



## GENERAL COMMENTS

It was pleasing to see the majority of students attempt each question on the 2011 Biology 2 examination. The more able students were able to apply their knowledge well, and many students presented papers of an outstanding standard. Students who were able to set out their answers in a logical manner scored well. Answers should not be rushed or contradictory. It is important that students follow any suggestions or requirements given within a question, such as the use of the allele symbols in Question 2c.

Students must, as always, endeavour to correctly spell and use common biological terms. Ambiguous terms and abbreviations are to be avoided.

Students are encouraged to use pen for written responses in Section B as it is easier to read than pencil. It is, however, appropriate for students to complete some responses, such as diagrams and genetic crosses, in pencil.

## 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	6	14	63	17	
2	6	22	20	52	
3	1	89	1	8	
4	8	6	9	77	
5	27	13	36	24	Options B and C were both accepted. Different types of stem cells have different potentials.
6	19	34	6	40	Apoptosis is programmed cell death. This process requires special enzymes (lysozymes). Some organelles are recycled.
7	4	3	70	22	
8	7	5	35	53	
9	50	14	8	28	
10	3	85	4	8	
11	28	7	49	16	DNA replication is semi-conservative. After two cycles, two labelled strands remain that produce two hybrid strands and two fully unlabelled strands.
12	3	12	12	73	
13	6	3	86	5	
14	8	5	67	20	
15	94	3	3	0	
16	7	64	11	18	
17	25	17	40	18	Males develop from an unfertilised (haploid) egg, therefore by mitosis. The eggs would therefore be genetically identical. As the eggs are haploid, homologous chromosome pairs will not be found.
18	58	33	5	3	
19	4	4	85	7	
20	58	12	13	16	
21	3	87	6	4	
22	5	7	7	81	
23	8	25	65	2	
24	14	77	5	4	
25	4	75	15	6	

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## Section B – Short answer questions

**Note: Student responses reproduced herein have not been corrected for grammar, spelling or factual information.**

For each question, an outline answer (or answers) is provided. In some cases the answer given is not the only answer that could have been awarded marks.

### Question 1a.

Marks	0	1	Average
%	0	100	1

As the nucleus was not labelled as a structure, all students were awarded a mark for this question.

### Question 1b.

Marks	0	1	2	Average
%	46	23	32	0.9

Two of:

- involved in transcription
- copies DNA template
- joins nucleotides.

### Question 1c.

Marks	0	1	2	Average
%	34	17	49	1.2

Both of:

- pre-mRNA (strand G) is formed
- introns are removed.

Some students described DNA replication and others incorrectly stated that exons were removed.

### Question 1d.

Marks	0	1	2	3	Average
%	30	17	20	33	1.6

### Strand H

mRNA: carries instructions to the ribosomes

### Structure P

tRNA: carries a specific amino acid to the ribosomes

### Structure M

Ribosome: site of protein synthesis production

The description had to relate to protein synthesis. Students were not asked to give information about mRNA, for example, mRNA is single stranded, which was not relevant to the question. Other errors stated by students were that ribosomes package protein or make amino acids.

### Question 2a.

Marks	0	1	2	3	Average
%	16	15	34	35	1.9

### 2ai.

Yellow flower: B

Blue flower: b

Any other suitable letter was acceptable, as long as the notation used did not imply sex-linked, incomplete or co-dominance.

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**2aii.**

Bb and bb

**2aiii.**

Genotypes: Bb and bb

Phenotypes: yellow and blue

Some common errors were that students gave genotypes rather than allele symbols in 2ai., and in 2aiii. many failed to identify the genotype and phenotype.

**Question 2b.**

Marks	0	1	Average
%	43	57	0.6

If any blue-coloured offspring are produced this indicates that the yellow parent was heterozygous.

Some students explained their answer fully and clearly showed their understanding and the significance of a test cross.

**Question 2c.**

Marks	0	1	2	3	Average
%	19	6	17	58	2.1

**2ci.**

b<sup>b</sup>t<sup>t</sup>

**2cii.**

The pups could either be heterozygous Bb or homozygous BB for gene 1 locus.

**2ciii.**

Dog F and Dog G could have any of the following genotype combinations:

- BbTt and b<sup>b</sup>t<sup>t</sup>
- BbTt and BbTt
- B<sup>b</sup>t<sup>t</sup> and b<sup>b</sup>Tt
- B<sup>b</sup>t<sup>t</sup> and BbTt.

**Question 3a.**

Marks	0	1	2	Average
%	32	28	40	1.1

**3ai.**

Somatic (cell)

**3aii.**

The nucleus chosen needs to be diploid or have a full set of chromosomes.

**Question 3b.**

Marks	0	1	2	3	Average
%	49	13	21	17	1.1

**3bi.**

Nucleus removed/cell is enucleated

**3bii.**

Ensure:

- the DNA of the egg/donor female is removed
- only the desired DNA/correct number of chromosomes in the clone.

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This question required students to explain the purpose of the procedure; however, this was not always done.

### Question 3c.

Marks	0	1	Average
%	24	76	<b>0.8</b>

Organism M

### Question 4a.

Marks	0	1	Average
%	67	33	<b>0.4</b>

Homologous chromosomes have identical gene loci.

It was not sufficient to say they are a pair of chromosomes or to comment on their size or the position of the centromere.

### Question 4b.

Marks	0	1	Average
%	70	30	<b>0.3</b>

Translocation has occurred (or a suitable description of this process).

### Question 4c.

Marks	0	1	Average
%	70	30	<b>0.3</b>

The diploid number of these hybrid flies would be 7.

### Question 4d.

Marks	0	1	2	Average
%	50	34	16	<b>0.7</b>

Both of:

- the chromosomes are not homologous and therefore do not pair during meiosis
- no gametes are produced, or viable offspring are not produced.

### Question 5

Questions 5b. and 5c. referred to the same information. Most students correctly identified the relationship as autosomal recessive; however, many then went on to treat the relationship as sex-linked in 5c.

### Question 5a.

Marks	0	1	Average
%	32	68	<b>0.7</b>

Gametes or sperm

### Question 5b.

Marks	0	1	Average
%	24	76	<b>0.8</b>

Autosomal recessive

### Question 5c.

Marks	0	1	2	Average
%	43	27	30	<b>0.9</b>

- parents (mare) Hh X HH (stallion) both normal
- offspring Hh or HH all phenotypically normal

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## Question 5d.

Marks	0	1	2	Average
%	35	41	25	<b>0.9</b>

### 5di.

Any of:

- 4/16
- $\frac{1}{4}$
- 0.25
- 1 dies at birth:3 live.

### 5dii.

9/16 (if the OLWS condition is recessive) or 3/16 (if the OLWS condition is dominant)

As mentioned in past reports, when students are asked to give the chance of particular events occurring, ratios such as 2:3 should not be used. Most students who use this form of ratios do not do so correctly and are strongly advised not to use them.

## Question 5e

Marks	0	1	2	Average
%	28	47	26	<b>1</b>

### 5ei.

Any of:

- point mutation
- substitution
- missense mutation.

### 5eii.

There may not be a restriction enzyme available that cuts at the faulty position, or the two strands are the same length and therefore can't be separated using gel electrophoresis.

## Question 6a.

Marks	0	1	Average
%	72	28	<b>0.3</b>

The change in allele frequency in a population by chance

Many students described gene flow. As these definitions are commonly confused, students are advised to revise the differences and ensure they are understood.

## Question 6b.

Marks	0	1	2	3	Average
%	24	29	29	18	<b>1.4</b>

### 6bi

Students were required to give two valid points such as:

- fewer alleles present in the Illinois population
- less variation present
- greater risk of extinction.

### 6bii.

Either of:

- gene flow or interbreeding has occurred between the two populations
- there has been a recent isolating mechanism.

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Migration alone was not enough to gain the mark. Another incorrect answer was that the two populations experienced similar selection pressures.

### Questions 6c.

Marks	0	1	2	3	Average
%	17	25	26	32	1.7

#### 6ci.

Both of:

- an environmental condition, such as a disease
- members of the population are more susceptible or at risk of extinction.

#### 6cii.

One of:

- breed with members of populations from other states
- use a captive breeding program
- habitat protection/modification.

### Question 7a.

Marks	0	1	2	Average
%	34	38	28	1

#### 7ai.

One of:

- mtDNA is inherited from the mother
- there is no crossing over/recombination/non-disjunction in mtDNA
- the mutation rate is known and used to determine evolutionary time.

Many students made comments about the mutation rate. It is important to note that coding regions of mRNA mutate at a slow rate and non-coding regions mutate at a fast rate.

#### 7aii.

Nuclear/chromosomal DNA

### Question 7b.

Marks	0	1	2	Average
%	31	51	18	0.9

Inferences could include:

- modern humans evolved relatively recently
- African populations are the oldest
- humans are related to small number of ancestors
- humans evolved and migrated out of Africa.

### Question 7c.

Marks	0	1	2	3	Average
%	12	30	36	22	1.7

#### 7ci.

DNA has degraded.

#### 7cii.

Other evidence such as examination and comparison of (one of):

- fossils
- tools
- amino acids.

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Dating methods such as:

- stratigraphy
- radioisotopic dating.

It was important that students outlined evidence as requested in the question. For example, to state 'fossils' did not gain the mark, but to state that 'the skulls of early hominins could be compared' gained the mark.

## Question 7d.

Marks	0	1	2	Average
%	31	39	30	1

### 7di.

Parts of the hominin could have been scattered by scavengers or decayed faster due to exposure to decomposers.

### 7dii.

One of:

- absence of decomposers
- low oxygen levels
- the organism had hard body parts.

Some incorrect answers included that fossils were covered by lava or that oxygen inhibits fossilisation.