



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

**Leaving Certificate 2019**

**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 an examiner determines that a candidate has presented a valid answer but 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 they 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 that 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 specifically asked for, the 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.

## 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)**. 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 three separate '3's, under each other, 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 the first correct answer encountered 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.
- Examiners should write the total mark for each question at the beginning of the question, 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

Any six parts to be answered

6(10)

(a)	<i>Target yields in tonnes per hectare of</i> (i) <i>Barley:</i> 6 – 8 (ii) <i>Wheat:</i> 7 – 9 (iii) <i>Oats:</i> 5 – 7	4 + 1 + 5
(b)	<i>Why dense planting in Irish forests:</i> Trees grow tall or straight or increases competition/ fewer side branches/ free from knots/ allows for thinning/ controls weeds/ allows for diseased or failed trees <b>Any three</b>	4 + 1 + 5
(c)	(i) <i>Vegetative reproduction:</i> Producing plants from existing plants without using seeds <b>or</b> asexual (ii) <i>Examples of vegetative propagation:</i> Stolons/ runners/ bulbs/ corms/ rhizomes/ grafting/ cuttings/ layering/ tubers/ budding/ micropropagation/ offshoots or plantlets <b>Any two</b>	4 + 1 + 5
(d)	<i>Characteristics of loam:</i> Easily tilled or light/ good drainage/ retains nutrients/ good aeration/ warmer/ retains water <b>Any four</b>	4 + 1 + 1 + 4
(e)	(i) <i>Zoonosis:</i> Disease that can be transmitted from animals to humans (ii) <i>Agriculturally relevant zoonoses:</i> Orf/ TB/ brucellosis/ ringworm/ foot and mouth/ anthrax/ bird 'flu/ swine 'flu/ BSE (CJD)/ rabies/ Lyme disease/ Weil's disease or leptospirosis <b>Any two</b> [Read only the first two items given by the candidate]	4 + 1 + 5
(f)	(i) <i>Test for nitrates:</i> Diphenylamine <b>or</b> iron sulfate + H <sub>2</sub> SO <sub>4</sub> <i>Test for phosphates:</i> Ammonium molybdate + HNO <sub>3</sub> (ii) <i>Positive colour for nitrates:</i> Blue with diphenylamine <b>or</b> brown (ring) with FeSO <sub>4</sub> <i>Positive colour for phosphates:</i> Yellow	4 + 1 + 1 + 4
(g)	<i>Functions of the liver:</i> Produces bile/ stores glycogen or regulates glucose level/ stores minerals/ converts amino acids to urea (deamination)/ breaks down (old) red blood cells/ regulates temperature/ stores fat-soluble vitamins or named/ assimilates food/ produces plasma proteins/ detoxification <b>Any three</b>	4 + 1 + 5
(h)	(i) <i>Biological control:</i> Control of pests by predators or parasites or infectious agent (ii) <i>Example:</i> Rodent or named by cat or dog <b>or</b> mudsnail by geese or ducks <b>or</b> whitefly by parasitic wasp or red spider mite <b>or</b> aphid by ladybird <b>or</b> vine weevil by nematodes <b>or</b> other correct example	6  4
(i)	(i) <i>Location of nephron:</i> Kidney (ii) <i>Location of adrenal gland:</i> Above or on top of kidney (iii) <i>Location of cerebrum:</i> Brain	4 + 1 + 5
(j)	<i>Value of sheep dipping and pour-on:</i> Control of parasites/ prevention of fly strike or control of maggots/ prevention of sheep scab or control of mange mites/ boost production/ control of intestinal worms or ticks <b>Any three</b>	4 + 1 + 5

## Q 2

(a)	<p>(i) 1. <i>Moisture stress:</i> Water level in plants lower than normal <b>or</b> water is held tightly in soil by capillary forces <b>or</b> the transpiration rate is too high</p> <p>2. <i>Permanent wilting point:</i> The point at which plants cannot extract water from soil</p> <p>(ii) 1. <i>Available water capacity:</i> The water that can be extracted from soil <b>or</b> the water available between field capacity and permanent wilting point</p> <p>2. <i>Soil with highest available water capacity:</i> Loams or sandy loams</p> <p><i>Reasons:</i> High field capacity/ medium-to-low permanent wilting point/ water not held tightly by soil pores <b>or</b> large pores</p> <p style="text-align: right;"><b>Any two</b></p>	<p><b>3</b></p> <p><b>3</b></p> <p><b>3</b></p> <p><b>2</b></p> <p><b>2(2)</b>      <b>(15)</b></p>
(b)	<p>(i) <i>Causes of increasing soil acidity over time:</i> Rainfall or acid rain/ crop production/ animal urine/ leaching/ use of some fertilisers/ manures or slurry or OM/ pine needles/ cation exchange/waterlogging</p> <p style="text-align: right;"><b>Any four</b></p> <p>(ii) <i>Detail for any one answer from (i):</i> <i>Rainfall:</i> Slightly acidic nature of rain/ because of dissolved CO<sub>2</sub> <i>Acid rain:</i> Pollution or detail of/ makes rain more acidic than ordinary rain <i>Crop production:</i> Uptake by crops of base-forming cations/ e.g. Ca<sup>2+</sup> <i>Animal urine:</i> Urine is acidic/ due to presence of uric acid <i>Leaching:</i> Deposition of alkaline cations or named/ away from A horizon <i>Some fertilisers:</i> Lead to cation exchange/ removing base-forming cations/ acidic components in some fertilisers <i>Cation exchange:</i> Where some base-forming cations are replaced/ by more acid-forming ones <i>Manures:</i> Decomposition of organic matter/ acidic component in slurry <i>Pine needles:</i> Pine needles are acidic/ decomposition releases acid <i>Waterlogging:</i> Anaerobic conditions/ produce acids</p>	<p><b>4(3)</b></p> <p><b>Two points from any one category 2(3)</b></p> <p><b>(18)</b></p>
(c)	<p><i>To show flocculation:</i> Equal volumes of water in suitable containers/ deionised water/ equal volumes of soil or clay/ add lime or named flocculant to one/ shake both for equal amount of time/ allow to stand/ result or conclusion</p> <p style="text-align: right;"><b>Any five</b></p>	<p><b>5(3)</b>      <b>(15)</b></p>

Q 3 Option One

(a)	<p>(i) <i>Breeds used to produce cross-breed sucklers:</i> Any two named breeds (maximum one dairy breed) <b>Any two</b></p> <p>(ii) <i>Benefits of cross-breeds:</i> Beef traits or named/ increased milk yield/ hybrid vigour or named <b>Any two</b></p> <p>(iii) <i>Reproductive efficiency:</i> Number of calves weaned/ per hundred cows mated (per year) <b>or</b> per pregnancy rate (per year)</p>	<p><b>2(2)</b></p> <p><b>2(3)</b></p> <p><b>2(3)</b> <b>(16)</b></p>
(b)	<p>(i) <i>Comparing calf growth rates</i> <i>Suckled (artificially reared):</i> LWG 1.2 kg per day (LWG 0.8 kg per day) <b>or</b> higher (lower)</p> <p>(ii) <i>Grazing management:</i> A named grazing system/ any three management points from the named system:</p> <p><i>Paddock grazing:</i> 21 equal-size paddocks/ a paddock grazed for one day/ stock moved to next paddock/ fertilizer spread on grazed paddock/ grass has three weeks to recover/ permanent water supply/ central roadway/ permanent fencing/ all grass eaten</p> <p><i>Strip grazing:</i> Movable electric fence/ fresh grass supplied each day/ back fence used to allow grass to recover/ all grass eaten/ movable water supply/ labour-intensive</p> <p><i>Block grazing:</i> Livestock in same field for up to a week/ moved to next field/ permanent fencing/ not as productive as paddock or strip grazing/ weeds and unpalatable grasses a problem/ permanent water supply/ field fertilized when animals are moved to next field</p> <p><i>Set stocking:</i> Animals have free access to most of the farm/ difficult to manage livestock/ weed problems/ unpalatable grasses not eaten/ little fertilizer used/ permanent water supply</p> <p><i>Zero grazing:</i> Animals indoors or confined in yard/ grass is cut and brought to animals/ land not poached</p> <p><i>Leader-follower:</i> Younger animals graze ahead of older animals/ young animals eat the tender grass/ older animals eat the tougher grasses/ efficient use of grass/ fewer stomach worms in young animals</p> <p><i>Creep grazing:</i> Creep gate or raised fence/ young or smaller animals can access fresh grass/ young animals can access concentrates/ calves can return to suck mother/ older animals remain in field to eat tougher grasses</p> <p><i>Mixed grazing:</i> Two different livestock species graze the same field (sheep and cattle)/ increases productivity/ sheep encourage tillering of grass/ sheep eat ragwort/ sheep eat grass near dung paths which cattle do not eat/ fewer tufts of grass</p>	<p><b>2(2)</b></p> <p><b>3</b></p> <p><b>3(3)</b></p> <p><b>(16)</b></p>

(c)	<p><i>Comparing beef production systems</i></p> <p><i>Bull production:</i> High LWG/ 1.4 – 1.6 kg per day/ leaner <b>or</b> higher killing-out %/ housed or fenced/ aggressive/ age 15 – 24 months/ more concentrates <b>Any four</b></p> <p><i>Heifer production:</i> Lower LWG/ 0.8 – 1.0 kg per day/ fatter <b>or</b> lower killing out %/ outdoors/ docile/ 19 – 24 months/ less concentrates <b>Any four</b></p>	<p><b>3 + 1 + 1 + 3</b></p> <p><b>3 + 1 + 1 + 3</b> <b>(16)</b></p>
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**OR**

**Q 3 Option Two**

(a)	<p>(i) <i>Photosynthesis equation:</i> <math>6\text{CO}_2 + 6\text{H}_2\text{O} \longrightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2</math></p> <p>(ii) <i>How leaf structure suited to photosynthesis:</i> Thin so faster diffusion/ broad or large surface area traps light/ chlorophyll or chloroplasts near top surface increases photosynthesis/ (efficient) transport in vascular bundles/ cuticle conserves water/ air spaces or cells not tightly packed allow diffusion/ gaseous exchange through stomata <b>Any four</b></p>	<p><b>4, 0</b></p> <p><b>5 + 1 + 1 + 5</b> <b>(16)</b></p>
(b)	<p><i>How photosynthesis and microorganism activity affect silage feeding value:</i></p> <p><i>Photosynthesis:</i> High carbohydrate or sugar/ cut in middle of day or cut in afternoon/ for high quality silage</p> <p><i>Microorganisms:</i> Lactobacillus (species) <b>or</b> fermentation <b>or</b> anaerobic respiration/ converts sugar to lactic acid/ (weak) acids preserve grass/ correct pH stated/ fermentation by clostridium produces poor quality silage <b>or</b> aerobic respiration leads to decay <b>Any four: at least one point from each category</b></p>	<p><b>4(4)</b> <b>(16)</b></p>
(c)	<p><i>Positive effects of microorganisms:</i> Mineralisation <b>or</b> decomposition of organic matter/ nitrogen fixation/ nitrification/ rumen or hindgut digestion/ vitamin synthesis/ microbial protein/ mycorrhizal effect/ vaccines or biotechnology <b>Any two</b></p> <p><i>Negative effects of microorganisms:</i> Animal diseases or named/ plant diseases or named/ denitrification/ food spoilage or example/ production of toxic gases in slurry tanks <b>Any two</b></p>	<p><b>2(4)</b></p> <p><b>2(4)</b> <b>(16)</b></p>



Q 4

Two of (a), (b), (c) to be answered

2(24)

(a)	<p><i>Effect of a mineral deficiency on crop growth:</i>  Two sterile flasks/ deionised water/ seedlings to both/ nutrient tablet in one/  described control/ aerate both/ cover both/ leave for at least two weeks/  comparison detail/ correct result <b>Any six</b></p> <p style="text-align: center;"><b>OR</b></p> <p>Fertile soil/ soil deficient in mineral/ sow equal number of plants in each/  similar conditions or named/ grown for same length of time/  harvest or observe/ comparison detail/ correct result <b>Any six</b></p>	<b>6(4)</b>
(b)	<p><i>Percentage water and solids in milk:</i>  Mass of clean container/ add milk sample/ find mass of milk/  dry in oven or on hotplate/ to 100 °C/ reweigh/ to constant mass/  loss of mass = mass of water or remaining mass = mass of solids/  % calculation for both water and solids <b>Any six</b></p>	<b>6(4)</b>
(c)	<p><i>Presence of microorganisms in clover roots:</i>  Swab bench with disinfectant or work near lit Bunsen/ two sterile agar plates/  one unopened/ wash soil off roots/ dip in mild disinfectant solution/  crush nodules/ streak on agar plate/ with inoculating loop/  incubate for at least 5 days/ 20 – 30 °C or room temperature/ colonies <b>Any six</b></p>	<b>6(4)</b>
(d)	<p><i>Digestibility of silage:</i>  Mass of sample/ separate into leaf and stem components/  mass of each component/ calculate ratio between stem and leaf masses/  express as fraction or percentage of total mass/  the greater the leaf component, the better the digestibility/ repeat <b>Any six</b></p>	<b>6(4)</b>

## Q 5

(a)	<p><i>Potato cultivation</i></p> <p>(i) <i>Soil preparation:</i> Remove stones/ deep plough or &gt; 20 cm depth/ rotavate or harrow/ drills or ridges <b>Any three</b></p> <p>(ii) <i>Planting:</i> Sprouting/ potato planter/ 10 cm deep/ drills 70 – 80 cm apart/ seeds 25 – 35 cm apart/ size of seed 35 – 55 mm/ 40,000 – 60,00 per ha/ correct month of planting for category of potato <b>Any three</b></p> <p>(iii) <i>Weed control:</i> (Contact and residual) herbicide/ earthing-up/ shading/ hand method or hoeing or scuffling <b>Any three</b></p> <p>(iv) <i>Harvesting:</i> Correct time of year related to category/ spray haulms in advance/ leave for 2 – 3 weeks (to allow skins to harden)/ elevator digger/ short drop to avoid tuber damage/ by hand <b>Any three</b></p>	<p><b>1 + 1 + 2</b></p> <p><b>1 + 1 + 2</b></p> <p><b>1 + 1 + 2</b></p> <p><b>1 + 1 + 2 (16)</b></p>
(b)	<p>(i) <i>Catch crops:</i> Kale/ radish/ buckwheat/ red clover/ berseem clover/ fodder rape/ black oats/ Phacelia/ mustard/ rye/ redstart/ IRG/ vetch/ peas/ beans/ stubble turnip <b>Any two</b></p> <p>(ii) <i>Rotation with catch crop:</i> Named crop/ named catch crop/ named following winter or spring crop</p> <p>(iii) <i>Catch crop benefits other than fodder:</i> Ground cover/ captures soil nutrients/ improves soil organic matter levels/ weed suppression/ reduces nitrate leaching/ less need for winter housing/ high yielding/ prevents soil erosion or maintain soil structure/ some have high crude protein/ increases biodiversity/ provides a break between grass and cereals or crop rotation <b>Any four</b></p>	<p><b>2(2)</b></p> <p><b>6, 0</b></p> <p><b>2(2) + 2(1) (16)</b></p>
(c)	<p>(i) <i>Situations in which to use broad-spectrum weedkillers:</i> Before reseeding/ pre-harvesting cereals/ paths or farm roads/ controlling invasive species/ seed bed preparation <b>Any two</b></p> <p>(ii) <i>Precautions when using sprays:</i> Certified operative/ face mask or goggles/ respirator/ gloves/ overalls/ do not apply on windy days/ wash hands after use/ do not apply near waterways or hedgerows/ safe disposal of containers or washing out/ not on crops near harvest time/ apply at the correct rate/ correct time of application/ avoid livestock <b>Any four</b></p> <p><i>Matching reasons for precautions:</i> To avoid inhaling the chemical/ to avoid skin contact/ to avoid pollution or to avoid killing non-target species/ to avoid entry to food chain <b>Four matching</b></p>	<p><b>1 + 3</b></p> <p><b>4(2)</b></p> <p><b>4(1) (16)</b></p>

Q 6

(a)	<p>(i) <i>Causes of soil compaction:</i> Machinery/ livestock/ overcultivation/ plough pan <b>Any two</b></p> <p>(ii) <i>Effects of soil compaction:</i> Poor aeration/ poor root penetration/ restricted growth/ poor drainage/ soil erosion or run-off/ damages soil structure <b>Any two</b></p> <p>(iii) <i>Remedy for soil compaction:</i> Cultivation or example of cultivation <b>or</b> subsoiling <b>or</b> aerating</p>	<p><b>2(2)</b></p> <p><b>2(4)</b></p> <p><b>3</b> <b>(15)</b></p>															
(b)	<p>(i) <i>Benefits of clover:</i> Nitrogen fixation/ ground cover/ weed control/ palatable/ protein rich/ high in minerals/ high yielding/ suited to organic farming or less N application <b>Any three</b></p> <p>(ii) <i>Why different clovers in different seed mixtures</i> <i>White clover:</i> Prostrate/ N-fixation/ persistent/ grazing encourages stolon growth/ aggressive or weed control <b>Any two</b></p> <p><i>Red clover:</i> Upright or tall/ N-fixation/ drought tolerant/ because deeper tap root/ high yield/ competes better with taller plants <b>Any two</b></p>	<p><b>3(3)</b></p> <p><b>2(3)</b></p> <p><b>2(3)</b> <b>(21)</b></p>															
(c)	<p><i>Comparing slurry and FYM</i></p> <table border="1"> <thead> <tr> <th></th><th><i>Slurry</i></th><th><i>FYM</i></th></tr> </thead> <tbody> <tr> <td>(i) <i>Composition:</i></td><td>Liquid <b>or</b> Urine + faeces <b>or</b> No straw <b>or</b> High N</td><td>Solid <b>or</b> Urine + faeces + straw (bedding) <b>or</b> Low N</td></tr> <tr> <td>(ii) <i>Organic matter:</i></td><td>Lower OM</td><td>Higher OM</td></tr> <tr> <td>(iii) <i>Storage:</i></td><td>Stored in tanks</td><td>Stored open or dungsted</td></tr> <tr> <td>(iv) <i>Spreading method:</i></td><td>Slurry tanker <b>or</b> trailing shoe</td><td>Muck spreader <b>or</b> fork</td></tr> </tbody> </table>		<i>Slurry</i>	<i>FYM</i>	(i) <i>Composition:</i>	Liquid <b>or</b> Urine + faeces <b>or</b> No straw <b>or</b> High N	Solid <b>or</b> Urine + faeces + straw (bedding) <b>or</b> Low N	(ii) <i>Organic matter:</i>	Lower OM	Higher OM	(iii) <i>Storage:</i>	Stored in tanks	Stored open or dungsted	(iv) <i>Spreading method:</i>	Slurry tanker <b>or</b> trailing shoe	Muck spreader <b>or</b> fork	<p><b>4(2) + 4(1)</b></p> <p><b>(12)</b></p>
	<i>Slurry</i>	<i>FYM</i>															
(i) <i>Composition:</i>	Liquid <b>or</b> Urine + faeces <b>or</b> No straw <b>or</b> High N	Solid <b>or</b> Urine + faeces + straw (bedding) <b>or</b> Low N															
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## Q 7

(a)	<p>(i) <i>Pedigree herd</i>: All animals descended from a purebreeding line</p> <p>(ii) <i>Recessive allele</i>: Not expressed when paired with dominant allele <b>or</b> only expressed when paired with another recessive allele</p> <p>(iii) <i>Natural service</i>: Use of a male animal in the herd to mate or fertilise the females</p> <p>(iv) <i>Independent assortment</i>: When either of a pair of alleles can combine with either of another pair</p>	4																										
(b)	<p><i>Parental genotype</i>: WwFf</p> <p><i>Gamete genotypes, across</i>:</p> <p><i>Gamete genotypes, down</i>:</p> <table border="1"><tr><td><b>Gametes</b></td><td><b>WF</b></td><td><b>Wf</b></td><td><b>wF</b></td><td><b>wf</b></td></tr><tr><td><b>WF</b></td><td>WWFF</td><td>WWFf</td><td>WwFF</td><td>WwFf</td></tr><tr><td><b>Wf</b></td><td>WWFf</td><td>WWff</td><td>WwFf</td><td>Wwff</td></tr><tr><td><b>wF</b></td><td>WwFF</td><td>WwFf</td><td>wwFF</td><td>wwFf</td></tr><tr><td><b>wf</b></td><td>WwFf</td><td>Wwff</td><td>wwFf</td><td>wwff</td></tr></table> <p><i>Offspring phenotypes and ratios</i>: White, flat: 9 White, round: 3 Yellow, flat: 3 Yellow, round: 1</p>	<b>Gametes</b>	<b>WF</b>	<b>Wf</b>	<b>wF</b>	<b>wf</b>	<b>WF</b>	WWFF	WWFf	WwFF	WwFf	<b>Wf</b>	WWFf	WWff	WwFf	Wwff	<b>wF</b>	WwFF	WwFf	wwFF	wwFf	<b>wf</b>	WwFf	Wwff	wwFf	wwff	2 2, 0 2, 0	Offspring genotypes 6, 0  Phenotypes: 2, 0 Matching ratios 2, 0 (16)
<b>Gametes</b>	<b>WF</b>	<b>Wf</b>	<b>wF</b>	<b>wf</b>																								
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<b>wf</b>	WwFf	Wwff	wwFf	wwff																								
(c)	<p>(i) <i>Why Drosophila used</i>: Large number of offspring/ short reproductive time/ easily identified traits/ easy to keep or cheap/ small number of chromosomes/ large chromosomes/ distinct male and female bodily characteristics/ visible sex-linked characteristics/ well documented mutations <b>Any four</b></p> <p>(ii) <i>Lambing percentage</i>: 180% or lambing rate of 1.8 lambs per ewe or a valid comment on lowland sheep production</p> <p><i>Numbers male and female</i>: Males produce X or Y gametes/ females produce only X gametes</p>	4(2)  4  2(2)	(16)																									

Q 8

Two of (a), (b), (c) to be answered

2(24)

(a)	<p><i>Liver fluke life cycle</i>  <i>Drawing to show:</i>  Any six stages in the correct cyclical sequence, indicated or drawn  <i>Labels or description:</i>  Adult fluke in sheep or in cow or in primary host/ eggs out with faeces/  eggs hatch into miracidia/ water or acidic conditions or 10 °C/  miracidia into water snail or into secondary host/ time point (24 hours)/  sporocysts develop in snail/ rediae develop from sporocysts/  cercariae develop from rediae/ cercariae exit snail onto grass/  cercariae encyst/ are grazed by primary host</p> <p style="text-align: right;"><b>Any six</b></p>	<p><b>6, 3, 0</b></p> <p><b>6(3)</b>      <b>(24)</b></p>
(b)	<p>(i) <i>Diagram of TS of dicot stem</i>  <i>Drawing to show:</i> Circular outer surface/ a ring of oval shapes (bundles)/  at least one bundle shown divided into an inner and an outer region by a  central strip  <i>Labels:</i> Epidermis or dermal tissue/ vascular bundles(s)/ xylem/ phloem/  cambium/ cortex or pith or ground tissue</p> <p><i>Differences between monocot and dicot stem TSs:</i>  <i>Monocot stem TS:</i>  Vascular bundles scattered/  no cambium or no secondary thickening or no annual rings</p> <p><i>Dicot stem TS:</i>  Vascular bundles in ring/  cambium present or secondary thickening occurs or annual rings</p>	<p><b>6, 3, 0</b></p> <p><b>6(1)</b></p> <p><b>2(3)</b></p> <p><b>2(3)</b>      <b>(24)</b></p>
(c)	<p><i>Distinguish between the members of any three of the pairs at (i), (ii), (iii), (iv)</i></p> <p>(i) <i>Omasum:</i> Third ruminant stomach compartment or book stomach or  manyplies or absorbs water  <i>Abomasum:</i> Fourth ruminant stomach compartment or true stomach or  completes digestion</p> <p>(ii) <i>Ureter:</i> Connects kidney to bladder or carries urine to the bladder  <i>Urethra:</i> Carries urine out of body or from bladder</p> <p>(iii) <i>Split dressing:</i> Fertiliser applied in more than one application  <i>Top dressing:</i> Fertiliser spread over growing crop or bare ground</p> <p>(iv) <i>Maintenance ration:</i> Amount of food needed to maintain bodyweight or to  maintain health  <i>Production ration:</i> Amount of extra nutrients needed to produce milk or  meat or wool or eggs</p>	<p><b>3(4 + 4)</b></p> <p><b>(24)</b></p>

Q 9

Four of (a), (b), (c), (d), (e) to be answered

4(12)

(a)	<i>Change in grass digestibility:</i> Before seed head mainly soluble carbohydrate or sugar (and protein)/ almost fully digestible/ after seed head more fibre or more cellulose/ less digestible/ drop from 80% to 50% or drop of 0.5% per day/ less glucose at the end of the season <b>Any three</b>	<b>3(4)</b>	<b>(12)</b>
(b)	<i>Culling older dairy cows:</i> Milk yield decreasing/ fertility decreasing/ lameness or injury/ calving difficulties/ increasing cell count or decline in milk quality/ more prone to disease/ genetic improvement of herd <b>Any three</b>	<b>3(4)</b>	<b>(12)</b>
(c)	<i>Low rate of establishment in wet spring:</i> Soil temperature too low/ waterlogging/ lack of oxygen/ low air temperature/ slower seedling growth/ deferred germination/ fungal diseases/ pest attack <b>Any three</b>	<b>3(4)</b>	<b>(12)</b>
(d)	<i>Hedgerow conservation:</i> Shelter livestock or crops or buildings <b>or</b> warm soil/ nature corridor or habitat/ biodiversity/ aesthetic/ division of land/ environmental schemes/ biosecurity <b>Any three</b>	<b>3(4)</b>	<b>(12)</b>
(e)	<i>Flushing ewes:</i> Ewes in improving condition/ more eggs/ better conception rate/ regular heat/ higher implantation rates/ more compact lambing/ higher chance of multiple births <b>Any three</b>	<b>3(4)</b>	<b>(12)</b>

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