Biology CAT 3: Written examination

GENERAL COMMENTS

There were eight articles with eight compulsory questions. The total number of marks was 75. The highest mark awarded to a student was 72. The average mark obtained by the students was 32.41, which is slightly lower than the CAT 3 mean mark in 1996.

SPECIFIC INFORMATION

For each question, an outline answer (or answers) is provided. Each answer is broken into parts to give an indication of how marks are allocated on the paper. The answer provided is not always the only answer that could be awarded marks. Comments are made about student performance at the end of each set of answers. The mean mark refers to the mean mark awarded for each question over all markings.

Question-by-question details

Question 1

1ai–ii (mean mark 1.43; possible mark 2)

a.i. recessive

a.ii. person IV-1 has alkaptonuria and neither parent is affected
OR
alkaptonuria skips generation II and III
OR
if dominant the trait would not reappear after generations II and III

1b (1.8; 3)

b. Probability of alkaptonuria is 1/4
Working required:

Parents	(III 3) Aa	x	(III 4) Aa
Offspring	1/4 AA: 1/2 Aa; 1/4 aa		

1ci–ii (0.9; 2)

c.i. enzyme 3

c.ii. Build up of homogentisic acid suggests that it is not being converted to maleylacetoacetic acid, enzyme 3 catalyses this reaction
OR
enzyme 1 and 2 are present because homogentisic acid is produced.

1d (1.39; 3)

d.

DNA	AGA	GAG	TAG	C
mRNA	UCU	CUC	AUC	G
amino acid	ser	leu	iso	

one possible change would have been to delete the first A
This results in:

DNA	GAG	AGT	AGC
mRNA	CUC	UCA	UCG
amino acid	leu	ser	ser

Students could have deleted another base and been awarded full marks.

*Most students could correctly identify the pattern of inheritance displayed in the pedigree. In part **a ii**, general comments such as 'the trait skipped a generation' were not awarded a mark. A response such as 'if the trait was dominant, there would be more sufferers' displays a lack of understanding by the student.*

*Many students could correctly work out the probability in part **b**. Students who experience difficulty with ratios should use fractions or percentages when expressing probability. Some students incorrectly used a ratio of 1:4.*

*A common error in part **d** was the substitution of a base instead of the deletion of a base. Students are reminded to read each question carefully in an effort to avoid such mistakes. Some other students made up their own DNA sequence instead of using the DNA sequence provided. Marks were not awarded in these cases.*

2a–b (1.61; 2)

a. 31

b. meiosis

2ci–ii (1.15; 2)

c.i. 53

c.ii. The donkey gamete contains 31 chromosomes and the zebra gamete contains 22 chromosomes. The fusion of the two gametes would result in a zygote with 53 chromosomes.

2d (0.58; 2)

d. Chromosomes are not found in homologous pairs
AND
chromosomes will not synapse at meiosis and the gametes may be genetically unbalanced
OR
donkey and horse chromosomes are different or chromosomes are from different species
AND
chromosome pairing would be difficult during meiosis and gametes may be genetically unbalanced
OR
a number of chromosomes are unpaired
AND
when chromosomes pair during meiosis many may be without a partner so the gametes may be genetically unbalanced.

*Parts **a**, **b** and **c** were generally well done. Students were required to spell meiosis correctly in order to attain full marks for Part **a**. A few students made mistakes in adding in part **c**. Some thought that a somatic cell did not contain sex chromosomes and arrived at an answer of 51 instead of 53. In part **c ii** an answer such as 31 + 22 = 53 was not sufficient.*

*Part **d** was not answered well by many students. A significant number tried to explain the problem of gamete formation in terms of the gametes of the donkey and the zebra. They failed to recognise that the zonkey did exist.*

3a (0.24; 1)

a. Alleles on the same chromosome pass more frequently into the same gamete at meiosis
OR
alleles on the same chromosome are inherited together

3bi–ii (0.87; 2)

b.i. B and W

b.ii. Greatest distance apart of loci shown.

3c (1.22; 2)

c. genotype
HG
hg
phenotype
purple, hairy

3d (1.33; 2)

d.

	1	2	3	4
Genotype	HG / hg	Hg / hg	hG / hg	hg / hg
Phenotype	Hairy, purple stem	Hairy, green stem	Hairless, purple stem	Hairless, green stem

3ei–ii (0.52; 3)

e.i. If the loci are assorting independently you would expect equal proportions of the 4 phenotypes. In this case two phenotypic classes are in high frequency and two phenotypes are in lower frequency
OR
the 4 phenotypes are in unequal proportions
OR
ratio of phenotypes is not 1:1:1:1

e.ii. phenotypes
Hairy, purple stem : Hairy, green stem : Hairless, purple stem : Hairless, green stem
AND
ratio
1:1:1:1

*A common error made by students in part **a** was to give a description of linkage and not explain the significance of linkage. Students often loosely referred to genes rather than correctly discussing the segregation of alleles at the loci.*

*In part **b**, the most common mistake made by students was to state that L and W were linked.*

*In part **d** most students could correctly identify the phenotypes.*

*Part **e** was one of the more difficult questions. Many students left a blank space. Those students that had some idea often failed to give both the phenotypes and the ratio in part **e ii**.*

4a–b (0.4; 2)

a. individual II 1

b. An obese female (II 1) does not have an obese father (I 1)
OR
the father (I 1) of an obese female (II 1) is not obese.

4c (1.11; 2)

c. Any two of:
- ribose sugar in mRNA compared with a deoxyribose sugar in DNA
- mRNA is single stranded compared with DNA which is double stranded
- uracil is found in mRNA compared with thymine in DNA

4di–ii (1.54; 3)

d.i. tRNA **OR** transfer RNA

d.ii. Complementary pairing of anticodon of tRNA with codon in mRNA
AND
tRNA brings amino acid into position

4ei–iii (2.12; 3)

e.i. cytosine

e.ii. adenine

e.iii. codon

4f (0.24; 1)

f. G to A

4g (0.56; 1)

g. A stop codon instead of the amino acid arginine therefore the translation of the polypeptide will stop prematurely
OR
polypeptide is shortened.

4h–i (0.89; 2)

h. A trait that is the result of several genes.

i. One of
body length, fur colour, ear length, tail length, etc.

4ji–ii (1.33; 2)

j.i. Graph B

j.ii. Continuous distribution of phenotypes shown in graph B
OR
discontinuous distribution of phenotypes shown in graph A.

*Students who shaded in more than one symbol in part **a** were not awarded a mark. Some students did not give a satisfactory response in part **b** after getting part **a** correct.*