LEAVING CERTIFICATE EXAMINATION

2001

BIOLOGY

HIGHER AND ORDINARY LEVELS

CHIEF EXAMINER'S REPORT

1. INTRODUCTION

This subject is assessed by means of a terminal written examination paper. The paper is divided into two parts, Part I and Part II. Part I is allocated 120 marks and Part II is allocated 280 marks. Candidates are required to answer six questions from seven in Part I, each question being allocated a maximum of 20 marks. Candidates are required to answer four questions from eight in Part II, each question being allocated a maximum of 70 marks.

2. PERFORMANCE OF CANDIDATES

Biology was taken by 24 059 candidates in the Leaving Certificate in 2001. This represented 42% of the total Leaving Certificate cohort of 56 686.

Higher Level

The Higher level paper was taken by 14 582 candidates (61% of the total number taking Biology). The numbers and percentages achieving each grade are outlined in Table 1.

Table 1 **Numbers and percentages achieving each grade in Leaving Certificate Biology Higher level 2001**

Grade	A	B	C	D	E	F	NG	Total
Number	1891	3831	4344	3265	983	245	23	14582
Percentage	13.0	26.2	29.8	22.5	6.7	1.7	0.2	

The grades achieved by candidates in the years 1999-2001 are outlined in the Appendix.

Ordinary Level

The Ordinary level paper was taken by 9477 candidates (39% of the total number taking Biology). The numbers and percentages achieving each grade are outlined in Table 2.

Table 2 **Numbers and percentages achieving each grade in Leaving Certificate Biology Ordinary level 2001**

Grade	A	B	C	D	E	F	NG	Total
Number	304	1643	2731	2661	1242	763	133	9477
Percentage	3.2	17.3	28.8	28.1	13.1	8.1	1.4	

The grades achieved by candidates in the years 1999-2001 are outlined in the Appendix . The cumulative percentage of E, F, NG was higher in 2001 than in either of the previous two years. A statistical analysis of the total grade distribution, however, showed no significant variation in the normal distribution around the mean.

3. ANALYSIS OF PAPERS

Higher Level

Table 3 outlines the popularity of questions in terms of the percentage of candidates attempting each question and the performance of candidates in terms of the average mark achieved in each question. The analysis is based on a random sample of 860 scripts.

Table 3 **Popularity of questions and performance of candidates in Leaving Certificate Biology Higher level 2001**

	Question Number	Popularity		Performance	
		Attempt Rate %	Rank Order	Average Mark	Rank Order
Part I	1	99.1	1	15.3	1
	2	96.3	3	12.3	3
	3	98.0	2	9.6	4
	4	94.2	5	9.3	5
	5	84.5	7	8.6	6
	6	95.2	4	12.4	2
	7	89.6	6	7.6	7
Part II	8	50.9	7	41.7	3
	9	21.3	8	34.2	6
	10	59.2	4	37.9	5
	11	51.3	6	32.4	7
	12	72.5	1	29.1	8
	13	54.6	5	48.5	1
	14	65.8	3	45.6	2
	15	70.0	2	39.7	4

Part I

Q.1 This question was attempted by the vast majority of candidates and it was generally well answered. The main errors were:

(i) sulphur instead of nitrogen;

(ii) 24 instead of 23;

(iii) iron instead of calcium;

(iv) pacemaker.

Q.2 This question was also very popular. The main errors were:

(i) 'potato blight' was given instead of *Phytophthora* or 'potato blight fungus';

(ii) 'tube feet' as a characteristic of echinoderms was not generally known.

Q.3 Although this was a popular question, the standard of answering was not good.

Labels A, B and C were frequently named incorrectly. Many candidates were unable to give two functions of the skin. Marks were not awarded for 'protection' on its own as a function of the skin – the marking scheme required a qualification, e.g. protection against UV radiation, infection, etc. The concept of a germ layer was poorly understood and many candidates listed the germ layers only.

Q.4 The quality of answering in this question ranged from extremely poor to excellent. The main difficulty was in (b), where the required comments on otoliths were often incorrect. Candidates also lost marks in (e) by failing to qualify the stored sperm as those of the partner.

Q.5 This was not a popular question. It was answered by slightly less than two thirds of the candidates. The completion of the diagram was generally satisfactory but the labelling was poor. Few candidates were able to label deoxyribose or phosphate. Whilst candidates explained replication, few were able to explain its significance.

Q.6 This question was popular and generally well answered. Some candidates had difficulty in naming the hormones, in particular oxytocin.

Q.7 This was an unpopular and generally poorly answered question. Marks were lost in the following cases.

(i) Peptide was defined in terms of peptide link and protein as a food group.

(ii) Very few candidates were able to mention fibrinogen as the precursor of fibrin.

(iii) Both terms (urethra and ureter) caused problems and were even confused with the uterus.

(iv) Cerebrum and cerebellum were quite frequently confused and the functions of the medulla were often given for the functions of the cerebellum.

(v) Failure to mention plant or cell wall was the main reason for loss of marks.

Part II

Q.8 Approximately half of the candidates attempted this question on genetics and the average mark achieved was 41.7.

(a) The definitions of 'haploid' and 'autosomes' presented some difficulty. 'Haploid' was commonly defined as 'half diploid'.

(b) Most candidates showed a mastery of the mechanics of the dihybrid cross.

(c) Most candidates selected evidence from the fossil record and took the evolution of the modern horse as an example.

Q.9 This question centred on elementary areas of plant physiology. It was the least popular question in Part II. The main problem areas were as follows.

(a) Some candidates were unable to distinguish between 'transpiration' and 'transpiration stream'. Marks were also lost because water vapour was not mentioned in relation to transpiration.

(b) A significant number of candidates described an experiment that investigated the effect of changing light intensity on the rate of photosynthesis. Many candidates were unable to sketch a correct graph.

(c) Few candidates showed a full understanding of plasmolysis and related the shrinkage of the cytoplasm to water loss. Very few candidates scored full marks on food preservation because of a failure to mention salting or sugaring.

Q.10 This question on animal structure and insect metamorphosis was popular and ranked fifth in average mark attained. Part (b), however, caused some problems.

(i) Few candidates associated 'chitin' with 'fungi'.

(ii) Suggested reasons for water intake during ecdysis were poor.

(iii) There was much confusion between 'life cycle' and 'metamorphosis' and many candidates regarded the two terms as synonymous. Few candidates mentioned the change of a larva into an adult, and instead gave examples.

Q.11 This question on microbiology was not popular, with less than half the candidates attempting it.

The main difficulties arose in part (a).

(i) Definitions of a virus were generally poor. Some candidates merely mentioned that a virus is an obligate parasite and few could state two differences between a virus and a bacterium.

(ii) The biological basis of vaccination was very poorly answered.

(iii) Most candidates failed to explain antibiotic satisfactorily and mentioned simply preventing disease or infection.

The answers to (b) were very varied in quality.

Q.12 Although this question was very popular, the standard of answering was generally very poor.

(a) There was a general inability to relate apical dominance to the observation. There were many incorrect statements, e.g. 'capillaries dilating' and 'blood vessels moving to surface'.

(b) There was vague reference to spores in the soil but little mention of the significance of infected tubers in the soil.

(c) There was little awareness of the relationship between high humidity and guttation.

(d) There was little mention of a zygospore or of its germination under favourable environmental circumstances.

(e) There was insufficient detail in statements such as 'liver fluke won't survive without water'.

(f) There were few references to lactic acid or oxygen debt.

(g) Most candidates performed well on this question but some lost marks with such statements as, 'no carbon dioxide being produced'.

(h) There was considerable confusion between long sight and short sight.

(i) Many candidates had no idea of sex linkage.

Q.13 This was not a very popular question but was generally well answered and provided the highest average mark in Part II.

Part (a) provided few difficulties for candidates but marks were lost in (i) for giving simply 'field' or 'garden' as the chosen habitat.

Marks were lost in part (b) for the following reasons:

(i) providing one answer only;

(iii) use of a Bunsen burner instead of an oven;

(iv) confusion between types of soil components and types of soil particles.

Q.14 This was one of the most popular questions in Part II and was generally well answered.

(a) Some candidates lost marks due to a failure to indicate the metabolic origin of excretory matter in (i) and the role of the contractile vacuole in excretion in (ii). Few of the candidates who opted for *Amoeba* mentioned diffusion of waste matter.

(b) This was well answered and diagrams of the nephron were generally of a good quality, although the associated vascular supply was less well done. A common problem was the failure to connect the efferent arteriole to the capillary supply of the nephron.

(c) This was generally well answered with the exception of (iii), where candidates gave only one difference between 'glomerular filtrate' and 'blood'.

Q.15 (a) This was the least popular part of this question and was not generally well answered. Explanations of 'dormant period' were not specific enough.

Many candidates failed to get marks for the labels in (iii).

In section (iv), the experiment was poorly described, with many candidates failing to mention warmth or a method for removing oxygen.

(b) This part posed few problems for candidates. Few mentioned ‘enzyme action’ in the ileum and concentrated instead on absorption in some detail. The quality of diagrams of a villus was generally very good.

(c) This was a popular and well-answered section. Diagrams of the chloroplast were very good, with the absence of a double membrane being the main error. A number of candidates failed to place an X on the diagram as required.

Descriptions of the events of the dark phase were good.

(d) This part was popular and well answered. Marks were lost by candidates failing to explain ‘heterogamy’ in section (iv). Section (v) also proved difficult for candidates – a common error was to interpret ‘evolution of the sporophyte’ as ‘development of the sporophyte’.

Ordinary Level

Table 4 outlines the popularity of questions in terms of the percentage of candidates attempting each question and the performance of candidates in terms of the average mark achieved in each question. The analysis is based on a random sample of 520 scripts.

Table 4 **Popularity of questions and performance of candidates in Leaving Certificate Biology Ordinary level 2001**

	Question Number	Popularity		Performance	
		Attempt Rate %	Rank Order	Average Mark	Rank Order
Part I	**1**	94%	3	11.2	4
	2	96%	1	11.9	2
	3	87%	6	7.8	5
	4	96%	1	12.6	1
	5	66%	7	6.2	7
	6	94%	3	11.4	3
	7	89%	5	6.7	6
Part II	**8**	78%	1	33.6	5
	9	52%	5	35.2	4
	10	40%	7	37.8	1
	11	26%	8	31.7	6
	12	65%	2	37.4	3
	13	56%	4	31.1	7
	14	50%	6	31.0	8
	15	60%	3	37.7	2

Part I

Q. 1 This scored an average mark of 11.2, which was disappointing in view of the fact that all the questions had been asked previously. The meaning of ‘geotropism’ and the test for carbon dioxide posed most problems.

Q.2 This question required the candidate to tick a True or False box next to a number of statements. The average mark scored was 11.9, ranking the question second in terms of average score in this part of the paper. A number of candidates omitted to mark either box in some of the statements.

Q.3 This question dealt with the standard test for starch in a leaf. It ranked sixth in popularity and scored an average mark of 7.8. The word ‘variegated’ seemed to have caused problems. A number of candidates had right answers but inserted them in the wrong locations on the question paper. The last part of the question was problematic as many candidates did not realise that there would be two separate results (depending on which part of the variegated leaf was being tested).

Q.4 This multiple choice question dealt with mammalian physiology, co-ordination and genetics, and scored the highest average mark (12.6) in Part I.
The number of chromosomes in a skin cell caused most problems.

Q.5 The transverse section of a root proved an unpopular topic for candidates and scored the lowest average mark. Few candidates identified B (endodermis) and many had difficulty with the functions of A (root hair) and D (phloem).

Q.6 This question on the human male reproductive system scored an average mark of 11.4. A (prostate) and B (vas deferens or sperm duct) caused most problems.

Q.7 This standard question on the eye scored an average mark of 6.7.
B (aqueous humour) and D (fovea) were not generally known and few candidates could give the function of the iris.

Part II

Q. 8 This question dealt with food and digestion. A Junior Certificate Science Ordinary level candidate would be expected to be able to answer most of parts (a) and (c). Candidates in this examination, however, scored an average mark of 33.6 (48%) only. Diagrams of a vertical section of a human tooth were generally poor. The concept of an experimental control was poorly understood. A number of candidates named individual minerals as other parts of the diet (apart from minerals).

Q. 9 This question on ecology was only fifth in popularity and scored an average mark of 37.2. In (a), few candidates managed to define three basic terms as used in ecology. The sketch map was reasonably well done but most candidates omitted to include the N cardinal point. Many candidates could not explain how to use a quadrat. The part of the question that caused most difficulty, however, was the experiment to estimate the percentage volume of air in soil.

Q.10 The average mark for the answer to the question on genetics has improved in the recent past, mainly due its more 'student-friendly' layout. It was noted that a number of candidates defined the term 'locus' as an insect! It was also noted that a number of candidates failed to give the phenotypes of the crosses. Part (c) caused a number of problems, such as candidates drawing two other stages of mitosis other than those required.

Q.11 This question on microbiology was the least popular question in Part II. Candidates had difficulty in describing how *Rhizopus* obtains its food and also in describing its asexual reproduction (answers were mostly limited to 'spores are released and produce new plants'). Part (c) on immunity proved particularly difficult.

Q.12 This question on *Spirogyra* and the insect was popular and reasonably well answered. Definitions of 'ecdysis' and 'metamorphosis' proved difficult for a number of candidates.

Q.13 The answers to this question scored a low average mark of 31.1. Parts (a) and (b) (blood circulatory system and vessels) proved the most problematic. Candidates scored well on part (c) – the experiment on the effect of exercise on heart rate.

Q.14 This question scored the lowest average mark (31.0). In spite of the question allowing for a word equation for photosynthesis, this equation proved difficult for many candidates. Many candidates had difficulty with the purpose of the water bath and in determining the rate of photosynthesis. In part (b) some candidates did not use the names of the parts that were given when drawing the diagram and others used names that were not required. The standard of answering in part (c) (separation of plant pigments) was poor.

Q. 15 This was the third most popular question and scored the second highest average mark (37.7).

(a) This was a popular part of the question, although the experiment created difficulties for a number of candidates.

(b) This was poorly answered – many candidates drew an outline diagram of a plant instead of a more detailed diagram of a flower. Candidates confused 'seed dispersal' with 'pollination'.

(c) This was by far the least popular part of the question and the standard of answering was generally poor. While many candidates mentioned an enzyme (amylase), a substrate (starch), and iodine to indicate the presence of starch, few were able to describe in any meaningful way how the experiment should proceed.

(d) This was a popular part of the question and was generally well answered.

4. OVERALL COMMENTS

There was a marked tendency for candidates to avoid questions on plant physiology (OL Q.14, HL Q.9), notwithstanding the fact that this forms a significant part of the Leaving Certificate Biology course. The average mark awarded was the lowest at Ordinary level and sixth of eight at Higher level.

The average mark awarded for the question on genetics was the highest in Part II at Ordinary level, though the question was attempted by only 40% of candidates. This high average mark represents a positive development, as this topic was generally poorly answered in the past and was often avoided.

There is continuing evidence of candidates' unfamiliarity with experimental work as shown by the answering in Questions 8, 14(a) and (b), 15 (a) and (c) at Ordinary level and Questions 9(b) and 15(a) at Higher level.

The diagrams at Ordinary level were often of a very poor quality.

5. RECOMMENDATIONS FOR TEACHERS AND STUDENTS

Plant physiology forms a significant part of the Biology syllabus [Section 4 (b), (c), (g)]. It is recommended that an appropriate amount of time be allocated to the teaching and learning of this section and that relevant experimental work be undertaken in class.

The change in the nature of the question on genetics on the Ordinary level paper in recent years has led to a gradual improvement in performance of candidates. It is recommended that all Ordinary level pupils study this important topic.

APPENDIX

Table 5. **Grade distribution by percentage of results in Leaving Certificate Higher level Biology for the years 1999-2001**

Grade	A	B	C	D	E	F	NG
1999	11.7	28.4	30.4	21.6	6.0	1.7	0.3
2000	9.4	27.1	32.8	22.9	6.1	1.5	0.2
2001	13.0	26.2	29.8	22.5	6.7	1.7	0.2

Table 6. **Grade distribution by percentage of results in Leaving Certificate Ordinary level Biology for the years 1999-2001**

Grade	A	B	C	D	E	F	NG
1999	1.7	15.0	30.2	31.1	14.3	6.8	1.0
2000	3.8	20.0	26.9	27.4	13.2	7.4	1.3
2001	3.2	17.4	28.7	28.1	13.1	8.1	1.4