



GENERAL COMMENTS

The quality of the responses provided by some students was excellent; however, questions that required explanations or analysis still caused difficulty for most students. Often it was evident that students had not carefully read the question or referred to the information provided when answering questions. It is also important that students follow the instructions 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.

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	58	8	33	1	
2	35	17	12	35	Prokaryotic organisms lack membrane bound organelles, therefore they do not have a nucleus with linear chromosomes. They do have ribosomes.
3	24	18	13	45	
4	10	10	63	17	
5	22	29	33	16	Meiosis is the usual method to produce gametes; however, in this example as the males are haploid, no further reduction would occur.
6	8	16	22	54	
7	78	4	5	13	
8	20	13	19	47	
9	22	5	2	70	
10	2	2	90	6	
11	5	80	11	5	
12	3	16	40	41	Polygenic means there are many genes involved, most likely on different chromosomes, and this leads to continuous variation of phenotypes.
13	31	53	9	7	
14	8	8	74	11	
15	29	5	10	56	
16	16	15	54	14	
17	74	5	19	2	
18	5	16	66	14	
19	33	49	5	13	
20	77	11	5	6	
21	80	16	2	3	
22	20	42	2	36	The evidence of a prominent brow ridge, relatively small brain case and large canine teeth indicate that X is the most likely chimpanzee skull.
23	81	3	2	13	
24	12	65	17	5	
25	9	87	3	1	

Section B – Short-answer questions

For each question, an outline or examples of the correct answer(s) is provided. It is important to note that alternative wording of these answers or, in some cases, alternative answers could also have been awarded marks. General comments are made at the end of each part or question.

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Question 1a.

Marks	0	1	Average
%	16	84	

- Genotype of parents: Dd
- Genotype of child without a dimple: dd

Question 1b.

Marks	0	1	2	Average
%	27	32	41	

1bi.

Cross number 2

When students are asked to state a cross it is important that this is clearly done. In many cases the parent's phenotype was given and this was ambiguous.

1bii.

The appearance of sensitive offspring from resistant parents indicates that the parents were heterozygous and that sensitive is the recessive phenotype.

It was important that the explanation did not simply restate the data, such as 'Resistant parents had sensitive offspring'.

Question 1c.

Marks	0	1	2	Average
%	47	12	40	

Answer (using the allelic symbols: R resistant, r sensitive):

	resistant		sensitive
Parents	Rr	X	rr
Offspring	Rr	and	rr

Students had to clearly distinguish between the genotypes of the parent's and the offspring. The normal convention of assigning symbols had to be used. Students who used the upper and lower case of **different** letters (for example, Rs) were not awarded any marks. Ratios were not required in the answer.

Question 1d.

Marks	0	1	2	Average
%	55	18	27	

Answer (using allelic symbols: Y yellow, y grey):

Parental Cross	Yy	X	Yy
Offspring	$\frac{1}{4}$ YY; $\frac{1}{2}$ Yy; $\frac{1}{4}$ yy		
Phenotype	3 yellow; 1 grey		

Answers to this part were poorly set out by many students. The requests to give the phenotypic, genotypic ratios and to indicate the allelic symbols were often not followed. It is important to note that the ratio needed to identify the phenotype in addition to the relative quantity. So in this case, the phenotypic ratio 3:1 alone was not awarded any marks. The ratio needed to be expressed as 3 yellow to 1 grey.

Question 1e.

Marks	0	1	Average
%	72	28	

The genotype YY is lethal, or kills those mice with this genotype.

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Questions 2a–c.

Marks	0	1	2	3	4	Average
%	24	13	23	19	21	2.0

Question 2a.

Transcription

Question 2b.

2bi.

Either of:

- Pre-mRNA
- primary RNA.

mRNA was not an acceptable answer.

2bii.

Either of:

- introns are removed
- any other post transcriptional modification.

Question 2c.

One of:

- translation
- polypeptide synthesis
- protein synthesis.

Question 2d.

Marks	0	1	2	Average
%	47	15	38	0.9

2di.

Transfer RNA (tRNA)

2dii.

Transfer RNA brings a specific amino acid to the ribosome. The anticodons of the tRNA are complementary to the codons of the mRNA.

Many students incorrectly called tRNA, transport RNA. An incorrect answer was that 'tRNA is involved in making an amino acid'.

Questions 3a–c.

Marks	0	1	2	3	Average
%	28	21	16	36	1.6

Question 3a.

- I1: $X^H X^h$
- I2: $X^h Y$

Question 3b.

The chance is 1 or 100% (that is, all sons will be haemophiliac).

Question 3c.

1/2 or 50% chance of a child having haemophilia.

Question 3d.

Marks	0	1	2	Average
%	15	12	73	1.6

- I1: Gg
- I2: Gg

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- II1: gg
- II2: GG or Gg

A number of students did not recognise the symbols in the pedigree representing males and female. It is important that when provided in the question, students use the symbols provided (that is, G and g).

When students are asked to express the probability of an event, it is best to express this as a fraction or a percent rather than as a ratio. A ratio of 1:2 is not the same as 1/2.

Questions 4a–b.

Marks	0	1	2	Average
%	36	54	10	0.8

Question 4a.

Circular

Question 4b.

Transformation

‘Heat shock’ was not an acceptable answer as this is a process of taking up the plasmid. Neither was ‘transfection’ as this applies to viral vectors.

Many students were aware that the required answer began with ‘trans’. Examples of common incorrect answers included transduction, translocation and transgenic. Recombination was also a common incorrect answer.

Question 4c.

Marks	0	1	2	Average
%	34	12	54	1.2

4ci.

No growth of bacteria.

4cii.

The bacteria are sensitive to the antibiotic tetracycline and therefore do not grow.

Question 4d.

Marks	0	1	2	Average
%	51	27	22	0.7

- Plate A: The bacteria are able to grow as there is no tetracycline present.
- Plate C: Only those bacteria which take up the plasmid can grow in the presence of tetracycline.

It was important that students distinguished between Plates A and C, recognised the significance of the presence/absence of the antibiotic and realised that only **some** of the bacteria were transformed. One mark was awarded for each of the points above. Some students gave a specific percentage transformation which could not be deduced from the information. Students need to be aware that if their answers include incorrect information they may not receive full marks.

Question 5a.

Marks	0	1	Average
%	42	58	0.6

Making genetically identical copies (of organisms).

The key point was that the copies are genetically identical. Many students stated that the copies were identical or phenotypically identical; these responses were not awarded a mark.

Question 5b.

Marks	0	1	2	Average
%	15	37	49	1.4

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5bi.
19

5bii.

Female. The donor of the nucleus was from the somatic cell of a female donor.

A common incorrect answer was 'The cell was an egg cell and this comes from females'.

Question 5c.

Marks	0	1	Average
%	85	15	0.2

The reason for the two numbers is that this locus is found on a pair of homologous chromosomes.

This part was not well answered. Many students incorrectly thought the two numbers were representative of the two strands of DNA.

Question 5d.

Marks	0	1	Average
%	88	12	0.1

The different values indicate that the individual being tested is heterozygous for this locus, indicating that the alleles are of different lengths.

Most students attempted this question, however, many students again related the numbers incorrectly to the two strands of DNA or made reference to the occurrence of mutations having occurred, which was also incorrect.

Question 5e.

Marks	0	1	Average
%	26	74	0.8

CC is a true clone as the DNA of CC is identical to the donor DNA and not the surrogate.

This was generally well answered, however students who stated the DNA was almost identical could not be awarded the mark.

Question 6a.

Marks	0	1	Average
%	25	75	0.8

9

Question 6b.

Marks	0	1	2	Average
%	39	46	15	0.8

6bi.
18

6bii.

The chromosomes in the hybrid are not found in homologous pairs and are therefore unable to line up during meiosis.

Many students gave an odd number, such as 19, as the answer to part a. and then incorrectly argued that meiosis does not occur if the chromosome number is odd. Other students argued why the hybrid was not formed, but this is contrary to the information supplied.

Questions 6c–d.

Marks	0	1	2	Average
%	51	31	18	0.7

Question 6c.

Polyploid

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The answers given here were varied and often incorrect, such as aneuploidy, trisomy plurypotent, polygenic and polysomatic.

Question 6d.

Due to the doubling process, the chromosomes from each species are now able to form homologous pairs during meiosis, which can now proceed normally.

Question 6e.

Marks	0	1	Average
%	44	56	0.6

In selective breeding humans choose organisms with a desirable trait and breed them. In random mating each bull and cow have an equal chance of mating.

It was important here that students made a comparison between the two.

Question 6f.

Marks	0	1	Average
%	27	73	0.8

Selective breeding reduces genetic variability.

This part was well answered, however many students did not gain the mark as they made further incorrect statements, such as that the number of genes were reduced. Students must realise that all members of the same species have the same genes, it is the alleles which may be different.

Question 6g.

Marks	0	1	Average
%	82	18	0.2

Artificial insemination will influence the frequency of alleles in the next generation by one bull contributing more frequently to the population.

This part was poorly answered. Many incorrect answers were seen, such as 'there would be less chance of mutation occurring' and 'evolution would stop'. A new word appeared, evolutionise, which was novel but incorrect.

Question 7a.

Marks	0	1	Average
%	58	42	0.4

Genes are only expressed when required to conserve energy or time.

Question 7b.

Marks	0	1	Average
%	83	17	0.2

RNA polymerase

This part was poorly answered as students did not relate their answer to gene expression and the enzyme needed to bind to allow this process to occur. The most common incorrect answer was enzyme X.

Questions 7c–d.

Marks	0	1	2	Average
%	39	29	33	1.0

Question 7c.

Production of enzyme X will occur.

Question 7d.

The binding of the tryptophan to the repressor protein changes its shape (from the diagram) and this complex can no longer bind to the operator gene (therefore transcription can occur).

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Questions 8a–c.

Marks	0	1	2	3	4	Average
%	33	26	21	15	5	1.3

Question 8a.

Inability to mate is not enough evidence; it is the inability to produce viable offspring which is important.

Question 8b.

Allopatric speciation

Incorrect answers included divergent evolution and founder effect.

Question 8c.

- There were different selection pressures in the two environments, which allowed differences in allele frequencies to develop.
- Over time there is an accumulation of genetic differences which changes a trait, such as mating behaviour.

This question was poorly answered and was generally not recognised as a ‘natural selection’ question. Students needed to provide both of the above points for two marks.

Question 8d.

Marks	0	1	Average
%	80	20	0.2

Either of

- thylacines were hunted to extinction by indigenous Australians
- thylacines were out-competed by another predator, for example, the dingo.

Too many students made vague statements such as ‘unsuitable environment’ or ‘hunted’. It was also disappointing the number of students who made some statement about Europeans having an input into their demise. The question clearly asked why the thylacines were not found at the time of European settlement.

Question 8e.

Marks	0	1	Average
%	70	30	0.3

Either of

- no thylacines have been captured or found alive
- there is no specific, named evidence such as scats, recent remains or tracks.

Again the answers provided here were vague or incorrect, such as ‘no evidence found’, ‘the thylacines had evolved into a different species’ or other answers which restated the stem of the question.

Question 8f.

Marks	0	1	Average
%	65	35	0.4

Convergent evolution is when two species, which do not share a recent common ancestor, independently develop similar feature due to similar selection pressures.

This question required a definition. Students should be able to correctly define terms/concepts as specified in the study design.