

**SPECIFIC INFORMATION**

**Section A – Multiple-choice questions**

This table indicates the approximate percentage of students choosing each distractor. The correct answer is the shaded alternative.

Question	A	B	C	D	Question	A	B	C	D
1	78	7	9	6	14	81	15	3	1
2	9	5	81	5	15	5	1	1	93
3	26	55	5	14	16	6	21	54	19
4	19	9	50	22	17	2	10	77	11
5	54	31	10	5	18	3	21	23	53
6	6	91	2	1	19	48	21	27	4
7	9	3	79	9	20	10	24	13	53
8	6	51	34	9	21	1	6	2	91
9	9	29	7	55	22	16	76	6	2
10	9	10	70	11	23	11	6	76	7
11	3	14	61	21	24	11	55	15	19
12	5	3	90	2	25	15	13	59	13
13	11	48	35	6					

**Section B – Short-answer questions**

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

Comments on student performance (where appropriate) follow the answers for each part of the question (and are in italics).

Question	Marks	%	Response				
Question 1	<b>a</b>		A gamete of a cat would contain 19 chromosomes.				
	0/1	27					
	1/1	73					
	(Average mark 0.73)						
	<b>bi–ii</b>		<b>bi</b> The phenotype of an organism is the characteristics of an organism (physical, biochemical and behavioural) which are the result of the genotype and the effect of the environment. Students need to be reminded that responses such as the appearance or the physical appearance are not at a standard expected of Year 12 Biology students. <b>bii</b> The cat would still have a normal phenotype because it still has the same amount of DNA <b>or</b> the cat has not lost or gained any DNA or chromosome, <b>or</b> no genes have been lost.				
	0/2	12					
	1/2	54					
	2/2	34					
	(Average mark 1.21)						
	<b>c</b>		<table border="1" style="width: 100%;"> <tr> <td><b>Chromosome make-up of sperm type 3</b></td> </tr> <tr> <td>one translocation 9/18 chromosome</td> </tr> <tr> <td><b>Chromosome make-up of sperm type 4</b></td> </tr> <tr> <td>one chromosome 9</td> </tr> </table> This question tested student understanding of meiosis. Students needed to think about how chromosomes line up on the spindle during the first stages of meiosis. Many incorrect responses included either two number 9 chromosomes or two number 18 chromosomes in the one sperm.	<b>Chromosome make-up of sperm type 3</b>	one translocation 9/18 chromosome	<b>Chromosome make-up of sperm type 4</b>	one chromosome 9
	<b>Chromosome make-up of sperm type 3</b>						
	one translocation 9/18 chromosome						
<b>Chromosome make-up of sperm type 4</b>							
one chromosome 9							
0/2	71						
1/2	17						
	2/2	12					
	(Average mark 0.41)						

	<p><b>di-ii</b> 0/2 83 1/2 15 2/2 2 (Average mark 0.19)</p>	<p><b>di</b> Sperm type 4 or the sperm with chromosome 18 missing is most likely not to survive as there has been a significant DNA loss. <b>dii</b> Answer: 1/3. Some students realised that there is only one sperm type (type 3) that will give a 'normal' kitten with the same translocation as the father. The stem of the question told students that one sperm type did not survive, so the chance is <math>\frac{1}{3}</math> and not <math>\frac{1}{4}</math>.</p>														
<b>Question 2</b>	<p><b>a</b> 0/2 43 1/2 41 2/2 16 (Average mark 0.72)</p>	<p>The evidence from the pedigree that supports the conclusion is that red and liver are present in the offspring <b>or</b> the offspring include dogs that are rrB- and R-bb, <b>and</b> II-1 must be homozygous rr and II-3 must be homozygous bb. Students who did not refer directly to the pedigree and name individuals showing particular traits were not awarded full marks.</p>														
	<p><b>bi-ii</b> 0/2 30 1/2 9 2/2 61 (Average mark 1.31)</p>	<p><b>bi</b> The specific genotype of II-4 is RrBb. <b>bii</b> The specific genotype of III-4 rrBb.</p>														
	<p><b>c</b> 0/2 50 1/2 17 2/2 33 (Average mark 0.83)</p>	<p>There could be 4 different phenotypes expected in the offspring. Alternative 1 Showing working in a punnet square:</p> <table border="1" style="margin-left: 20px;"> <thead> <tr> <th></th> <th><b>RB</b></th> <th><b>Rb</b></th> <th><b>rB</b></th> <th><b>rb</b></th> </tr> </thead> <tbody> <tr> <th><b>rB</b></th> <td><b>RrBB</b></td> <td><b>RrBb</b></td> <td><b>rrBB</b></td> <td><b>rrBb</b></td> </tr> <tr> <th><b>rb</b></th> <td><b>RrBb</b></td> <td><b>Rrbb</b></td> <td><b>rrBb</b></td> <td><b>rrbb</b></td> </tr> </tbody> </table> <p>Alternative 2 Show working as follows: Rr X rr gives Rr and rr                      Bb X Bb gives BB, Bb and bb Genotypes that can be obtained are 1. RrBB or RrBb 2. Rrbb 3. rrBB or rrBb 4. rrbb  After working students then needed to show a connection between the phenotype and the genotype as follows 1. RrBB or Bb = same phenotype (3 black) 2. Rrbb (1 red) 3. rrBB or Bb = same phenotype (3 liver) 4. rrbb (1 lemon)  The question specifically asked that students show all working. One mark was given for the working and 1 mark for showing the connection between the genotype and phenotype. Students were more likely to make mistakes if completing a punnet square with the sperm types rB and rb repeated.</p>		<b>RB</b>	<b>Rb</b>	<b>rB</b>	<b>rb</b>	<b>rB</b>	<b>RrBB</b>	<b>RrBb</b>	<b>rrBB</b>	<b>rrBb</b>	<b>rb</b>	<b>RrBb</b>	<b>Rrbb</b>	<b>rrBb</b>
	<b>RB</b>	<b>Rb</b>	<b>rB</b>	<b>rb</b>												
<b>rB</b>	<b>RrBB</b>	<b>RrBb</b>	<b>rrBB</b>	<b>rrBb</b>												
<b>rb</b>	<b>RrBb</b>	<b>Rrbb</b>	<b>rrBb</b>	<b>rrbb</b>												
<b>Question 3</b>	<p><b>a</b> 0/2 38 1/2 35 2/2 27 (Average mark 0.89)</p>	<p>Linked genes are genes that are found on the same chromosome <b>and</b> are likely to be inherited together <b>or</b> do not assort independently <b>or</b> are relatively close together <b>or</b> crossing over can occur between them.  Students were required to make two separate points about linked genes. Many responses stated that linked genes are found on the same chromosome but did not go on and make another correct statement.</p>														

	<p><b>b</b> 0/1 70 1/1 30 (Average mark 0.30)</p>	<p>The genes for body colour and sex determination are 6 map units apart. The percentage of recombinant offspring corresponds to the number of map units separating the two genes. In this case there was a total of 6% recombinant offspring (black females and bronze males) indicating that the genes are 6 map units apart.</p>																										
	<p><b>ci–ii</b> 0/2 86 1/2 1 2/2 13 (Average mark 0.26)</p>	<p><b>ci</b> <u>Bm</u> Bm <b>cii</b> <u>bM</u> bm</p> <p>The stem of the question stated that the genes for body colour and sex determination are linked. Many students did not use the correct notation for linkage. Others showing correct notation failed to show the correct combination of alleles on the chromosomes. A common incorrect response was <math>\frac{bb}{Mm}</math>.</p>																										
	<p><b>d</b> 0/1 53 1/1 47 (Average mark 0.47)</p>	<p>The offspring would be black males and black females. The question referred to both the sex of the insect and the body colour of the insect. Both of these should have been mentioned in the answer.</p>																										
<b>Question 4</b>	<p><b>a</b> 0/1 16 1/1 84 (Average mark 0.84)</p>	<table border="1"> <tbody> <tr> <td><b>part of the template strand</b></td> <td>A</td> <td>A</td> <td>A</td> <td>G</td> <td>T</td> <td>A</td> <td>C</td> <td>T</td> <td>G</td> <td>C</td> <td>G</td> <td>C</td> </tr> <tr> <td><b>complementary strand</b></td> <td>T</td> <td>T</td> <td>T</td> <td>C</td> <td>A</td> <td>T</td> <td>G</td> <td>A</td> <td>C</td> <td>G</td> <td>C</td> <td>G</td> </tr> </tbody> </table>	<b>part of the template strand</b>	A	A	A	G	T	A	C	T	G	C	G	C	<b>complementary strand</b>	T	T	T	C	A	T	G	A	C	G	C	G
<b>part of the template strand</b>	A	A	A	G	T	A	C	T	G	C	G	C																
<b>complementary strand</b>	T	T	T	C	A	T	G	A	C	G	C	G																
	<p><b>b</b> 0/1 21 1/1 79 (Average mark 0.79)</p>	<p>Adenine.</p>																										
	<p><b>c</b> 0/1 31 1/1 69 (Average mark 0.69)</p>	<p>mRNA or messenger RNA is produced during transcription.</p>																										
	<p><b>di–diii</b> 0/3 14 1/3 12 2/3 22 3/3 52 (Average mark 2.13)</p>	<p><b>di</b> Ribosome <b>dii</b> Translation <b>diii</b> A polypeptide or protein.</p>																										
	<p><b>e</b> 0/1 60 1/1 40 (Average mark 0.40)</p>	<p>asp (aspartic acid) is replaced by glu (glutamic acid) <b>or</b> asp to glu</p>																										

<b>Question 5</b>	<b>a</b> 0/2      47 1/2      38 2/2      15 (Average mark 0.67)	The polymerase enzyme catalyses the production of a new strand of DNA <b>or</b> is involved in making multiple copies of DNA <b>or</b> amplification of DNA <b>and</b> DNA polymerase replicates the DNA by extending from the primer <b>or</b> by complementary base pairing <b>or</b> by using the original DNA as a template. Some students incorrectly identified the enzyme and discussed the role of another enzyme. Many other responses gave one part of the expected answer. Students need to be reminded to use the number of marks allocated to the question as an indication of the depth required in their answer.
	<b>b</b> 0/2      37 1/2      31 2/2      32 (Average mark 0.95)	A DNA fragment will move according to its charge and molecular weight (size) <b>or</b> DNA is negatively charged and moves to the positive pole; smaller DNA fragments move further or faster than larger fragments.
	<b>c</b> 0/1      70 1/1      30 (Average mark 0.30)	There is only one band in lane 2 because individual 2 is homozygous, the others on the gel are heterozygous <b>or</b> the <b>two</b> fragments of DNA are the same size <b>or</b> the number of repeats in the <b>two</b> fragments is the same. Students should be able to read results from a gel and make appropriate conclusions. Many find this a difficult task, but this can be improved by attention to practical experience in class.
	<b>d</b> 0/1      63 1/1      37 (Average mark 0.37)	There are 5 different alleles at the HUMTHO1 locus represented on the gel.
	<b>e</b> 0/1      23 1/1      77 (Average mark 0.77)	DNA piece A has the greater number of the 4 base repeat sequence. The greater the molecular weight of the sample the smaller distance the sample will move from the loading well.
	<b>f</b> 0/1      62 1/1      38 (Average mark 0.38)	The bands on the gel for suspect 5 match the sample of blood found on the victim, which was not the victim's blood (lane 3). Students could not be given a mark for the correct identification of suspect 5. The mark was awarded for the explanation as to why suspect 5 appears to have committed the assault.
<b>Question 6</b>	<b>a</b> 0/2      59 1/2      31 2/2      10 (Average mark 0.5)	<i>Drosophila</i> , since it has the highest heterozygosity. Therefore, at each locus there are at least two alleles, which may result in two or more phenotypes, <b>or</b> heterozygotes produce more genotypes and phenotypes. The most common incorrect response was the elephant. Many students who correctly identified <i>Drosophila</i> could not give an adequate explanation.
	<b>b</b> 0/2      44 1/2      25 2/2      31 (Average mark 0.87)	There may be a change in a selection pressure <b>and</b> if no variation exists all individuals within the population will respond to the change in the same way. This means that many of the individuals within the population may die. Students were awarded marks if they used a particular example, such as: 'If a disease infects the group the individuals in the population are likely to be equally susceptible. The disease may kill all individuals within the population.'

	<p><b>c</b></p> <p>0/2      59</p> <p>1/2      22</p> <p>2/2      19</p> <p>(Average mark 0.59)</p>	<p>The founder effect involves a small group founding a new population and the allele frequency in the founding group may not represent the frequencies in the original population.</p> <p>Many students did not understand the founder effect concept.</p>
<b>Question 7</b>	<p><b>a</b></p> <p>0/4      34</p> <p>1/4      19</p> <p>2/4      22</p> <p>3/4      16</p> <p>4/4      9</p> <p>(Average mark 1.48)</p>	<p>The process that led to the increase in the percentage of resistant rats included warfarin resistant rats existing in the population before the use of warfarin <b>and</b> when warfarin is used non-resistant rats are killed <b>and</b> warfarin resistant rats survive to reproduce, and pass on the allele for resistance <b>or</b> warfarin resistance is inherited and so is passed on to next generation <b>and</b> over several generations the proportion of warfarin resistant rats increases.</p> <p>Students who could clearly express their ideas in a logical way were more likely to be awarded full marks. Students must be encouraged to formulate answers to questions that require a detailed account of a concept/s.</p>
	<p><b>b</b></p> <p>0/2      78</p> <p>1/2      12</p> <p>2/2      10</p> <p>(Average mark 0.32)</p>	<p>From the graph it can be seen that the percentage of resistant rats decreases when the use of warfarin is discontinued (years 3 and 4) <i>therefore</i> resistant rats are at a disadvantage in a non warfarin environment <b>or</b> resistant rats are less fit in a non warfarin environment <b>or</b> non-resistant rats are at a selective advantage in a non warfarin environment.</p> <p>The question asked students to use the data in figure 13. Therefore, students were expected to explain how the data was used in arriving at their conclusion, for example more successful answers specifically mentioned that the number of rats decreased in years 3 and 4.</p>
<b>Question 8</b>	<p><b>a</b></p> <p>0/2      30</p> <p>1/2      56</p> <p>2/2      14</p> <p>(Average mark 0.84)</p>	<p>The populations of red-necked wallabies in Tasmania have not been isolated long enough from the populations of red-necked wallabies on the mainland for sufficient genetic differences to accumulate <b>and</b> the populations of the red-necked wallabies occupy similar habitats so similar selection pressures <b>or</b> a specific example of a selection pressure.</p> <p>Students could score 1 mark if they gave a specific example of a similar selection pressure but were not awarded 2 marks if they gave two examples of similar selection pressures.</p>
	<p><b>b</b></p> <p>0/2      24</p> <p>1/2      41</p> <p>2/2      35</p> <p>(Average mark 1.11)</p>	<p>The Eastern Quoll may be extinct on the mainland of Australia because a disease may have spread through the mainland populations and killed all quolls <b>or</b> a predator may have been introduced on the mainland which killed all of the quolls <b>or</b> the quoll habitat may have been destroyed when humans cleared much of the mainland for farming.</p> <p>One-word answers such as 'hunting' or 'predators' are unlikely to be awarded marks. The space provided for the answers indicated the detail needed in the response.</p>