



GENERAL COMMENTS

It was evident this year that students had suitable time to adequately address the questions posed in the examination. The quality of the responses provided by many students was excellent; they interpreted and answered the questions in a clear and logical fashion. However, questions that required explanations or analysis still caused difficulty for many students.

Students appeared to use their time efficiently, using the reading time to analyse the questions in Section B and begin the complex thought processes required to answer these questions adequately. It is also important that students follow any instructions that are given within a question.

The marks for each question were a guide to the amount of information required in a response. Students were more likely to be awarded full marks for a question when their answers were clearly expressed and the information included was organised logically and addressed the question directly.

Students must endeavour to spell and use common biological terms correctly. Any ambiguous terms should be avoided.

Students are directed to complete Section B in pen. The use of pencils in Section B is strongly discouraged as responses are often difficult to read and interpret. This year the increased use of pen in Section B improved the clarity of the writing and consequently the ease of marking. It is important to note that if a student starts writing in pencil and then remembers the instruction, there is no need to go over the answers in pen.

SPECIFIC INFORMATION

Section A – Multiple-choice questions

The table below indicates the percentage of students who chose each option. The correct answer is indicated by shading.

Question	% A	% B	% C	% D	Comments
1	22	9	54	14	
2	92	5	2	1	
3	1	1	92	7	
4	9	4	3	84	
5	12	73	10	5	
6	21	72	3	4	
7	72	7	12	9	
8	6	59	30	5	
9	24	11	15	50	In prokaryotes, DNA is contained in a circular chromosome and also within plasmids.
10	38	25	32	5	As <i>Homo sapiens</i> are thought to have originated and evolved in Africa, there has been more time available for random mutations to occur in mitochondrial DNA and hence greater genetic variation. The environment, in general, would not affect the mutation rate, hence response B is incorrect. By definition, interbreeding between different species would not occur, hence response C is incorrect. As mitochondrial DNA codes for proteins responsible for cellular respiration, there could be natural selection operating, hence response D is incorrect.
11	7	4	37	52	Darwin's theory of evolution was proposed well before Mendel's works were published and DNA was discovered. He also had no knowledge of alleles being passed on to offspring, which is a component of genetics, via meiosis.



12	14	35	41	9	Rock paintings are evidence of hominin culture, a characteristic of the more recent group, represented by skull Y. Earlier hominin groups used fire, stone tools and like many other animals, hunted prey for food.
13	85	7	6	2	
14	16	59	21	4	From the pedigree and information it can be seen that individual III-3 is able to produce the enzyme. Both her parents are heterozygous as they produce a daughter, III-1, who is affected. If a cross is done for these parents, II-4 and II-5, the expected predicted results are: three offspring are produced who are unaffected and able to produce the enzyme, and one offspring is produced who is affected and cannot produce the enzyme. As it is known that daughter III-3 is unaffected, she is one of the three offspring identified by doing the cross outlined above. Of these three predicted offspring, two are heterozygous and one is homozygous. The chance of her being unaffected and heterozygous is therefore 2/3.
15	1	85	11	3	
16	10	1	25	64	
17	3	76	11	9	
18	3	57	9	31	
19	14	62	20	4	
20	3	4	37	55	When cutting occurs at point Q the first fragment is 3 kB and the remainder is 7 kB. This larger fragment is then cut at P, removing the smaller right hand fragment of 2 kB, therefore leaving a fragment of 5 kB, the size of the segment between points Q and P.
21	29	4	62	5	
22	66	9	6	19	
23	2	22	70	6	
24	9	14	12	64	
25	5	10	5	80	

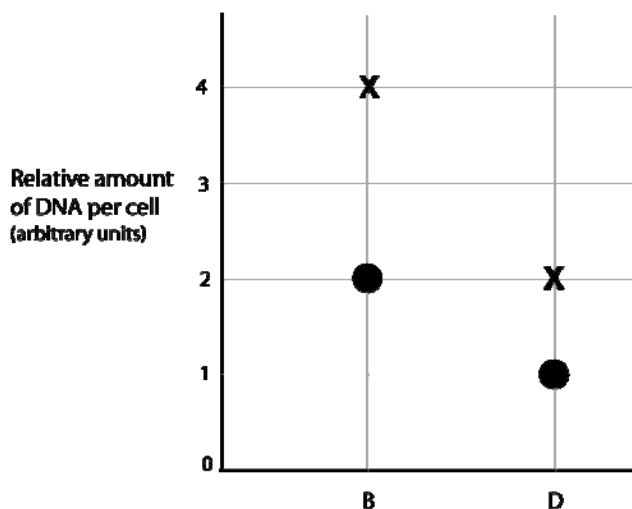
Section B – Short-answer questions

For each question, an outline or examples of the correct answer(s) is provided. In some cases the answer given is not the only answer that could have been awarded marks. General comments are made at the end of each part or question.

Question 1a.

Marks	0	1	Average
%	55	45	0.5

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Two examples are shown on the graph. Note that any position marked against D must be half the value of that marked against B.

Some students drew a graph to join these points. This did not affect the allocation of the mark.

Question 1b.

Marks	0	1	Average
%	15	85	0.9

Q, S, P, R.

Question 1c.

Marks	0	1	Average
%	21	79	0.8

Apoptosis.

This had to be recognisable.

Question 1d.

Marks	0	1	2	Average
%	30	19	51	1.3

One of:

- meiosis produces gametes, mitosis produces somatic cells
- homologous chromosomes pair in meiosis, not in mitosis
- crossing over **or** non-disjunction occur in meiosis, not in mitosis.

To gain two marks it was important that students stated a specific feature of meiosis and how this was different from mitosis.

A common incorrect answer was that meiosis was the division of gametes. This is incorrect as gametes are the product of the process.

Question 2

Question 2a.

Marks	0	1	2	Average
%	60	31	9	0.5

The newborn baby is DS 11, 15.

- either allele could have come from the mother
- neither allele could have come from the father

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It was of great concern that many students could not recognise the symbols of circle for female and square for male. As the stem indicated that the baby was a boy, students should have been able to identify the correct symbol.

Other students incorrectly stated that it had to be the mother's child as the baby had identical alleles as the mother, indicating that he was a clone, or that no alleles came from the father.

Question 2b.

Marks	0	1	Average
%	66	34	

Gene therapy aims to insert a normal/functioning allele into a cell.

An example of incorrect information provided by students was 'the removal of an allele or the insertion of an allele into the body'.

Question 2c.

Marks	0	1	Average
%	70	30	

Virus or liposome

A common incorrect answer was 'plasmid'. This is not a vector used for humans. Gene delivery systems such as gene guns are not vectors. Mosquitoes, which are vectors of parasites, are not involved in gene therapy.

Question 2d.

Marks	0	1	Average
%	71	29	

Either of:

- the virus may have reverted to active state
- insertion disrupted an essential gene.

As the patient died in four days and the question stated that he was healthy, cancer was not a suitable answer. However, a suitably explained immune response, such as infection contracted during the procedure, was acceptable.

Question 3

Question 3a.

Marks	0	1	2	Average
%	17	23	60	

Blood Group	Possible genotypes
B	$I^B I^B$ or $I^B i$
AB	$I^A I^B$

Students received one mark for each correct blood group.

Question 3b.

Marks	0	1	Average
%	13	87	

hh

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Question 3c.

Marks	0	1	Average 0.4
%	63	37	

Blood group *O*

Question 3d.

Marks	0	1	2	Average 1
%	33	36	32	

Genotype	Antigens appearing in saliva
Hh I ^A I ^A	A and H
HH i i	H

Students were given one mark for the correct antigens for each genotype.

Question 4

Question 4a.

Marks	0	1	2	3	Average 1
%	37	36	21	5	

Appropriate factors that should be considered are:

- the magnitude of exposure to the veterans
- the prevalence of disorders in general population/background mutation
- the comparison to other populations exposed to H bombs
- comparison of chromosomes of offspring and parent
- prior or subsequent exposure to mutagens by the veterans
- comparing offspring's chromosomes to parent's.

or

Appropriate factors to consider in the **design** of the experiment include:

- select veterans from a range of socio-economic groups
- select a control group of males for comparison with veterans
- the age distribution of the control group selected to match that of the veterans chosen
- living and work conditions of control group to be matched with those of the veterans
- similar chromosome tests for veterans and controls
- similar chromosome tests for children and grandchildren of veterans and controls.

Question 4b.

Marks	0	1	2	3	4	Average 1.5
%	29	28	22	14	7	

4bi.

Both of:

- parts of non-homologous chromosomes have been translocated
- the insertion may have disrupted the function of other genes.

or

Normal proteins not produced in the new position.

4bii.

Both of:

- changes occurred in the gonads of the veterans

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- these changes are passed on to offspring via gametes.

Question 4c.

Marks	0	1	Average
%	77	23	0.3

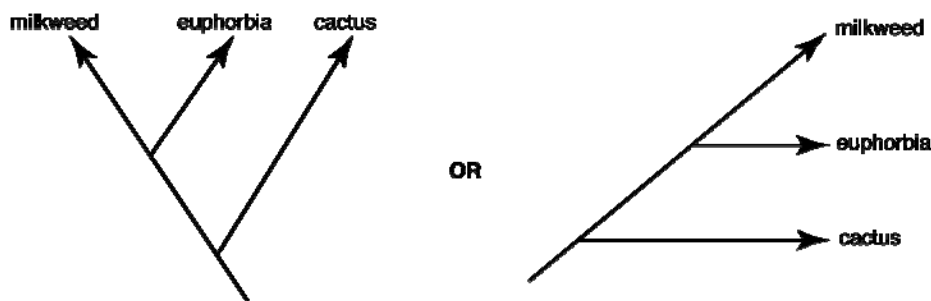
Disagree, as large sections of chromosomes have been translocated, and **many** or **thousands** of bases are involved, not a single base.

It was important that students made the link that the section consists of a large number of bases.

Question 5

Question 5a.

Marks	0	1	Average
%	28	72	0.8



Question 5b.

Marks	0	1	Average
%	42	58	0.2

Natural Selection

Question 5c.

Marks	0	1	Average
%	56	44	0.5

Either of:

- lack of sedimentation
- lack of hard parts.

For students to gain the mark, it was important that they named a necessary condition for fossilisation or identified that the lack of a specific condition would have prevented fossilisation.

Vague statements such as ‘incorrect conditions for fossilisation’ did not score a mark.

Question 6

Question 6a.

Marks	0	1	Average
%	60	40	0.4

Restriction enzymes cut at a **particular base sequence/recognition site**.

Answers that referred to cutting at ‘a place or gene locus’ were not awarded a mark.

Many students incorrectly thought that specific restriction enzymes cut DNA into specific lengths.

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Question 6b.

Marks	0	1	2	Average
%	29	42	30	1.1

6bi.

Either of:

- DNA is negatively charged and moves towards the positive electrode
- shorter DNA fragments travel further/more quickly through a gel.

6bii.

DNA of individuals is different, therefore will be cut at different places and produce fragments of different length.

Question 6c.

Marks	0	1	2	Average
%	61	27	12	0.5

Both of:

- the RNA probe is complementary to the single stranded DNA sample and these join together/hybridise
- this enables the DNA to be seen/identified.

Many students treated this question as 'describe DNA hybridisation' and in doing so, they ignored the instruction to 'examine stages Y and Z'.

Question 7

Question 7a.

Marks	0	1	Average
%	43	57	0.6

- phenotypic characteristic: colour of skin
- selection pressure: camouflaged from predators

Many students could not correctly identify the selection pressure.

Question 7b.

Marks	0	1	2	Average
%	6	13	80	1.8

Two of *L. myola* has:

- a longer mating call than *L. genimaculata*
- a faster note rate than *L. genimaculata*
- a higher pitch than *L. genimaculata*.

This part was well answered and most students correctly interpreted the data. Some students needed to take greater care in constructing their answers, for example, stating that '*L. myola* mates more frequently and faster than *L. genimaculata*' has a completely different meaning.

Question 7c.

Marks	0	1	Average
%	79	21	0.2

Either of:

- pockets of rainforest may have changed and become more or less favoured by frogs
- some ponds may have dried up restricting location of frogs.

The condition that isolated the groups had to be **permanent**, due to **climate change**, and relevant. Some incorrect suggestions were flooding (not a permanent event), mountains, (not climatic) and volcanoes (not relevant).

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Question 7d.

Marks	0	1	Average
%	74	26	0.3

Extent of differences in:

- mitochondrial DNA
- DNA
- amino acid sequence.

or

A description of fossil or stratigraphic evidence, such as ‘the sequence of fossils are observed to determine when divergence occurred’.

Question 7e.

Marks	0	1	2	3	Average
%	58	17	14	11	0.8

All of:

- for many generations, a small population of *L genimaculata* was isolated by changed geography due to climate and there was no gene flow (or allele flow) between the populations
- allele frequencies in the small population changed (particularly with respect to size and mating call) due to natural selection or genetic drift
- eventually the two groups are different enough to prevent successful reproduction.

Many students failed to recognise that this was a question on speciation. Many students wrote a sentence using the words required with no additional information.

Question 7f.

Marks	0	1	Average
%	63	37	0.4

Either of:

- interbreed the two species and if they produce viable and fertile offspring, **they are the same species**
- interbreed the two species and if they do not produce viable or fertile offspring, **they are not the same species.**

To gain the mark for this question students needed to state what could be concluded from their suggestion.

Question 8

Question 8a.

Marks	0	1	Average
%	75	25	0.3

Different palaeontologists may make different **interpretations** of the same data.

Question 8bi-ii.

Marks	0	1	2	Average
%	14	32	55	1.4

8bi.

Either of:

- *Australopithecus afarensis* evolved about three million years ago
- *Homo heidelbergensis* evolved from *Homo ergaster* (about one million years ago).

8bii.

Any of:

- *Homo erectus* evolved from *Australopithecus afarensis* in Model 1
- *Homo erectus* evolved from *Homo ergaster* in Model 2
- Model 2 shows linear evolution from *Australopithecus afarensis*.



For this part, any correct statement about the relationships illustrated was awarded a mark. These parts of the question did not require interpretation.

Question 8c.

Marks	0	1	2	Average
%	32	35	33	1.1

Homo erectus had:

- a larger brain case
- a less prominent brow ridge
- a more parabolic jaw.

or

Correct statements with respect to teeth size or position of foramen magnum received one mark for each correct feature named.

Many answers were not structural, such as type of diet. Other incorrect answers included, placement of eyes, sagittal crest and hair.

Size of brain is incorrect as this can only be inferred; the size of the brain case is the feature.

Question 8d.

Marks	0	1	Average
%	65	35	0.4

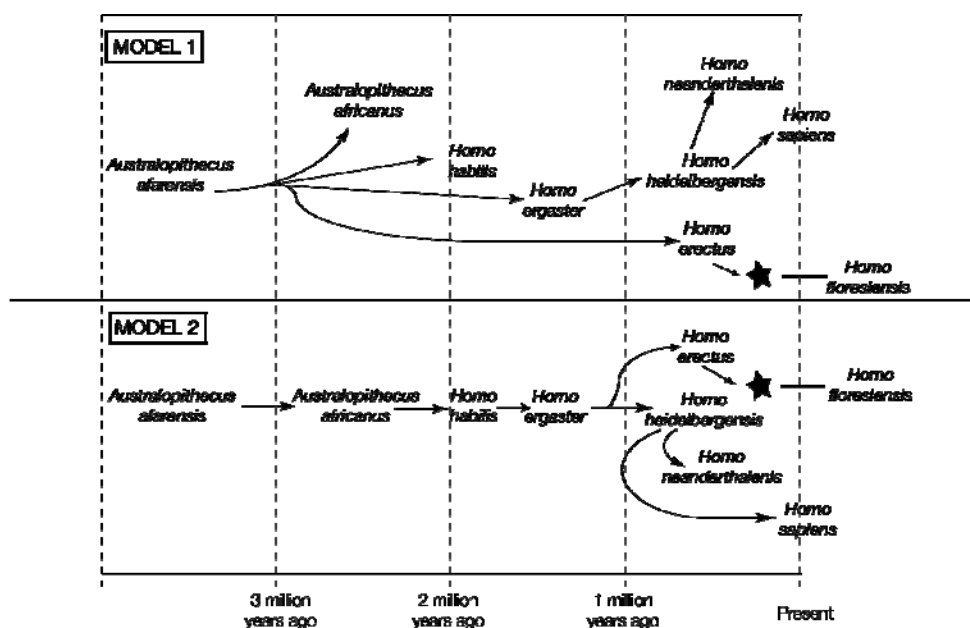
Any of:

- different customs and lifestyle prevented interbreeding
- different mating behaviour or rituals
- mating occurred, however, viable offspring were not produced.

A common incorrect answer was that the two species were geographically isolated, yet the stem of the question stated that the two species 'were living in the same area'.

Question 8e.

Marks	0	1	Average
%	23	77	0.8



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The arrow could be placed in either Model 1 or Model 2.

Unfortunately many students failed to answer this question; presumably they did not see this part.

Question 8f.

Marks	0	1	2	Average
%	89	9	1	0.1

8fi.

If adult and child fossils of *Homo floresiensis* were found that had skulls indicating all had the same small brain characteristic.

8fii.

If fossils were found in the same area and had normal sized skulls.

If adult and child fossils of *Homo sapiens* were found in the same area and had skulls indicating child brain size much larger than that of the fossil called *Homo floresiensis*.