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Marking Schedule and Examination Commentary 2002

BIOLOGY

University Entrance, Bursaries and Scholarships Examination

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Marking Schedule and Examination Commentary

INTRODUCTION

This report is written to assist teachers and future candidates in University Bursaries Biology. Comments and guidelines to aid in preparation for future exams are given following the marking schedule for each section.

Overall, markers were very satisfied with the standard of this year's paper. Continuing the trend of recent University Bursaries Biology papers, the longer answer questions required candidates to show their understanding of biological concepts and processes by linking together and discussing ideas. Many candidates found this a challenge, and instead gave answers that consisted of isolated facts and ideas. They were able to 'describe', but struggled with questions requiring them to 'explain', 'discuss' or 'evaluate'. Candidates need to be familiar with the key verbs used in questions, such as describe, compare, contrast, explain, and define.

Candidates who gained over 100 marks in the paper used correct terminology, and their length of answer was appropriate to the number of marks allocated. To score good marks, candidates needed to have in-depth biological knowledge and be able to use biological terms precisely.

MARKING SCHEDULE

SECTION 1: ANIMAL BEHAVIOUR AND PLANT RESPONSES (50 marks)

Question One (13 marks)

(a) Photoperiodism. *(not photoperiod)* [1]

(b) Ensures flowering at a time when pollinators are available/Flowers in suitable environmental conditions for seed production or germination/Time of flowering coordinated for plants of the same species to ensure pollination. *(Any two)* [2]

(c) Leaf fall/bud dormancy/bulb and tuber formation/formation of runners in strawberries/chlorophyll synthesis/dormancy/vernalisation/germination. *(Any one)* [1]

(d) Long day plant [1]

(e) When the length of the night **exceeds** a certain period [1]

(f) Cocklebur has a CDL of **at least** 12 hours/the night length that triggers flowering is ≤ 12 hours (1). (When day and night length are equal) day length is less than the CDL/night length exceeds critical length/nights getting longer so cocklebur flowers (1) [2]

(g) March (1). May (1). [2]

(h) D [1]

(i) It will flower/nothing (ie no effect on flowering) (1) because **length of darkness not length of day** triggers flowering (1). [2]

Comment

This question appeared to be a straightforward question on photoperiodism but this was not borne out by the marks. A large proportion of the candidates gave answers that indicated only a very basic understanding of the concept. The common description of the factor regulating flowering in short-day plants (SDP) as long nights, does not explain SDP with a critical day length (CDL) of over 12, eg poinsettia (13 hours). Recognising this was crucial to the correct answers for (e) and (f).

(a)–(b) Answered well.

(c) The majority of incorrect answers were examples of processes controlled by day/night or light intensity, eg photosynthesis, opening of flowers.

(d) Most candidates answered this correctly

(e) The answer given in the marking schedule is the only one that accurately describes flowering in all short day-plants, including those with a CDL of greater than 12 hours. Many candidates simply wrote 'long nights'.

(f) Correct answers here depended on a clear understanding of what a SDP is. Many candidates had a good understanding of the regulation of flowering but could not apply it to the specific example of a SDP flowering when day and night lengths are equal.

(g)–(h) Answered correctly by most candidates.

(i) Many candidates correctly recognised that flowering is unaffected but found the second mark more difficult.

Question Two (12 marks)

(a) Good food supply/safe place to: court/mate/rear young [1]

(b) **EITHER:** Other birds can identify the different territories (1) description of advantage of identifying territories, eg to avoid disputes/to challenge for a territory (1)
OR: Attract mates (1) different songs more attractive to females (1) [2]

(c) Male and females **look** very different [1]

(d) Indicates health/agility/alertness (can evade predators despite conspicuous colour)/selective advantage (1)
Passing on good genes (to offspring) (1) [2]

(e) Attracts a female/ensures mating with birds of same species/overcomes aggression/prepares male and female for successful mating/enables female to select best mate/establishes pair bond. *(Any two)* [2]

(f) Twelve-wired Bird of Paradise:
EITHER: more mixing of genes in offspring (1) greater variation in population (1)
OR: Fitter males likely to produce more offspring. [2]

Albatross:
EITHER: less energy/time invested in courtship behaviour (1) **more** time/energy into survival and raising young (1)
OR: no need for distinctive colouration (energy cost) (1) **more** energy for survival and raising young (1) [2]

Comment:
(a) Answered well by majority of candidates.
(b) Most candidates recognised that songs are used to identify territories but could not explain why this identification is useful.
(c) Many candidates gave examples of sexual dimorphism rather than a definition.
(d)–(e) Candidates generally had few problems with these questions.
(f) Many candidates did not provide answers that described the benefit to the species. Good candidates gave well-reasoned answers.

Question Three (11 marks)

(a) Movement (1) of the sun (1) [2]

(b) Nastic because sunflower response: is movement (not growth)/fast/temporary (1)
Tropic because response is directional (1)
Response is to sunlight (1)
(Answer needs to be more than a definition of photonastic and phototropic – must be linked to behaviour of the sunflower.) [3]

(c) Controlled endogenously (internally)/by an internal (biological) clock [1]

(d) Synchronise foraging with nectar production (1) *(not synchronise with when flower is open)*
Ensures maximum food/efficient use of time and energy for foraging (1) [2]

(e) Occurs approximately every 24 hours (*must have approximately or similar words that imply endogenous)* [1]

(f) Entrainment [1]

(g) Sunlight is a zeitgeber/resets the biological clock [1]

Comment:
A straightforward question. Candidates who knew the material achieved good marks. The second mark in (a) proved challenging with many candidates not mentioning that the sun was moving. From the answers to (b), it appears the differences between nastic and tropic response are not well understood. Some candidates gave correct definitions without applying their knowledge specifically to the sunflower.

Question Four (14 marks)

(a) Hierarchy [1]

(b) (i) Grooming – used to signal submissiveness/reduces aggression/indicate willingness to mate/bonding/establish or maintain hierarchy. (A*ny two)* (2)

(ii) Play fights – test relative strength/establish dominance/develop group hunting skills (defence skills)/establish or maintain position in the hierarchy. *(Any two)* (2) [4]

Prevents inbreeding/reduces chance of recessive mutations **showing**/introduces variation/only 'strong' young males survive to join a new pack so bring desirable genes with them/reduces aggression between males. *(Any two)* [2]

(c) B [1]

(d) Indicates the submissive status [1]
Minimises aggression/chance of injury/increases chance of getting food *(any one)* [1]

(e) Gains protection from the pack/benefits from pack hunting to get food/has more chance of finding a mate than if on own/warmth in numbers. *(Any two)* [2]

(f) Greater density of human population (1)
Less area for territory/less food/higher mortality (1) [2]

Comment:
Candidates generally scored well in this question. However, markers commented on a tendency in candidates' answers towards anthropomorphism rather than good biology.

SECTION 2: GENETICS AND EVOLUTION

(90 marks)

Question One (16 marks)

(a) **DNA** replication [1]

(b) (enzyme) joins nucleotides/bases (1) to complementary bases (on original DNA) (1) [2]

(c) DNA polymerase only works in the 3′ to 5′ direction/Nucleotides can only be added to the 3′ end of the new DNA strand/New strand is formed in the 5′ to 3′ direction/Replication occurs in opposite directions on each original strand/One strand replicated in fragments. *(Any two)* [2]

(d) Similarities
Both strands synthesised by DNA polymerase/use **same** base pairings (A-T, C-G)/**both** original strands copied 3′ → 5′/**both** new strands formed 5′ → 3′.
Differences
Strand B is synthesised continuously/Enzyme is moving in the same direction as the DNA unwinds or replication fork is forming/Strand C is synthesised in short segments (Okazaki fragments)/(DNA) ligase joins fragments/Strand B or C synthesised in opposite direction *(Any four ideas BUT if only mention ONE strand, maximum one mark.)* [4]

(e) Organisms grow by: cell division or mitosis or increasing the number of cells/New cells need a complete set of DNA/DNA needed for normal metabolic processes/DNA codes for proteins/for each new cell to have a set of DNA it must be replicated prior to the division. *(Any three ideas)* [3]

(f) (i) AAA (1)
(ii) AAA (1) [2]

(g) **EITHER:** Two bases and a triplet code = 8 combinations, enough to produce the 6 amino acids (2)
OR: Two bases and a doublet code only produces 4 different combinations (1) [2]

Comment:
It is disturbing to still see large numbers of candidates confusing DNA replication with protein synthesis.

(a)–(b) Answered correctly by most candidates.
(c) The significance of the 3′ and 5′ ends is not well understood. Many candidates knew that DNA replication is anti-parallel but took this to mean the direction of synthesis is different for each strand, ie 5′→3′ on one strand and 3′→5′ on the other.
(d) Candidates who had a good understanding of DNA replication generally gained full marks.
(e) Answers here suggest that DNA replication is being taught in isolation from its role in mitosis and meiosis.
(f) Easy marks for candidates who knew the relationship between DNA triplets and RNA codons. The most common answer was AAAAAAAAAAAAAAAAAA.
(g) This question required candidates to apply their knowledge of degeneracy in the genetic code to the specific scenario given in the question.

Question Two (8 marks)

(a) Protein synthesis/transcription **and** translation [1]

(b) (i) Enzymatic proteins: **catalysts** for chemical reactions/**speed up** chemical reactions/**control** conversion of substrate to end product *any one* (1)
(ii) Regulatory proteins: control processes inside organism, eg expression of genes (1) [2]

(c) End products/substrate/regulatory proteins control protein synthesis (1)
Presence/absence of these chemicals switches protein synthesis on and off (1) [2]

(d) Phenotype results from:
Genotype (1)
Structural proteins made or products of metabolic activity (1)
Modified by environmental factors (1) [3]

Comment:
(a) Answered well.
(b) Most candidates knew the function of enzymatic proteins. Regulatory proteins proved more difficult even with the resource material provided.
(c) The majority of candidates either did not recognise Process 2 as regulation of gene expression or, despite the resource material, did not know how to describe it.
(d) Most candidates gained one or two marks by using information from the diagram. Many missed the idea that the expression of the genotype is the foundation of phenotype.

Question Three (11 marks)

(a) (Ionising) radiation or named example/chemical mutagens or named example/viruses or named example/microorganisms or named example *(any one)* [1]

(b) Gene mutation changes the sequence of bases/changes the amino acids coded for/incorrect amino acid inserted into polypeptide *(any one)* (1). Changes shape of enzyme/active site (1) [2]

(c) Deletion of base causes reading frame shift *or words to that effect* (1). Polypeptide/protein produced will have very different structure/will not be produced/shorter/have no function (*Any*

one) (Second mark must link effect of mutation to functioning of the enzyme) (1)

Substitution of a base only affects one triplet/amino acid (1). Protein/polypeptide may still function if new amino acid is similar or not at key spot, eg active site/the triplet may still code for same amino acid. *(Any one)* (1)
(Second mark must link effect of mutation to functioning of the enzyme) [4]

(d) Must occur in gamete/reproductive tissue (1) to be inherited (1)
EITHER: Must be beneficial/convey some survival advantage (1) so is selected for (1)
OR neutral (1) so is not selected against (1) [4]

Comment:
(a) The majority of candidates had no problem with this question.
(b) Most candidates could describe what a gene mutation was but only the top candidates went on to explain how the mutation resulted in an ineffective enzyme.
(c) The majority of candidates understood the difference between the two types of mutation but found it difficult to explain the comparative effect on enzyme function.
(d) This question required candidates to draw together their knowledge of mutation, inheritance and natural selection. Some of the answers supplied contained fundamental errors such as only mutations on the sex chromosomes or that are sex linked can be inherited. Most candidates recognised the need for inheritance but then focused on the mutation needing to be not harmful rather than what is needed to make it spread (ie be beneficial)

Question Four (7 marks)

(a) (i) F1: all magenta-rose (1)
(ii)

	YR	Yr	yR	Yr
YR	YYRR Crimson	YYRr Orange red	YyRR Magenta	YyRr Magenta rose
Yr	YYRr Orange red	YYrr Yellow	YyRr Magenta rose	Yyrr Pale yellow
yR	YyRR Magenta	YyRr Magenta rose	yyRR White	yyRr White
yr	YyRr Magenta rose	Yyrr Pale yellow	yyRr White	yyrr White

Correct gametes (1) correct Punnett square (1).
(Gametes incorrect NO marks AT ALL)

F2
1 Crimson: 2 Magenta: 2 Orange red: 4 Magenta rose: 1 Yellow: 2 Pale yellow: 4 White
(All or nothing) (2) [4]

(b) Supplementary (1) or Epistasis
Polygenic (1) [2]

Comment:
In (a) (ii), the majority of candidates proved able to work their way through a standard Punnett square and gained full marks. Some candidates didn't give the phenotypes, only the number ratio. Most candidates recognised one of the two interactions in (b) with a few identifying both. Epistasis was accepted as an alternate answer for supplementary. It should be noted, however, that epistasis is now used to describe any interaction between two or more genes controlling one phenotype and covers a number of interactions including complementary and supplementary.

Question Five (9 marks)

(a) Within (same) species [1]

(b) **Environment**: Grow genetically identical trees (1) along the environmental gradient/in the different environmental conditions *(ie keep genetics the same, change environment)* (1)

Genetic: EITHER: Grow seeds/seedlings from the different sites (ie along the cline) (1) under the same environmental conditions (1)
OR: take seeds/seedlings from each end (1) and grow under the conditions at the opposite end *(ie keep environment the same, change genetics)* (1)

(All answers must imply use of more than one plant/seed) [4]

(c) Formation of a new species [1]

(d) There are no barriers either geographical or reproductive/gene flow is still occurring/still a common gene pool *(any one)* [1]

(e) Salt/wind/temperature/nutrients/drainage.
(Any two) not pH [2]

Comment:
(a) Most candidates answered this correctly.
(c) This question proved challenging to all but the top candidates. It required candidates to apply their knowledge of experimental design to the specific problem given. Most candidates recognised the need to change something but missed the idea of controlling the key variable. A few candidates recognised that DNA could be used to identify genetic variation. This was accepted as a correct answer although it is unrealistic due to the financial cost.

(c)–(e) Candidates with a sound knowledge of speciation generally had little problem with these questions.

Question Six (9 marks)

(a) Selection pressures = the environmental factors (1) that favour certain phenotypes/genotypes (1) *(or converse)*. As a result, only some individuals in a population successfully reproduce/ increases chance of selected alleles being passed on (1) [3]

(b) Individuals can't adapt because their genes do not change in response to selection pressures (1) Adaptations result from selection pressures acting on genetic variation in a **population** (1) (Over time gene) coding for the adaptation **predominates** in gene pool (1) [3]

(c) **EITHER:** to produce a plant with the yield and grain quality (of wheat) (1) with the tolerance to cold, dry winters (of rye) (1)
OR: to get the best characteristics of both species (1 mark only) [2]

(d) Induce chromosome doubling (amphidiploidy) [1]

Comment:
Many candidates found this question difficult.
(a) Most candidates could explain what selection pressures were but only a few related the effect of selection pressures to successful reproduction of the organism.
(b) This question tested candidates' understanding of a key principle in evolutionary biology – adaptation. Top candidates gave considered and precise answers. Unfortunately, too many answers showed fundamental errors such as 'adaptations are features that individuals can consciously change' or 'adaptations can change in a lifetime, eg individuals can acquire favourable adaptations through mutation'. Another common misconception, 'individuals can adapt but need a population to be able to reproduce and pass on their adaptation'.
(c) If candidates read this question carefully, they generally gained full marks.
(d) Candidates who knew their material had no problem with this question but some candidates appeared to have no idea what 'sterile' meant as their answers often contained the phrase 'fertilise with'.

Question Seven (14 marks)

(a) *Two of:*
Jaws: smaller, less robust/Face flatter
Teeth/Enamel smaller
Cranial capacity increased/bulging forehead
Zygomatic arch reduced
Brow ridges reduced
Foramen magnum more forward
Development of chin [2]

(b) Jaws: change in diet from seeds, fruit, plant material to meat/fire used to soften food (1) required smaller teeth and jaw muscles (1)

Teeth/Enamel: as for jaws

Zygomatic arch: as for jaws

Cranial capacity/forehead: development of language/speech (1), abstract thought (tool making, spirituality, art) (1)

Brow ridges: less stress from chewing (1) as jaw muscles reduced (1)

Foramen magnum: back of brain (occipital lobe) got bigger (2)

Chin – no possible answer
(Two matching answers to (a)) [4]

(c) Increase in brain size required more energy/ nutrients (1). **EITHER:** meat better source than plant material **OR:** cooking/hunting/tools: improved quality/quantity/consistent supply of food (1) [2]

(d) *Any three of:*
Tools – EITHER: better capture/butchering of animals/ digging of plants (1) Allowed more food to be found/wider range of food/more reliable food source (1)
OR: processing of food/food more edible (1) wider range of food could be eaten (1)

Fire – EITHER: killed microbes/disease organisms (1) increased range of food that could be eaten/improved storage ability (1)
OR: tenderised food/made it easier to digest (1) increased range of food that could be eaten/ more nutrients extracted from cooked food
OR: 'fire drives' in hunting/burn off vegetation to attract grazing and browsing animals (1) increased range of food that could be eaten (1)

Domestication of plants/animals (1) continuity of supply/looked after animals or crops are better quality (1)

Communication – development of cooperative hunting (1) could now catch larger animals/more successful hunting (1)

Settlements – trading of food/specialisation of roles, eg animal minders, tool makers (1) increased variety of diet (1)

(First mark describes effect of the cultural development, second mark links this to a ***description*** *of the improvement in the quality or quantity of food).* [6]

Comment:
A straightforward question straight from the prescription. Candidates who knew their material generally had little problem gaining good marks. Answers to (b) provided some very creative reasons as to why brow ridges reduced in size such as: 'no longer needed to protect the eyes from the sun once hominids

started walking upright' or 'once hominids moved from living in trees, brow ridges were no longer required to protect their eyes from branches'. Candidates who correctly described the change in the foramen magnum in (a) invariably gave as their reason in (b) as the evolution of bipedalism, failing to recognise that all the hominids shown were already bipedal. Only the better candidates gained full marks in (c), while many reversed the question by describing how increasing brain size contributed to a better diet. Part (d) required candidates to apply their knowledge of cultural evolution to the impact on diet. Answers from candidates who had a good understanding of cultural evolution were well thought out.

Question Eight (16 marks)

(a) Potassium-argon dating/Fission tracking: of rocks around the fossil/comparison to other fossils/knowing age of strata in which fossil found/description of magnetic reversal dating. (*NOT carbon dating*)
(*Any two*) [2]

(b) *Ardipithecus/Australopithecus* [1]

(c) Skull – foramen magnum central/reduced size of area for neck muscles attachment/nuchal area smaller/occipital condyles relatively forward. (*Any two*) (2)

Knee – increased valgus (carrying) angle/able to be fully straightened/enlarged lateral condyle (buttress of bone). (*Any two*) (2)

Foot – big toe now aligned with other toes (non-opposable) (1) development of 'arches'. (1)
[6]

(d) *Homo (H.) erectus/ergaster* [1]

(e) Created land bridges (*not froze oceans*)/removed geographical barrier (water) (1) allowed access to other continents/areas (1). (*Second mark only if first idea correct*) [2]

(f)

Multi-regional model	Replacement (Out of Africa) model
B	A
C	D

[4]

Comment:

(a) Carbon dating was a common answer here. Answers often showed a lack of understanding about how dating techniques work and what materials are dated. The second mark was hard to achieve, as two separate techniques were needed.

(b) Although the question asked only for the genus, many candidates gave a species name, which was often incorrect.

(c) Generally done well by most candidates but a surprising number only gave one characteristic.

(d) If candidates had got (b) correct, they generally were correct here.

(e) This question showed up the common misconceptions that ice ages caused oceans to freeze over so the hominids could walk over them or that they travelled on icebergs.

(f) Most candidates gained at least half marks in this question.

SECTION 3: TECHNIQUES AND PROCESSES IN MOLECULAR BIOTECHNOLOGY (20 marks)

Question One (11 marks)

(a) **All** the genetic information of an individual/organism/species (cell) [1]

(b) (i) transports DNA (gene) into **bacteria** (1) to make multiple copies of the DNA/to express the gene (1)
(ii) separates the **DNA** fragments (1) on the basis of length (size) (1) [4]

(c) Cuts at known base sequences/recognition site
Many different enzymes, each cuts specific base sequence
Cuts repeatedly at same recognition site
(*Any two*) [2]

(d) **EITHER:** CTT GCT GAA CGTG.
OR: GAA CGA CTT GCAC (*Inverse (1)*) [2]

(e) Can be used to identify location of mutations in genetic disorders/used to develop tests for genetic disorders/future treatment by correcting genetic mutations (gene therapy)/investigating evolutionary relationships (*any two*) [2]

Comment:

Candidates who had a good understanding of the topic and wrote detailed answers generally gained good marks. The answers to part (b) needed to go beyond the information provided in the resource material. For (c) the answer 'can be reused' was accepted, although it should be noted that restriction enzymes are not reused once all the DNA in the sample has been cut. For (d) the answer for either the original DNA fragment or the complementary strand was accepted. Candidates either had a good knowledge of the human genome project in (e) or thought it was something to do with DNA profiling.

Question Two (9 marks)

(a) Bacteria – contain plasmids that can be easily removed and modified/unicellular so any modified DNA absorbed will automatically be passed on to all offspring. (*Any one*) (1)

Plants – plants totipotent (any plant cell can form a new plant)/has naturally occurring vectors such as viruses and bacteria that exchange DNA with the plant (*Any one*) (1) [2]

(b) Protein too complex for bacteria to produce/human gene may be too big for plasmid/bacteria can't remove introns found in human genes (*Any one*) [1]

(c) (Micro) injection (1) into a **fertilised** egg cell (1) [2]

(d) 1. B
2. D
3. A
4. C [4]

Comment:
Many candidates found it difficult to describe the relative merits of genetically modifying bacteria and plants compared with animals (a)–(b). This knowledge underpins any understanding of the history of genetic modification and therefore needs to be included in a teaching programme. Candidates either knew how transgenic animals were produced, (c), or else described the method for producing transgenic bacteria. The majority of candidates got (d) correct.

SECTION 4: CONTEMPORARY BIOLOGICAL ISSUES – ESSAY (40 marks)

ESSAY MARKING SCHEDULE
TWO MARKS/30 + /10 = /40

(1) Following the given criteria (30 marks)

There are three aspects to be evaluated for this mark:
- the biological aspects relating to the issue
- the biological, ethical and social implications (where appropriate)
- essay addresses the question

VERY GOOD – All three aspects addressed well

30/28 A comprehensive, thorough and accurate coverage of all three aspects; argument supported by a range of accurately quoted facts and statistics; a wide range of appropriate biological terms used. As good as could be expected under examination conditions.
3 very good

27/25 All three aspects covered well and accurately; quotes plausible facts or statistics; uses appropriate biological terms. **3 good**

GOOD – All three aspects addressed

24/22 Two aspects covered well and accurately; one aspect may be adequate; quotes some plausible facts or statistics; uses some appropriate biological terms.
2 good, 1 adequate

21/19 Adequately covers points for all three aspects/two aspects covered well and accurately, one aspect attempted.
3 adequate / 2 good, 1 attempted

COMPETENT – Two/Three aspects attempted

18/16 Two aspects adequate, one weak coverage/ weak coverage of all three aspects.

15/13 Superficial coverage of three aspects/two aspects adequate, one missing.

POOR

12/10 Attempts to cover two or three aspects/may have covered only one aspect but covered well.

9/7 Some relevant points presented in an attempt at an essay.

INADEQUATE

6/4 Presented a few relevant points/not in essay format (ran out of time to write an essay).

0 No essay.

(2) Communicating knowledge and ideas clearly, concisely and logically. (10 marks)

10 **EXCELLENT** A comprehensive answer that is written with flair.

8 **VERY GOOD** Well structured, logical answer, no internal contradictions or repetitions, accurate grammar and spelling, wide command of language.

6 **GOOD** Minor weaknesses in one or two of the features above (including structure/logic)/ essay is incomplete.

4 **MEDIOCRE** Serious weaknesses in two or more of the features above (including structure/logic).

2 **POOR** Poorly structured essay, difficult to follow, very poor command of English.

Comments:
Candidates seemed better prepared for the essays this year, with most showing they had studied or researched the topic to some degree. The use of options in this year's topics highlighted those candidates who had a thorough understanding of their topic and were able to select relevant ideas and facts to answer the question. But still too many candidates wrote a pre-memorised essay that bore no relation to the question asked. Some attempted to answer the question by restating it in their introduction and/or conclusion but often the body of the essay contained no reference to the question or sometimes contradicted the option they had chosen to answer.

Most essays were well constructed and easy to follow. In all topics, the best essays were informative, interesting and all points were backed up with appropriate facts and statistics. They were a pleasure to read.

Biological Control
As in past years this topic was the most popular. Gorse, rabbits and possums were the main pests chosen.

Candidates need to be careful in their choice of a pest or weed as there are still essays being written that are not true examples of biological control, eg painted apple moth. Biological control is the use of one living organism such as a predator, parasite or micro-organism to control another. The spray being used on the painted apple moth (although biological in origin) is not a living organism, it is a biocide. Some candidates described trapping, hunting and poisons as biological control. Candidates choosing to look at biological control of possums must research this carefully to ensure they meet the intent of the topic.

Candidates must also be encouraged to locate the most up to date information on the status of their pest or weed.

Biodiversity in Aquatic Environments
This continues to be the least popular topic. It was pleasing to see more candidates writing about specific areas, although descriptions of the biodiversity must relate only to aquatic organisms not terrestrial.

Genetically Modified Organisms
The essays this year tended to be more factual than seen previously, especially from those arguing against GMOs (option 2). In both options, though, candidates had difficulty arguing from a New Zealand perspective. A surprising number of candidates seemed unaware of the existence of the moratorium on the release of genetically modified organisms.

GENERAL COMMENTS
Questions such as Section One, Question Three (b), Section Two, Questions One (g) and Five (b) required candidates to use their biological knowledge to explain the specific example given in the question. A large proportion of answers simply described the biology involved, indicating that the candidates had either not read the question carefully or did not know how to apply their knowledge to the specific example. The thinking that is required to be able to apply knowledge to an unfamiliar situation can be developed with practice.

Summary of Main Points for Essay Questions

How the essay topics relate to the aspects for marking	Biological Control		Biodiversity		GMOs	
Aspect 1: Describes biological aspects of issue.	• Current (and past) biological control methods.		• Current conservation methods.		• Describes the techniques involved in the development of GMOs (doesn't necessarily have to be a technique currently carried out in NZ).	
Aspect 2: Implications.	• Discusses implications (biological, ethical or social) of biological control methods.		• Discusses implications (biological, ethical or social) of protecting biological diversity in aquatic environments.		• Discusses implications (biological, ethical or social) of GMOs.	
Aspect 3: Answers the question. Discussion of implications supports essay option chosen (key ideas given here, there may be others) – Look for both ideas that answer question and unnecessary information.	**Option 1: More research into biological control**	**Option 2: Problems with biological control**	**Option 1: Support conservation measures**	**Option 2: Reduce conservation**	**Option 1: Increase GMO research**	**Option 2: Support moratorium**
	• NZ example • Gives reasons why there should be more research into biological control • Benefits and implications for the NZ environment of using biological control methods.	• NZ example • Gives reasons why biological control will never eradicate the pest/weed • Implications for the NZ environment of using biological control methods.	• NZ example • Links conservation measures to maintaining biological diversity.	• NZ example • Gives reasons to support reduction in conservation measures • Implications of the control measure that justify their reduction.	• Example of GM plant or farm animal • Discusses benefits of GM to NZ • Implications of GMOs and how they might be overcome.	• Example of GM plant or farm animal • Discusses reasons for continuing moratorium (GE free NZ) • Advantages and disadvantages of a GM-free NZ.