



**Coimisiún na Scrúduithe Stáit
State Examinations Commission**

LEAVING CERTIFICATE EXAMINATION 2010

AGRICULTURAL SCIENCE

**ORDINARY LEVEL CHIEF EXAMINER'S REPORT
HIGHER LEVEL CHIEF EXAMINER'S REPORT**

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1. General Introduction

This report should be read in conjunction with the examination papers and the published marking schemes. These are available on the State Examination Commission's website www.examinations.ie

1.1 The Syllabus

The examination in Agricultural Science is based on the syllabus published in *Rules and Programme for Secondary Schools*. The syllabus may be found on the website of the Department of Education and Skills at www.education.ie by following the link 'Curriculum, Syllabus & Teaching Guidelines' under the heading 'Information by topic'. The published syllabus has remained unchanged for many years. It outlines the subject content and the structure of the examination but does not include aims or assessment objectives. It is examined at two levels – Ordinary Level (OL) and Higher Level (HL). There is no difference in syllabus content between the levels.

1.2. The Examination

There are two components in the examination – a report on practical coursework, allocated 100 marks (25% of the total), and a terminal written paper, allocated 300 marks (75% of the total). Candidates must sit the written paper in order to receive a grade. The assessment of the coursework is based on common criteria and standards for both levels. There are separate written examination papers for each level.

At Ordinary Level the paper consists of two sections – Section One (120 marks) and Section Two (180 marks). In Section One candidates are asked to answer six questions from seven – these are questions that elicit short and selected responses that are written on the question paper and each is allocated 20 marks. In Section Two candidates are asked to answer three questions from a total of six, each question eliciting constructed responses and being allocated 60 marks. One of the questions usually has an internal choice requiring candidates to answer two of four parts.

At Higher Level, candidates are asked to answer six questions from a total of nine. Question 1 is allocated 60 marks and all other questions are allocated 48 marks each. Question 3 has a choice of two options and there is significant internal choice in other questions. Candidates are allowed two and a half hours to complete the written examination.

1.3. The Candidature

The number of candidates taking Agricultural Science has shown a large increase (47.93%) from 2006 to 2010 and that number expressed as a percentage of the total Leaving Certificate cohort has also increased in the same period. The bar on candidates

taking both Agricultural Science and Biology in the Leaving Certificate examination was removed with effect from 2004 and this is strongly suspected to have had an effect on candidate numbers in Agricultural Science.

Table 1 shows the number of candidates taking both Agricultural Science and Biology and that number expressed as a percentage of all Agricultural Science candidates each year since the bar was removed on taking both subjects for the Leaving Certificate in the same year.

Table 1.

Number of candidates taking both Agricultural Science and Biology since the bar on taking both subjects in the same year was removed and that number expressed as a percentage of the total Agricultural Science cohort each year.

	2004	2005	2006	2007	2008	2009	2010
n	385	777	1108	1507	1782	2025	2426
%	11.89	21.43	28.32	35.32	37.61	38.41	41.92
% increase over previous year's %	N/A	80.24	32.15	24.72	6.48	2.13	9.14

Table 2 shows the number of candidates taking Agricultural Science in the Leaving Certificate in the years 2006 – 2010 and those numbers expressed as a percentage of the total Leaving Certificate cohort in each of those years. Both the total number and percentage of candidates taking Agricultural Science have increased markedly each year since 2006. Over the five years since the last chief examiner's report the average rate of increase in the percentage of candidates taking HL Agricultural Science as a percentage of the total Leaving Certificate cohort (9.43% per year) has been almost two and a half times as fast as the average rate of increase in the percentage taking OL (3.89% per year).

Table 2.

Number of candidates taking Agricultural Science at each level and their percentage of the total cohort in each of the years 2006 – 2010.

		2006	2007	2008	2009	2010
OL	n	896	1006	1026	1108	1112
	%	1.76	1.98	1.97	2.04	2.04
HL	n	3016	3261	3712	4164	4675
	%	5.92	6.41	7.12	7.68	8.58
Total Agricultural Science	N	3912	4267	4738	5272	5787
	%	7.68	8.39	9.09	9.73	10.62
*Total Leaving Certificate		50,955	50,873	52,143	54,197	54,480

*This total includes school candidates, repeat candidates, external candidates and VTOS / PLC candidates. Leaving Cert Applied candidates are excluded from all totals.

Table 3 compares the number and percentage of candidates taking Agricultural Science at Ordinary Level and Higher Level in the years 2006 – 2010. These figures show a 47.93% increase in the number of candidates taking the Agricultural Science examinations between 2006 and 2010. Over these five years the percentage of Agricultural Science candidates taking OL has fallen by 16.07% while the percentage taking HL has increased by 4.77%.

Table 3.

Number and percentage of candidates taking Agricultural Science at Ordinary and Higher Levels 2006 – 2010.

		2006	2007	2008	2009	2010
Total Agricultural Science		3912	4267	4738	5272	5787
OL	n	896	1006	1026	1108	1112
	%	22.90	23.58	21.65	21.02	19.22
HL	n	3016	3261	3712	4164	4675
	%	77.10	76.42	78.35	78.98	80.78

Table 4 shows the female-to-male ratio among Agricultural Science candidates, totally and at each level. The total ratio increased slightly but steadily between 2006 and 2010. At OL the ratio has fluctuated about a mean of 1:3.39 while at HL, after stability in 2006 and 2007, there was a slight increase from 2007 to 2010.

Table 4.

Number, percentage and ratio of female and male candidates taking Agricultural Science, totally and at each level, 2006 – 2010.

		2006	2007	2008	2009	2010
Total	n	3912	4267	4738	5272	5787
Total Female	n	1307	1451	1616	1841	2055
	%	33.41	34.01	34.11	34.92	35.51
Total Male	n	2605	2816	3122	3431	3732
	%	66.59	65.99	65.89	65.14	64.49
Total Female:Male		1:1.99	1:1.94	1:1.93	1:1.86	1:1.82
OL Female	n	211	216	231	269	248
	%	23.55	21.47	22.51	24.28	22.30
OL Male	n	685	790	795	839	864
	%	76.45	78.53	77.49	75.72	77.70
OL Female:Male		1:3.25	1:3.66	1:3.44	1:3.12	1:3.48
HL Female	n	1096	1235	1385	1572	1807
	%	36.34	37.87	37.31	37.75	38.65
HL Male	n	1920	2026	2327	2592	2868
	%	63.66	62.13	62.69	62.25	61.35
HL Female:Male		1:1.75	1:1.75	1:1.68	1:1.65	1:1.59

2. Practical Coursework

2.1 Introduction

This section of the report deals with the Agricultural Science practical coursework examination from the perspective of performance, conclusions and recommendations.

2.2 Performance of Candidates

Table 5 shows the percentage of candidates achieving each grade in the practical coursework component of Agricultural Science in the years 2006 – 2010.

Table 5.

Grade distribution in practical coursework in the years 2006 - 2010.

	A	B	C	ABC	D	E	F	NG	EFNG
2006	30.05	35.93	22.69	88.68	9.61	1.05	0.20	0.46	1.71
2007	31.60	36.54	22.32	90.46	7.81	1.20	0.38	0.16	1.73
2008	31.11	34.89	23.69	89.69	8.17	1.40	0.45	0.30	2.14
2009	31.92	34.39	22.30	88.61	9.49	1.22	0.36	0.32	1.90
2010	33.48	36.05	19.93	89.46	7.96	1.83	0.35	0.41	2.59

2.3 Analysis of Candidate Performance

There was a wide variation in the range of material presented by candidates and in the standard of the material examined. It was noted, however, that the range of presented topics seems to be narrowing and that most of the topics are suggested by syllabus headings. Some of the more popular topics for investigation continue to be dairying and beef production in the animal section and barley and grass from the crops. Less often encountered projects dealt with such topics as strawberries, market gardens, ducks, *Miscanthus*, and greyhounds.

Examples of good practice included: keeping an annual farming diary; the use of photographs taken by the candidates themselves; the compiling of weed collections and/or collections of agriculturally relevant invertebrates from the local environment; the inclusion of samples such as mart receipts, factory grades, and feed labels. However, monitors continue to highlight the widespread use of material downloaded from Internet sources. The weakest areas continue to be genetics, ecology, microbiology, and this year animal physiology, where there is little evidence of the required practical work being done. Many candidates continue to cover only one crop instead of the required two. Plant identification is weak, as is invertebrate identification. There is a noticeable lack

of recorded evidence of work done. There is a continuing incidence of candidates, during interview, demonstrating poor knowledge of the contents of their own projects.

2.4 Conclusions

The percentage of candidates achieving a grade in the ABC range for the practical coursework component continues to be high. Notwithstanding this, however, evidence continues to indicate that the practical coursework is not being given the prominence ascribed to it in the syllabus. It is essential that practical coursework be regarded as an integral part of the Agricultural Science course of study and that the work is actually carried out by the students as part of their learning experience in this subject.

2.5 Recommendations to Teachers and Students

- Teachers should be fully conversant with the contents of the document “Agricultural Science – Practical Assessment Guidelines for Teachers” that issues to schools in April every year.
- Teachers should ensure that their students fully engage in the practical aspect of Agricultural Science across the full range of topics outlined in the syllabus, including animal physiology, genetics, ecology, and microbiology.
- Students should report on their own experiences of practical agriculture to the fullest extent possible.

3. Ordinary Level

3.1 Introduction

This section of the report deals with the written examination at Ordinary Level from the perspective of performance, conclusions and recommendations.

3.2 Performance of Candidates

Table 6 shows the percentage of candidates achieving each grade at Ordinary Level Agricultural Science in the years 2006 – 2010.

Table 6.

Total candidature and percentage achieving each grade at Ordinary Level Agricultural Science 2006-2010.

Year	Total OL Candidature	%A	%B	%C	%ABC	%D	%E	%F	%NG	%EFNG
2006	896	1.23	15.63	37.83	54.69	32.81	9.71	2.68	0.11	12.50
2007	1006	0.60	8.75	31.11	40.46	37.97	14.71	6.06	0.80	21.57
2008	1026	0.78	12.67	35.77	49.22	37.33	10.92	2.44	0.10	13.45
2009	1108	0.36	9.39	32.58	42.33	38.27	13.18	5.78	0.45	19.40
2010	1112	0.36	14.30	36.33	50.99	35.70	9.89	3.24	0.18	13.31

3.3 Analysis of Candidate Performance

Table 7 shows the rank order of questions answered, section by section, in this year's Ordinary Level examination from the point of view of number of attempts per question and number of marks earned per question. These data are taken from a random sample of 60 examination scripts (5.4% of the total OL candidature).

Table 7.
Rank ordering of attempts and marks per question, Ordinary Level Agricultural Science 2010.

Question Number	Marks per Question	Topic	% Attempts	Rank Order - Attempts	Average Mark	Rank Order - Marks
Section One						
1	20	Soil	98.3	5	13.95	4
2	20	Machinery	100	= 1	14.50	2
3	20	Dairying	100	= 1	11.25	5
4	20	Animal diseases	100	= 1	15.60	1
5	20	Plant types	88.3	6	9.30	6
6	20	Plant cell	73.3	7	8.18	7
7	20	True or false	100	= 1	14.17	3
Section Two						
8	60	Grazing	73.3	1	22.50	6
9	60	Soil / Crops	56.6	2	28.70	3
10	60	Animal physiology	43.3	6	26.88	4
11	60	Livestock	55.0	3	24.24	5
12	60	2 parts from 4 Ecology / Pigs / Environment / Seeds	51.6	= 4	36.26	1
13	60	Genetics	51.6	= 4	31.65	2

Section One

Question 1

This question was the third least-often attempted and the fourth lowest-scoring in Section One.

- The majority of candidates obtained full marks in this part of the question.
- This part was very poorly answered. Many candidates misinterpreted the question and gave mineral elements (e.g. nitrogen, phosphorus) instead of mineral particles. Some candidates answered "humus".
- This part was well answered. Most candidates gave "earthworm".

Question 2

This ranked as one of the most frequently attempted questions in Section One. The most common error was not matching “subsoiler” with the appropriate function.

Question 3

This was a very popular question but one in which candidates scored poorly.

- (a) Most candidates correctly identified two dairy breeds. The most popular answers were “Friesian” and “Jersey”. The most common error was giving “Hereford” as a dairy breed.
- (b) This was poorly answered in general. Most candidates managed to give one desirable physical characteristic of a dairy cow ; very few (less than 5%) gave the required two characteristics.
The most common answers involved some reference to a “good udder” or “high milk yield” or “freedom from disease”.
- (c) This was well answered with most candidates obtaining full marks. It was evident that candidates had a good understanding of the term “colostrum”.
- (d) This was very poorly answered. Many candidates confused the length of lactation with such periods as the length of gestation or the oestrus cycle. It was also obvious that a certain amount of guesswork was involved in answering part (d).

Question 4

This proved to be a very popular, and the highest scoring, question in Section One. The most common error was identifying brucellosis as a non-notifiable disease.

Question 5

This question was both the second least-often attempted and second lowest-scoring in Section One.

- (a) This part was poorly answered in general. Most candidates were unable to correctly identify plants A and B ; many candidates gave either “daisy” or “dandelion” for plant A and “barley” or “wheat” for plant B. There was a large variety of answers for plant D with many giving “turnip”.
- (b) Most candidates were unable to place plant B into the appropriate family; many candidates gave “cereal(s)” as an answer. A significant proportion of candidates did not attempt part (b).
- (c) The majority of candidates correctly identified plant C as a weed.

- (d) This part was very poorly answered. Some examiners felt that many candidates did not understand the term ‘by-product’. The most common error was “sugar”.

Question 6

This question ranked last place in Section One in both number of attempts and performance.

- (a) Very few candidates obtained full marks in part (a). Many candidates did answer “cell wall” for A; some gave “cell membrane”. Many candidates actually confused structures B and C, giving “nucleus” for B and “vacuole” for C.
- (b) Many candidates were unable to identify the green pigment in chloroplasts often giving no answer at all here.
- (c) Many candidates who did answer part (b) correctly were unable to answer part (c) correctly. The most common error was “to give (the plant) a green colour”.

Question 7

This question was very popular, and candidates scored quite well in it. The most common errors occurred in parts (e), (g) and (j).

Section Two

Most candidates attempted three questions in this section, with a significant minority (about 25%) attempting a fourth. The most often attempted questions were 8, 9 and 11. Of these, question 8 was the most often attempted. However, it ranked last in terms of performance, and was the only question in Section Two that did not achieve an average mark equivalent to 40% or better. Candidates scored highest in Question 12 which ranked joint fourth in number of attempts.

Question 8

- (a) (i) Most candidates correctly identified both grazing systems. However, quite a few simply stated that grazing system B was a “rotational grazing system”.
- (ii) Most candidates were able to explain how each grazing system worked. The most common answers for grazing system A referred in some way to moving the electric fence to provide fresh grass/grazing. The most common answers for grazing system B referred to a permanent roadway/paddocks, and moving the livestock to provide fresh grass/grazing.
- (iii) This was poorly answered; in many cases candidates were not specific enough in their answering, while others did not give an advantage and disadvantage of

- each system. Most answers referred to cost factors and high labour input.
- (iv) This part was generally well answered with many candidates giving “leader-follower”.
 - (b) (i) Most candidates either named a grass or another plant species, but very few named both. The most common named grass was “ryegrass”, while “clover” was the most common answer for the other plant species.
 - (ii) Very few candidates gave an appropriate use for either the named grass or clover. Many answers were too vague and simply referred to “good quality”.
 - (c) A common error here was a failure to name an actual method of re-seeding. However, candidates did receive marks for mentioning tilling operations such as “ploughing” and “harrowing”.
 - (d) This part was poorly answered. Candidates showed little understanding of the term “tillering” and proceeded to explain “tilling” instead. Candidates also lost marks for their failure to give a reason for topping grassland.

Question 9

- (a) Most candidates answered part (a) correctly, with “liming” being the most common answer.
- (b) Most candidates got at least one correct mineral. However, some candidates gave soil particles (e.g. “sand”, “silt”) in their answers; others gave “water”.
- (c) Most candidates gave “potatoes” or “barley” as their chosen crop.
- (d) Most candidates named a suitable fertiliser; the most common fertiliser was “10:10:20” Some candidates gave “(farmyard) manure”.
- (e) (i) Most candidates mentioned “ploughing” and “harrowing/rotavating” in their answers.
 - (ii) Many candidates did not give a specific sowing date/month; many simply referred to “spring” or “autumn” in their answers.
 - (iii) Most candidates only gave one pest or disease. The most common pest was greenfly; the most common disease was “(potato) blight”.
 - (iv) The most common control method given was “spraying”. Some candidates gave “rotation”.
 - (v) This part was poorly answered as most candidates did not match the harvest date with the sowing date given in part (ii).
 - (vi) This was poorly answered; very few candidates gave an appropriate yield for their chosen crop.
- (f) Many candidates lost marks by failing to give four relevant points in their answers.

Question 10

- (a) (i) Many candidates confused the atrium with the ventricle. Very few candidates correctly identified the septum; the most common error was in naming C as heart/cardiac muscle.
- (ii) Most candidates correctly named at least two of the three types of blood cells; Most errors involved omitting “platelets” and/or naming “plasma” as a type of blood cell.
- (iii) Most candidates gave at least one correct function of one of the named blood cells in part (ii). A common error was “transport of food” for red blood cells.
- (iv) The majority of candidates associated anaemia with a lack of iron.
- (v) Most candidates did give “iron injections” for their answer; most errors involved using an alternative word to injection e.g. iron dose, iron tablets.
- (b) In general, part (b) was not answered as well as part (a).
- (i) Most candidates gave the correct answer for A; however a sizable number actually confused parts B and C, giving “womb/uterus” for B and “vagina” for C.
- (ii) The majority of candidates confused *flushing* with other terms associated with sheep production, particularly “sponging” and “steaming up”.
- (iii) This part was poorly answered due to the misunderstanding alluded to in part (ii).
- (iv) The vast majority of candidates gave the correct meaning of A.I.
- (v) Most candidates gave one advantage of using A.I.; the most common answers referred to “a better choice of breed” or “cheaper (for a small farmer)”.

Question 11

- (a) (i) Many candidates failed to give a precise explanation of the term *conformation*.
- (ii) Most answers were too vague; a common answer referred to the fact that “beef cattle have more muscle than dairy cattle”.
- (iii) Most candidates lost marks by giving a figure outside the acceptable range.
- (iv) This part was generally well answered; most candidates referred to “meat quality being better” (at this particular age).
- (b) (i) Most candidates gave two correct sheep breeds; the most common breeds given were “Texel”, “Suffolk” and “Mountain blackface”.
- (ii) Quite a few answers were outside the acceptable range here.
- (iii) Candidates scored well in this part. In relation to feeding, most correct answers referred to “(the need for) colostrum/biestings”. The most common answers relating to management were “(dipping the navel in) iodine”, “suitable bedding” and “warmth/ infra-red lamp”.
- (c) (i) This part was poorly answered which directly led to low marks in part (ii). Many candidates confused *creep feeding* with *creep grazing* and proceeded to explain the latter.
- (ii) Most candidates gave the advantages of creep grazing in part (ii). Those

who did give a correct explanation of creep feeding in part (i) gave a maximum of one correct advantage from the required three.

Question 12

This proved to be one of the least often attempted questions in Section Two but it ranked first in terms of performance. Most candidates, who completed this question, attempted part (a) and one other from parts (b) and (c). Many candidates attempted three parts. Candidates performed best in parts (a) and (c). A very small percentage of candidates attempted part (d).

- (a) (i) The majority of candidates named two weeds; the most common answers were “nettles”, “daisy” and “thistle”.
(ii) Most candidates gave “quadrat” in their answer; a small number gave “transect”.
(iii) Most candidates gave at least three correct steps in the use of the quadrat.
- (b) (i) Many candidates gave a temperature outside the acceptable range.
(ii) Most candidates lost marks as they only gave one reason for using a farrowing crate. The most common answer referred to avoiding injury to the bonham.
(iii) This was poorly answered in general; many candidates omitted the word “dry” in “Dry sow house”. Another common error was using “fattening house” for bonhams.
(iv) This part was also poorly answered as most candidates gave one criterion rather than the required three as outlined in the marking scheme.
- (c) (i) Most candidates gave at least two advantages; the most common answers were “fencing”, “wildlife (habitat)” and “boundary”.
(ii) Most candidates gave two ways of reducing run off; the most common answers included “(applying) less fertiliser” and/or “applying in dry weather”.
(iii) This part was generally well answered.
- (d) (i) This was poorly answered; most candidates were unable to give a satisfactory explanation for the term *establishment*.
(ii) Candidates performed relatively poorly in this experiment. A common feature being the failure of most candidates to lay out the method properly and/or to use a labelled diagram. A common error involved mentioning the need for light during germination.

Question 13

The genetics question proved to be just as unpopular in 2010 as in previous years. However, those candidates who did attempt it scored quite well in it.

- (a) Candidates did quite well in part (a), and they possibly benefited from the fact that they were not required to define common genetic terms, as was the norm in previous genetics questions. The most common errors involved some confusion

between the terms “homozygous” and “heterozygous”, and between the terms “dominant” and “recessive”.

- (b) (i) The vast majority of candidates scored maximum marks in the first cross. However, some candidates omitted the phenotype completely, or wrote down the genotype (i.e. Ee) in its place.
- (ii) Most candidates scored well in the second cross. However, some candidates inserted a homozygous recessive for the second parent (i.e. ee), and gained marks in the remainder of the cross by default. Another common error involved placing EE, Ee and Ee inside the brackets for the gametes.
- (c) (i) This part was well answered.
- (ii) Very few candidates scored any marks in this part. DNA was quite a common answer for part M.

3.4 Conclusions

- Almost 87% of candidates achieved a grade D or better in this examination.
- The standard of answering in Section One was quite good; the majority of candidates attempted six questions and a significant number attempted all seven.
- Question 4 was the highest scoring question and equally one of the most often attempted in Section One.
- Most candidates attempted three questions in Section Two and a considerable number attempted a fourth.
- An average mark, equivalent to 40% or better, was achieved in five out of the six questions in Section Two, with Question 8, with an equivalent of 37.5%, being the only exception.
- In general candidates followed the instructions on the examination paper correctly and attempted to answer the question that was being asked. A number of instances occurred in which candidates misinterpreted questions and/or gave irrelevant answers. Otherwise, in the vast majority of cases, the manner in which candidates presented material was satisfactory.
- One aspect that continues to give cause for some concern is the minimal amount of text written by candidates in their answers. This tends to lead to candidates not earning as many marks as they otherwise might do in Section Two.

3.5 Recommendations to Teachers and Students

It is recommended that teachers ensure:

- that students cover all topics in appropriate depth
- that students are well practised in reading questions fully and carefully to elucidate key points
- that students are well practised in following instructions in questions
- that students know not to rely on any key word or form of such word included in a term when defining or explaining the meaning of the term e.g. if *conformation* is to be defined or explained, do not rely in an answer on the word ‘conformation’ or any of its forms
- that practical activities are carried out by students in field and laboratory and that students understand the reasons behind the various steps in each activity
- that students understand the concept of a control in an experiment and the difference between the result and the conclusion of an experiment, and that all are accurately given in descriptions of experimental work
- that students understand the importance of drawing labelled diagrams when describing an experiment
- that students know to give at least two points/reasons when answering questions that involve “scientific explanations”
- that students are well practised in explaining the difference between terms that have the potential to be confusing e.g. ‘flushing’ and ‘sponging’
- that students fully cover all parts of the syllabus including the cells and genetics
- that students know to quote accurate specific figures or narrow ranges where appropriate e.g. for birth-weights, live-weight gain, yields, age at slaughter.

It is recommended that students:

- use past examination papers for practise
- read questions fully and carefully so it is clear what exactly is being asked
- follow instructions in questions
- practise drawing large, tidy, accurate diagrams and labelling their parts clearly
- learn to explain the difference between potentially confusing terms
- learn to define terms without relying on key words from the term
- learn the reasons behind all steps in practical activities
- learn the significance of a control and the difference between the result and the conclusion in scientific experiments, and use these concepts accurately in examination answers.

4. Higher Level

4.1 Introduction

This section of the report deals with the written examination at Higher Level from the perspective of performance, conclusions and recommendations.

4.2 Performance of Candidates

Table 8 shows the percentage of candidates achieving each grade at Higher Level Agricultural Science in the years 2006 – 2010.

Table 8.

Total candidature and percentage achieving each grade at Higher Level Agricultural Science 2006-2010.

Year	Total HL Candidature	%A	%B	%C	%ABC	%D	%E	%F	%NG	%EFNG
2006	3016	12.80	23.88	30.64	66.81	26.49	5.94	0.76	0.00	6.70
2007	3261	9.29	24.66	33.73	67.68	25.54	5.67	1.04	0.07	6.78
2008	3712	14.12	24.97	29.39	68.48	23.68	6.47	1.24	0.13	7.84
2009	4164	13.16	25.96	29.35	68.47	23.87	6.27	1.37	0.02	7.66
2010	4675	10.22	26.57	31.51	68.30	24.36	6.16	1.11	0.06	7.34

4.3 Analysis of Candidate Performance

Table 9 shows the rank ordering of candidate answering in this year's Higher Level examination from the point of view of number of attempts per question and number of marks earned per question. These data are taken from a random sample of 240 examination scripts (5.13% of the total HL candidature).

Table 9.

Rank ordering of attempts and marks per question, Higher Level Agricultural Science 2010.

Question Number	Marks per Question	Topic	% Attempts	Rank Order - Attempts	Average Mark	Rank Order - Marks
1	60	Miscellaneous; answer 6 from 10 short parts	96	1	31.5	5
2	48	Soil / peat	73	4	24.2	= 6
3 Option One	48	Dairying	70	5	24.2	= 6
3 Option Two	48	(a) Plant nutrients (b) Cattle diseases (c) Seedling establishment	36	10	26.4	4
4	48	Practicals; 2 from 4	80	3	30.2	1
5	48	(a) Sheep (b) Reseeding (c) Silage	65	6	29.1	2
6	48	(a) Potatoes (b) Scutch grass (c) Soil (d) Cereals	37	9	16.2	10
7	48	Reproduction and genetics	54	8	19.8	8
8	48	(a) Sheep (b) Plant physiology (c) Misc. animal terms; 2 from 3	94	2	28.3	3
9	48	Scientific explanations; 4 from 5.	55	7	17.5	9

The overall standard of answering was somewhat lower than recent years. Many candidates attempted more than the required six questions. A significant number attempted all nine questions, some in order of number. Fewer candidates achieved full marks for questions compared to previous years.

Question 1

This question was not as well answered as in previous years, with only a small number of candidates achieving full marks. Most candidates attempted more than six parts, and were generally unable to answer parts fully. Many of the more able candidates failed to get the last point, and the majority got six marks or less out of ten for individual parts. A significant number attempted all parts of this question.

- (a) This was unpopular and poorly answered. The average score was 4 for naming two plants. The term ‘indicator species’ was not understood and the plant names were not matched by any conditions in most cases.
- (b) The standard of diagrams of the tooth was generally poor, many drawing the external structure only. Labelling was also poor, with two correct labels being the average. “Nerves”, “gum” and “root” were among the more common labels.
- (c) Most candidates had just one correct point for this, “cheaper” or “palatable” being the common answer. The other points on the marking scheme rarely came up but the better candidates got a second point.
- (d) (i) Most had a good understanding of pH, referring to “level of acidity (or alkalinity)”; a minority gave “H ion concentration”.
(ii) Answers were poor for this part, most candidates giving an incorrect range or an incorrect value. Many confused the values for the rumen and abomasum. The most frequently correct answer was for sour milk, with a number within the range being given.
- (e) (i) Most candidates correctly stated the purpose of the soil auger, for “taking a soil sample”; there was rarely a reference to soil profile.
(ii) Not very well answered, but high-scoring candidates gave “sugar content”.
(iii) The burdizzo was not recognised with only a few candidates giving the correct purpose. Many referred to a soil function like “breaking up clods”.
- (f) (i) Most were familiar with clover and its family, generally given as “leguminosae”. The other names did not generally appear.
(ii) This was not as well known, except by the stronger candidates who gave “compositae”; few mentioned “asteraceae”. Some had “gramineae”, while others confused it with kale.
(iii) The better answers gave “cruciferae” or “brassica”, but the majority got this wrong or omitted it.
- (g) This was well answered, although some confused gestation and oestrous.

- (h) Most candidates knew the length of gestation, “3 months, 3 weeks, 3 days” being the most common answer.
- (ii) The length of oestrous was less well known; the correct answer was “21 days” in most cases, though some gave a correct range. A number lost out by giving an incorrect range.
- (i) This was poorly answered, and many confused it with the factors required for germination, giving “water”, “temperature” and “oxygen”, and just getting the marks for “oxygen”. “Sunlight” and “heat” were also given as answers.
- (j) Most candidates got just one correct point here, “cheaper” being the most common answer. Some referred to ammonia rather than sulphate of ammonia; many stated that it “causes less pollution” and “does not leach”.
- (k) Answers were vague for the three pests, very few candidates being clear on the difference between them.

Question 2

The soil question is normally unpopular, and was similarly unpopular this year. The standard of answering was very poor for part (a), but many got two or three points for part (b) while part (c) was very well answered.

- (a) The development of soil structure was confused with soil formation by a large number of candidates. The majority of these earned no marks for this part, giving “aspect”, “topography” and other factors involved in soil formation. However, some got marks under climate, for “freeze/thaw” and “wetting and drying”. Only the highest achieving candidates gained full marks for this. Many gave long explanatory answers despite the instruction to ‘list’ the factors.
- (b) There was a better standard of answering here, many being familiar with the topic of peat bogs. Many candidates achieved top marks for describing the formation of both blanket peat and basin peat, thereby getting more than two points, in some cases all four. Many candidates used one or more diagrams to show the formation of basin peat, getting marks for labels. Among the points given were “rainfall”, “water-logging”, “acidic conditions” and “accumulation of organic matter”.
- (c) Many candidates got the four points for the experiment, which they seemed to be very familiar with. The most common mistake was using an oven rather than a Bunsen burner to burn off the organic matter. Despite this, there were enough points given for full marks. Some candidates described other common soil experiments here.

Question 3 Option One

This was the more popular of the two options and was generally well attempted. Most candidates earned marks in all three parts, though very few got high marks.

- (a) Less able candidates seemed to find some of these questions confusing.
 - (i) Most gave a correct reason for using Friesians, like “good milk yield” or “dairy breed”, but many omitted the second part of the question. The better answers had “on his Friesians”; some said “on all of his cows”.
 - (ii) This was well answered; the reason for using continental sires being given - having “good conformation” or producing “good beef calves”. Few gave named beef characteristics.
 - (iii) Most candidates answered this correctly, giving a reason for using Angus bulls as “for easy calving” or “for good quality beef” or “on heifers”.
 - (iv) Many candidates seemed unsure of the replacement rate, and a range of answers was given, from as low as 5% up to 100%. Only a minority of candidates gave an answer within the correct range of 15-20%. A frequent answer was 30%.

- (b) Many candidates confused milk let-down with lactation and drying-off. Answers like “decrease in milk yield” were common, and some described the milking process. However, those who understood the topic got three or four correct points like “udder washed with a warm cloth”, “stimulus to brain”, “pituitary gland”, “oxytocin” and “milk released”. The most common mistake for these candidates was prolactin being named as the hormone.

- (c) The problems caused by mastitis were generally well known, but full marks were rare, the stronger candidates getting three points correct, the majority of the others getting just one correct point. The most common points given were: “high somatic cell count”, “presence of antibodies” and “unfit for human consumption”. A common mistake was stating that “disease remains in the milk” instead of antibodies. Few mentioned the effects on cheese or yogurt making.

Question 3 Option Two

This was the less popular option.

- (a) (i) The source of calcium was most often given as “limestone” or “addition of lime”, although “CAN” did feature occasionally. Most candidates earned the marks here.
 - (ii) For the two processes, many candidates mentioned cation exchange alone, and did not give a second process; some gave “limestone”, as the only process. Very few candidates even attempted to give two processes. Some referred to “osmosis” or “active transport” as processes.

- (b) Many candidates described both terms, parasite and deficiency, correctly, but did not give the second point. Only the stronger candidates got all of the marks

for both. A common error for deficiency was lack of “nutrient”, though the better answers had “mineral” or a named mineral, or “vitamin”.

Some candidates answered the second part of the question by describing the cause, symptom and control of both hoose and grass tetany, even though only one disease was required to be addressed. A number of candidates described “fluke” under the headings; and some gave “calcium deficiency” as the cause of grass tetany.

A number of candidates omitted the second part, and did not describe either disease.

- (c) Most candidates gave one or two correct reasons for the low rate of seedling establishment, among them “cold soil”, “drought”, “soil compaction”, “waterlogging” and “pests”. Many gave vague answers referring to weather or climate without giving specific conditions. There was very little reference to soil type or disease.

Question 4

Parts (a), the soil experiment, and (b), the earthworms, were the most popular choices; part (c), the rate of transpiration was next in popularity, while part (d), the digestibility experiment, was the least often attempted.

- (a) The soil texture experiment was well answered. Of the different methods to be chosen from, the sedimentation test, using the graduated cylinder, and the ‘feel’ method were roughly equal in popularity, with very few using the soil sieve method. Some candidates gave a combination of points from the different methods. Those who chose the sedimentation test scored higher in general. The last point was missed by many who failed to mention ‘measure the sand, silt and clay’; most got five correct points. For the ‘feel’ method, many candidates failed to give enough points for full marks, often giving just three or four points. The descriptions often ended at “rolling soil into a thread”, followed by a result and a conclusion.
- (b) The estimate of earthworm numbers was usually well described, earning high marks for most candidates who attempted it. Many scored full marks, giving all of the main procedural points. The most common omission was the final calculation where some candidates failed to multiply by the number of square metres in the field. A small number of candidates described the setting up of a wormery.
- (c) Many candidates described the wrong experiment for transpiration; the demonstration of transpiration using a potted plant covered by a plastic bag was described by many candidates who attempted this part; or the use of a stick of celery in food dye. Those candidates got just a couple of correct points which were in common with the correct experiment. Those who correctly described the use of a potometer to measure the rate of transpiration generally got good marks, giving most of the procedural points required.

- (d) The experiment on digestibility of barley was the least popular of the four. The method involving the feeding of two cows was the one most often described by those who attempted this. Most of those scored well; some lost marks by describing feeding the cows for a number of weeks and recording their weight. The laboratory experiment using amylase was rarely mentioned.

Question 5

This was a popular question and was answered well by most candidates.

- (a) (i) The role of the raddling harness was generally well known, though a number of candidates failed to get the second point. The most common answer was “to identify ewes that had been mated”. Some gave the “colour change every 17 days”, though a few got the number of days wrong. A common misconception was that the harness was a form of restraint used when handling sheep.
(ii) Footrot was well known, and among the points given were “bacterial”, “contagious”, “pain”, and “lame”. Again many got just a single point. Some described it as a fungal disease. The stronger answers gave more than two points for this.
- (b) (i) Most candidates were able to give three correct reasons for reseeded, including the improvement of “palatability” and “productivity”; also “weeds”, “poaching” and “overgrazing” were given. Some mentioned soil factors, but the points mentioned were the usual range of answers.
(ii) The seed mixture was very well answered, with most candidates getting both points for “perennial ryegrass” and “clover”; some gave “Italian ryegrass”, and some named all three. “Timothy” was mentioned occasionally, but other grasses were rarely mentioned.
- (c) The leaf-to-stem ratio was poorly answered, with most candidates giving only one correct point. Among the correct points given were “higher DMD”, “higher protein”, “more sugar” for leafy grass; there were some references to “more cellulose” in stems also. Many of the answers were vague, showing a lack of understanding of the question; some just described the process of silage making.

Question 6

This was not a popular question and was answered poorly by many who attempted it.

- (a) Most candidates got three correct points for blight control but failed to get the last point; many of those gave “rotation” as a control. Among the correct points given were “spraying”, “earthing-up”, “using certified seed” and “burning off stalks”. Some gave “herbicide” as the spray instead of fungicide, and a small number blamed aphids for spreading blight and suggested ladybirds as a control.
- (b) Little was known about scutch grass, and candidates who attempted it seldom gave more than two correct points. “Difficult to control” was the most common

answer, also “use a selective herbicide” and “competes with the crop”, with some giving an example of competition. The other points in the scheme like “rhizome”, “underground” and “vegetative propagation” were rarely mentioned. Some referred to it as an inferior grass in a pasture.

- (c) (i) Few gave two correct points for plough pan, often confusing it with iron pan. A few considered it part of a plough. The better answers included points like “ploughing to the same depth”, and “deep ploughing”, with candidates generally giving one of those points.
- (ii) The compulsory point for nitrogen fixation was not always given in the answer, so many were rewarded for only one correct point; some of these had two or more correct points. The stronger answers mostly had “changing nitrogen to nitrates” and “role of clover”. Few mentioned “symbiotic/mutualistic” or named a bacterium. Some produced a detailed diagram of the nitrogen cycle.
- (d) Few got full marks for this part, although most gave two correct points for stating a number of seeds and multiplying to get 1000 seeds. Many also had “weighing”. It was often confused with a seed germination experiment. Very few named a cereal.

Question 7

The genetic cross in part (b) was very well answered by many candidates, but the definitions in parts (a) and (c) were poorly answered. This resulted in low scores for this question.

- (a) The freemartin condition was not attempted by many candidates, and was only answered correctly by a handful.
- Hermaphrodite was very well known, with most giving two correct points for “male and female organs” and an example, usually “liver fluke” or “earthworm”. The other points on the scheme were rarely mentioned.
- Artificial selection generally earned 2 marks for one correct point, “used by breeders” being the most common; some gave a second correct point for “desirable characteristics”. Some confused this term with natural selection, and a few confused it with artificial insemination.
- ‘Pedigree animal’ was answered well, with most getting at least one point and many getting full marks for “pure-breeding” or “homozygous” and “desirable characteristics” or “have papers”. The other points did not appear often.
- (b) (i) This was generally answered correctly to earn the full 4 marks. Errors included Bb and Bb as the parents, and in some cases a di-hybrid cross was described.
- (ii) Those who got the parents right in part (i) got most or all of the marks here. A minority failed to draw a Punnett square but otherwise it was answered correctly. Some omitted the phenotypes of the offspring.
- (iii) Very few got this right, with “monohybrid” coming up regularly; some gave “di-hybrid”, but the correct answer “backcross” or “testcross” was rarely given.

- (c) (i) Polyploidy was poorly explained, many giving just one correct point for “3n” or “multiple copies of chromosomes” but few getting full marks. A few candidates gave “mutations”.
- (ii) Many named a plant but did not match it with a type of ploidy, thereby failing to earn marks. The better answers had “triploid” or “tetraploid” here but most failed to give an example; 3 marks was the common award.
- (d) Many gave one correct point for the calving difficulty index; the most frequent answer was “first time calver”, with “supervised calving” and “cost to farmer” also coming up. Some named a breed, “Jersey cow” or “Angus bull”, but the point referring to scientific accuracy was rarely mentioned. Some confused this with artificial insemination.

Question 8

This was the second most-often attempted and third highest-scoring question. Parts (b) and part (c) being better answered than part (a).

- (a) This was the least popular choice and most of those who attempted it struggled to get the required number of points. Some scored well by naming a breed of ewe, “Blackface” or “halfbred”, and a breed of ram, “Suffolk” mostly, with “purebred” added as an extra point. Other correct points, which came up, included “prolific” and “mothering qualities” for ewes and “carcass quality” for the ram. Two or three points was the usual outcome.
- (b) This part was very well answered with many giving the full equations for both photosynthesis and respiration, thereby obtaining full marks. Those who did not give the equations got marks for “needs chlorophyll” and “needs light” for photosynthesis, and “does not need chlorophyll” or “does not need light” or “uses oxygen” for respiration. Some candidates described detailed biochemical pathways for each process. A small number of candidates confused the two processes.
- (c) Most candidates were able to give correct differences for three of the pairs of terms here; the stronger candidates gave two correct points for each to get full marks for this part. However, a large number failed to give a second correct point for some of the terms.
- (i) Most gave two correct points for farrowing house, but only one for fattening house. For the former, the most frequent points given were “litter born”, “farrowing crate”, “infra-red lamp” and “20° C”. For fattening house, “22 degrees”, “last house before slaughter” and “ad lib feeding” were among the points that came up. Many just said it was for “fattening pigs”.
- (ii) Some interpreted zero grazing as letting land go fallow; stronger candidates got two correct points for “animals kept inside”, “grass cut” and an extra point “fed inside” in many cases. The other points did not come up. Creep grazing was

well answered, with the points “gap in the fence”, “access for young” and “return to suckle” coming up regularly. Some confused this with strip grazing.

(iii) This was the least popular part, and for those who attempted it, answers for bull beef were better than for heifer beef. For bull beef common points given included “without castration”, “better growth rates”, “dangerous” and “need a high quality diet”. For heifer beef, only one correct point was given by most candidates; among those points were “lower slaughter weights” or “correct weight gain” or “smaller”. Some confused this with replacement heifers.

(iv) Ectoparasites and endoparasites were explained correctly in almost all cases, many getting both points by also giving correct examples. The most commonly seen examples were “tick” for ectoparasite and “fluke” for endoparasite. Few other examples were given. A number of candidates just defined the terms and did not give an example, thus losing marks for the second required point.

Question 9

The standard of answering here was poor when compared to previous years. Indeed this was the third least-often attempted and the lowest-scoring of all the questions. Many candidates exhibited difficulty with parts (d) and (e) particularly, struggling to get more than one correct point for each of these.

- (a) Only the most able candidates got the full 12 marks here, most getting one or two correct points only. The common answers included “allowing blood to drain”, often the only correct point, “hygiene risk” or “improve meat quality”. Very few mentioned “lactic acid” or “break down tough fibres”. Some interpreted fasting as a method of “losing weight before slaughter”. There were many long vague answers about slaughter without any relevant points.
- (b) This was one of the better known and more popular parts, with most candidates giving points on water pollution; among those were “slurry” or “silage effluent”, “decrease in oxygen”, “algal bloom”, “bacteria” and “high BOD”. Full marks were common for this, with most getting at least 8 marks. Some candidates referred to over-fishing and tourism as the cause of fish kills.
- (c) Some got full marks for saying the Holstein is “a dairy breed”, with “milk yield too high” and “causes scour in calves”. A few gave “not winter hardy”. Some errors included “not enough milk”, “not a good dairy breed” and “good beef quality”.
- (d) Most candidates just got one correct point for “protein” in soya bean meal, with some also giving “muscle growth” and “contains lysine”. A small number mentioned that soya “complements cereals”. Some referred to “energy” rather than protein. There was no mention of methionine.
- (e) This was very poorly answered, most candidates giving long and vague answers. The most common correct point was “deciduous lose their leaves and conifers don’t”. Most got just this one point. Many gave long answers referring to shelter, without distinguishing the trees. The other points rarely came up.

4.4 Conclusions

- Almost 93% of candidates achieved a grade D or better in this examination.
- The best-answered questions were Questions 4, 5 and 8.
- The experiments in Question 4 were well answered. Full marks were achieved here more often than for any other question.
- The answering of questions involving definitions was poor this year.
- The standard of answering for Question 9 was lower than in previous years, with many candidates giving just one point for each part.
- Similarly, very few candidates achieved full marks for Question 1; some examiners reported just one or two such achievements. It was noted by examiners that more candidates than usual attempted more than the required six parts. Most failed to get the last point in many of the question parts.
- A common weakness this year was the tendency to omit sections of questions, resulting in lower totals for some of the most frequently attempted questions. Possibly in an effort to compensate for this, candidates attempted more than six questions.
- Another weakness shown by some candidates was an inability to relate topics to farming. This was often the case for Question 9 (b), where fish kills were not related to farming practices, but rather to overfishing or other practices.
- There was also some evidence of confusion of terms; many confused ‘development of soil structure’ in Question 2 (a) with ‘formation of soil’ and failed to get any marks. A minority confused photosynthesis and respiration.
- An average mark equivalent to 40% or better was achieved in seven of the nine questions with Questions 6 and 9, with equivalents of 33.75% and 36.46% respectively, being the only exceptions.
- In general, candidates followed the instructions on the examination paper correctly and attempted to answer the question that was being asked. A number of instances occurred in which candidates misinterpreted questions and/or gave irrelevant answers. Otherwise, in the vast majority of cases the manner in which candidates presented material was satisfactory.

4.5 Recommendations to Teachers and Students

It is recommended that teachers ensure:

- that students cover all topics in appropriate depth
- that students are well practised in reading questions fully and carefully to elucidate key points
- that students are well practised in following instructions in questions
- that students do not rely on any key word or form of such word included in a term when defining or explaining the meaning of the term e.g. if *deficiency* is to be defined or explained, perhaps in the context of a deficiency disease, do not rely in an answer on the word 'deficient' or any of its forms
- that practical activities are carried out by students in field and laboratory and that students understand the reasons behind the various steps in each activity
- that students understand the concept of a control in an experiment and the difference between the result and the conclusion of an experiment, and that all are accurately given in descriptions of experimental work
- that students understand the importance of drawing labelled diagrams when describing an experiment
- that students are well practised in explaining the meanings of terms and the difference between terms that have the potential to be confusing e.g. 'plough pan' and 'iron pan'
- that students know to quote accurate specific figures or narrow ranges where appropriate e.g. for birth-weights, live-weight gain, yields, age at slaughter
- that students know that Question 1 carries more marks than any other question and that it should always be attempted
- that students know that they should attempt at least the required number of questions and parts of questions in order to maximise their marks.

It is recommended that students:

- use past examination papers for practise
- read questions fully and carefully so it is clear what exactly is being asked
- follow instructions in questions
- practise drawing large, tidy, accurate diagrams and labelling their parts clearly
- learn to explain the difference between potentially confusing terms
- learn to define terms without relying on key words from the term
- learn the reasons behind all steps in practical activities
- learn the significance of a control and the difference between the result and the conclusion in scientific experiments and use these concepts accurately in examination answers.