* Poorest trees removed/ diseased or damaged trees removed/ reduces competition/ remaining trees grows faster/ improves size of trees/ allows access ***Any three***	**4 + 3 + 3**
(d)	*Dicot root diagram to show:* Vascular cylinder (stele) and xylem and phloem *Labels:* Vascular bundle or vascular cylinder or central cylinder or stele/ xylem/ phloem ***Any two***	**4, 2, 0** **2(3)**
(e)	(i) *Location of humerus:* Front leg (or arm) (ii) *Location of pituitary gland:* Brain (iii) *Location of Bowman's capsule:* Kidney (iv) *Location of cervix:* Uterus (or neck)	**2(3)** **+** **2(2)**
(f)	(i) *Dagging:* Cutting away (dirty or wet) wool from around the tail end of sheep (ii) *Tagging:* Attaching an ID (object or tag) to a livestock animal (or named animal)	**5** **5**
(g)	*How grass structure suited to wind pollination:* Long stamens/ stamens outside flower/ reduced petals or absent petals/ large amount of pollen/ light pollen or smooth pollen/ feathery stigma	**4 + 3 + 3**
(h)	*Length of gestation:* (i) 280 – 288 days (allow 9½ – 10 months) (ii) 145 – 150 days (allow 5 months) (iii) 113 – 117 days (allow 3 months, 3 weeks, 3 days)	**4 + 3 + 3**
(i)	*Principal rock types of:* (i) *Slate:* Metamorphic (ii) *Granite:* Igneous (iii) *Limestone:* Sedimentary	**4 + 3 + 3**
(j)	*Why barley rolled for use as feed:* Hard testa (coat) or rolling breaks coat Otherwise indigestible or allows digestion	**5** **5**

Q 2

(a)	(i) *Cementation:* (Soil) particles pushed together *Separation:* Break-up of aggregated or large (soil) particles (ii) *Factors contributing to cementation:* (Small) root activity/ bacteria or fungi/ drying/ ingestion or egestion by earthworms/ machinery load or poaching or trampling ***Any two*** (iii) *Factors contributing to separation:* Freeze-thaw action/ wetting/ (large) root activity/ earthworm casts or channels/ cultivation practice ***Any two***	**2** **2** **2(4)** **2(4)** ***(20)***
(b)	(i) *Cation exchange capacity:* Measure (allow quantity) of the ability of a soil to hold or to release/ positive ions or named example showing positive charges (ii) *Why CEC lower in sandy soils than in clay soils:* Sand particles chemically inert/ have fewer negative charges or clay has more (iii) *How CEC may be increased in a soil:* Add organic matter (or example) or add FYM or add slurry or add lime or add humus or add green manure or add clay	 **2** **2** **2** **2** **4** ***(12)***
(c)	*Test for named soil mineral:* Named mineral Matching reagent Correct result Soil sample in test tube or distilled water or shake or filter	 **4** **4** **4** **4** ***(16)***

Q 3 Option One

(a)	*Comparing sheep production enterprises:* Mountain sheep production vs Lowland sheep production Low stocking rate or extensive/ low production targets/ high mortality/ single lambs/ less labour/ outdoor/ no flushing or sponging/ later lambing/ named breed/ rough grazing vs High stocking rate or intensive/ high production targets/ low mortality/ more twins/ more labour/ indoor/ flushing or sponging/ earlier lambing/ named breed/ quality grazing	**2** **2** **Comparisons between the enterprises 3(4)** ***(16)***
(b)	*Flock preparation prior to mating:* One selection point based on: breed or terminal sire or ewe prolificacy or ram fertility or other valid criterion One health point based on: age or mouth or feet or udder or body condition or other valid criterion One flushing or sponging point: Any one extra point from any of the three above	**4** **4** **4** **4** ***(16)***
(c)	*Parasite control:* Answers from the following, with matching parasite in each case: Bolus: stomach worms/ Dipping: maggots or sheep scab/ Dosing: stomach worms or intestinal worms or other correct/ Land drainage: liver fluke/ Liming: liver fluke/ Pour-on: lice or worms or other correct/ Rotational grazing: worms or other correct/ Shearing or dagging: maggots/ Vaccination: lungworm ***Any four***	**4(4)** ***(16)***

OR

Q 3 Option Two

(a)	(i) *Features that influence location of cereal production in Ireland:* Climate or rainfall or sunshine or temperature Statement comparing effect of rainfall or sunshine or temperature Statement linking stated geographical feature to cereal growth Soil Heavier soils in northwest and lighter in southeast (or other similar comparison) Lighter soils better suited to cereal crops (ii) *Winter cereals vs spring cereals:* *Winter cereals:* Sown in September or October/ frost resistant/ harvested mid-July/ higher yield/ less N applied ***Any four*** *Spring cereals:* Sown in March or April/ not frost resistant/ harvested August or Sept./ lower yield/ more N applied ***Any four***	**1** **2** **1** **1** **2** **1** **4(1)** **4(1)** ***(16)***
(b)	*Potato or root crop cultivation:* (i) *Soil suitability:* Stone free/ pH 5.5 – 6/ sandy loam or similar soil type/ deep/ well-drained ***Any two*** (ii) *Choice of variety:* Maincrop/ first earlies/ second earlies or other named varieties ***Any two*** (iii) *Yield:* 30 – 40 tonne/ per hectare (for maincrop or appropriate tonnage for other varieties) (iv) *Uses:* Animal feed/ human consumption/ seed potatoes ***Any two*** Apply a similar system for a named root crop	**2(2)** **2(2)** **2** **2** **2(2)** ***(16)***
(c)	*Direct and indirect control of weeds, pests and diseases:* *Direct control:* Herbicide + description/ pesticide + description/ fungicide + description ***Any two*** *Indirect control:* Crop rotation + description/ growth encouragement+ description/ resistant varieties + description/ early harvest + description/ stubble cleaning + description/ biological control + description ***Any two***	**2(2 + 2)** **2(2 + 2)** ***(16)***

Q 4 **Two of (a), (b), (c), (d) to be answered** **2(24)**

Laboratory or field methods

(a)	*To extract pigments from a grass sample:* Grind grass/ in alcohol/ using mortar and pestle/ filter (extract)/ drop of extract onto/ chromatography paper/ allow to stand/ in solvent (or named)/ correct result or pigments named ***Any six***	**6(4)** ***(24)***
(b)	*To show the action of an animal enzyme:* Catalase or amylase or other named animal enzyme *Catalase:* Liver contains catalase/ grind liver with sand/ add hydrogen peroxide/ control or described/ water bath at 37 °C/ washing up liquid/ buffer solution or optimum pH or pH 7/ add liver/ correct result/ correct conclusion/ repeat ***or*** ***Any five*** *Amylase:* Saliva contains amylase/ saliva into a test tube/ add starch solution/ control or described/ water bath at 37 °C/ leave for 5 minutes/ buffer solution or optimum pH or pH 7/ test with Benedict's solution or Fehling's solution/ positive result or brick red colour/ correct conclusion/ repeat	**4** **5(4)** ***(24)***
(c)	*To compare soil capillarities:* Two dry soil samples/ different types of soil/ two open ended glass tubes/ cotton wool plugging one end of each/ one soil sample into each tube/ cotton wool end of both tubes into water/ leave for minimum of one hour/ correct result/ correct conclusion/ repeat ***Any six***	**6(4)** ***(24)***
(d)	*To estimate yield per hectare of a root crop:* Named root crop A measured area/ dig at harvest time/ wash or clean crop/ weigh crop / repeat/ calculate/ details of calculation ***Any five***	**4** **5(4)** ***(24)***

Q 5

(a)	(i) *Importance of the dry period:* Allows repair of udder tissue/ allows development of unborn calf/ allows production of colostrum/ avoids calving difficulty or cow regains body condition/ allows milk reserves to be built up or increased milk yield after calving/ allows minerals (or named mineral) to be replenished ***Any two*** (ii) *Management of animals during dry period:* Body condition score assessed/ appropriate feeding regime/ (dry cow) mastitis treatment/ dosing or other health point ***Any two***	**2(4)** **2(4)** ***(16)***
(b)	(i) *Heat detection methods:* Description of: Tail painting or pressure-sensitive paint tag/ teaser bulls/ electronic activity indicator/ mounting activity/ chin ball ***Any two*** (ii) *Advantages of AI:* Greater choice of breeds/ access to genetically superior bulls/ safety/ less expensive for smaller herd/ accurate calving dates/ sexed semen ***Any two***	**2(2 + 2)** **2(4)** ***(16)***
(c)	*Milk tests:* Test names: Total bacterial count (TBC)/ somatic cell count/ sediment/ % water or % solids/ % butterfat or % protein/ % lactose/ presence of antibiotics/ presence of thermoduric bacteria ***Any two*** Whether hygiene or composition determined for each test named Two points of description for each test named	**2(2)** **2(2)** **2(2 + 2)** ***(16)***

Q 6

(a)	*Direct sowing of grass seed:* (i) *Seed bed preparation:* Ploughing/ harrowing or rotavating/ rolling ***Any two*** (ii) *Sowing the seed:* Seed drill/ seeds and fertiliser/ 10 cm apart/ 2 cm deep/ one-pass system ***Any three*** (iii) *Benefit of direct sowing in loam:* Improves structure/ improves aeration/ improves drainage/ exposes pests to predators/ better soil-seed contact/ better capillarity ***Any two***	**2(2)** **3(2)** **2(3)** ***(16)***
(b)	(i) *Benefits of paddock grazing:* Maximum grass utilisation (no waste)/ parasite control/ leader-follower system/ high quality grazing/ less labour-intensive ***Any two*** (ii) *How paddock grazing may harm environment:* Monoculture or loss of biodiversity/ hedgerow removal or less shelter/ habitat removal or habitat loss/ poaching/ soil erosion/ excess fertiliser use ***Any two***	**2(4)** **2(4)** ***(16)***
(c)	*Comparing hay and silage:* *Hay:* Dehydration or drying/ less than 20% moisture/ stemmy or less leafy/ aerobic or uncovered ***Any two*** *Silage:* (Controlled) fermentation/ pH reduction/ leafy grass/ anaerobic or sealed ***Any two***	**2(4)** **2(4)** ***(16)***

Q 7

(a)	*Mitosis:* *Stages named in order:* Prophase—metaphase—anaphase—telophase Diagram of each stage Any two correct labels other than the stage names	 **4(1)** **4(2)** **2(1)** ***(14)***
(b)	(i) *Significance of meiosis in gamete formation:* Halves (or reduces) diploid number Allows for fertilisation (ii) *Crossing over:* *Process:* Homologous chromosomes Exchange DNA *Significance:* Allows variation	 **4** **4** **3** **3** **2** ***(16)***
(c)	(i) *Cross details:* HS Hs hS hs ***Parental gametes*** HS HHSS HHSs HhSS HhSs Hs HHSs HHss HhSs Hhss ***All offspring genotypes*** hS HhSS HhSs hhSS hhSs hs HhSs Hhss hhSs hhss (ii) *Expected proportions:* 1. *Hairless leaf:* 12/16 (75%) 2. *Straight petiole:* 12/16 (75%) 3. *Spiral petiole:* 4/16 (25%) 4. *Hairless leaf with spiral petiole:* 3/16 (18.75%)	**2(2)** **6, 0** **2** **2** **2** **2** ***(18)***

Q 8	**Two of (a), (b), (c) to be answered**	**2(24)**
(a)	(i) *Carbon cycle*: CO_2 in air/ plants/ animals/ fossil fuels*:* Diagram Labels (ii) *How to reduce C-cycle agricultural emissions:* Reduction in national cattle herd/ afforestation/ energy crops/ carbon sequestration/ reduction in fossil fuel use or example of increased efficiency/ renewable energy sources ***Any two***	**6, 3, 0** **5(2)** **2(4)** ***(24)***
(b)	*Antibiotics and resistance:* (i) *Farm animal bacterial diseases:* Mastitis/ blackleg/ footrot/ bacterial scour/ farrowing fever/ bacterial pneumonia/ joint-ill/ other correct ***Any two*** (ii) *How antibiotic resistance develops:* Overuse of antibiotics/ mutation/ evolution/ natural selection/ uptake of genes from plasmids or from viruses or from other resistant bacteria ***Any three*** (iii) *Disease control without antibiotics:* Milking out or hygiene or vaccination or footbath or biosecurity or culling or isolation	**2(4)** **3(4)** **4** ***(24)***
(c)	*Distinguish between members of pairs of terms:* (i) *Ruminant stomach:* Four-chambered stomach/ allows cellulose digestion *Monogastric stomach:* Single stomach/ does not digest cellulose (ii) *Transpiration:* Loss of water vapour/ from the stomata *Translocation:* Movement of materials/ through the phloem (iii) *Saturated flow:* Movement of water/ below water table *Unsaturated flow:* Movement of water/ above water table (iv) *Hypogeal germination:* Germination below the soil/ cotyledons for energy *Epigeal germination:* Germination above the soil/ cotyledons above soil **Any three from (i), (ii), (iii), (iv)**	**3 (2 + 2) vs (2 + 2)** ***(24)***

Q 9 **Four of (a), (b), (c), (d), (e) to be answered** **4(12)**

Scientific explanations

(a)	*Sprouting early potatoes:* Exposing potato tubers to light/ develops shoots/ early crop/ early harvest/ increased yield/ reduces incidence of blight ***Any three***	**3(4)** ***(12)***
(b)	*Grit in fowl digestive tract:* Fowl have no teeth/ gizzard/ muscular/ (mechanically) grinds food/ breaks hard coat/ allows digestion ***Any three***	**3(4)** ***(12)***
(c)	*High incidence of leatherjackets in cereals after grass:* Cranefly/ active in autumn/ lay eggs in tufts of grass/ larval stage is leatherjacket/ grass and cereal crops are same plant family ***Any three***	**3(4)** ***(12)***
(d)	*Deep ploughing podzol:* Iron pan/ hard or impermeable layer/ between A and B horizon/ improves drainage/ improves aeration/ deep ploughing breaks iron pan ***Any three***	**3(4)** ***(12)***
(e)	*More N in winter-finishing cattle's slurry:* Increased concentrates diet/ high level of protein/ protein digested/ amino acids broken down in liver/ urea produced/ removed from blood by kidneys/ excreted in urine ***Any three***	**3(4)** ***(12)***