Biology GA 3: Written examination 2

SPECIFIC INFORMATION

Section A

Correct responses to the multiple-choice section and percentage of students with the correct response:

Question	Correct response	%	Question	Correct response	%
1	C	91	14	D	51
2	D	61	15	D	27
3	A	55	16	B	54
4	C	69	17	A	63
5	B	76	18	B	62
6	B	47	19	B	92
7	D	20	20	A	66
8	B	60	21	A	55
9	D	57	22	D	74
10	C	54	23	A	70
11	C	94	24	C	68
12	C	77	25	C	67
13	D	56			

Section B

For each question, an outline answer (or answers) is provided. Each answer is broken into parts to give an indication of the allocation of marks shown on the paper. In some cases, the answer provided is not the only answer that could have been awarded marks. Comments on student performance on the question follow the answers for each question.

The mean marks quoted are the mean marks awarded for answers over all markings.

Question 1

a. (Average mark 0.88/Available marks 2)

Cell division in which the chromosome number is halved **or** Cell division in which the chromosome number goes from 2N to N **or** Cell division in which the chromosome number goes from diploid to haploid, **and one of**: occurs during gamete production **or** four cells are produced **or** involves two divisions.

b. (0.60/2)

An homologous pair of chromosomes fails to separate during the first meiotic division.

Students also needed to provide a diagram to illustrate recognition of homologous chromosomes remaining in the one cell and the other cell without a representative of this chromosome pair.

c. (0.48/1)

The same gene loci **or** the same gene sites **or** the same genes.

d. (1.53/2)

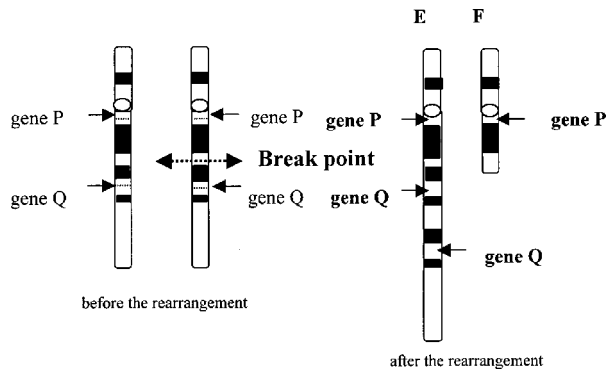


Figure 1

Note: the two copies of P and one copy of Q remain in same position. One copy of gene Q on long arm of E.

ei–ii. (0.93/2)

i. 100%

ii. 50%

Some students confused meiosis with mitosis in part a. Most students could give one correct statement about meiosis. Fewer could go on to make a valid second point.

The diagrams drawn by students in part b. failed to clearly show an homologous pair of chromosomes not separating during the first meiotic division. Incorrect responses included diagrams showing chromatids of a chromosome failing to separate in the second division or crossing-over occurring. Diagrams must be drawn with care and show adequate detail of the process.

Many students correctly completed part d. Failure to show the position of one of the four genes was the most common mistake.

Question 2

ai–ii. (1.35/2)

i. Colourless

ii. Colourless

bi. (0.95/2)

1/16 **or** 1:15

1/8 **or** 1:7

bii. (0.26/2)

Expected phenotypic ratio from this dihybrid cross is 9A-B-:3A- bb:3 aaB-:1aabb, but as only two phenotypes in a ratio of 9 purple :7 colourless instead of four suggests that the 3 + 3 + 1 = 7 without A and B gives the same phenotype (colourless) and only when alleles A and B are present do you get purple

or

Plants to have a purple coat need allele A and allele B. In a cross of two heterozygotes (or a dihybrid cross or this cross) 9/16 will have A and B and will be purple and the rest 7/16 do not and will be colourless.

c. (0.68/3)

Two possible answers were:

- Take samples of seeds from the plants on **both** farms and grow them in a controlled environment. If the trait is genetic the phenotypes should be tall from the seeds of the plants on the property where the plants were tall and shorter from the property where the plants were shorter.
- Take the seeds from **each property** and grow them on the other property. If the trait is genetic the phenotype of the tall plant should be tall on the property where the shorter plants grew and vice versa.

di. (0.45/1)

The heterozygote has a different phenotype from the two homozygous phenotypes, due to incomplete dominance or partial dominance.

dii. (0.52/2)

The inheritance of a trait involving the action of many genes is termed polygenic inheritance, and one of:

- each gene adding to the trait (phenotype)
- the trait will have continuous distribution of phenotypes.

diii. (0.34/2)

If the trait was polygenic, in the F_2 there would be a range (continuum) of heights from the short through to intermediate to tall **or** a distribution of heights approximating a normal curve **or** many different phenotypes with respect to height **or** many different heights **and** for a single gene the number of phenotypic classes is three **or** the only phenotypes would be tall, intermediate and short.

Part c. was addressing the examination criterion 'knowledge and application of experimental methods'. In some cases students did not show understanding of experimental design. Descriptions of moving plants or parts of plants were common. Few mentioned planting seeds or how the environment was to be controlled. Students should be given opportunities to evaluate experimental methods.

Some students confused polyploidy with polygenic inheritance in part dii.

Part diii. required a discussion of the F_2 of this cross. General answers to this question were not accepted. The student had to indicate that there would be three phenotypes if the trait was the result of a single gene, not that the number of phenotypes would be less than if the trait was the result of polygenic inheritance.

Question 3

a. (0.54/1)

Two

b. (0.46/1)

The purpose of PCR is to make multiple copies of this DNA or to amplify this DNA.

c. (0.17/1)

The new DNA strand consists of half old and half new DNA.

d. (0.88/1)

G	A
C	T

e. (0.55/1)

Male or TV personality.

f. (0.35/2)

The male is not the father. Of the two fragments in the gel for the child, the mother contributed the large fragment (or fragment closest to loading wells) and the father does not have the smaller fragment seen in the child (or fragment furthest from loading wells) therefore is not the father.

Fifty-four per cent of all responses were correct in part a. The most common incorrect response was forty-six. This suggests that some students thought there was a D1S80 locus on each of the chromosomes found in a human cell.

In part f. many students missed the point that the mother had to provide the large fragment to the child. The most common error was to state that the father and child had no common fragment. They do have the large fragment in common, except that the child must have received this large fragment from the mother. Another common error was to state that the child had a fragment half way between the smaller fragments seen in the male and the mother, making the male the father. Students need to be encouraged to think about an answer before starting to write a response. Explanations need to be clear and in a logical sequence.

Question 4

a. (1.36/3)

- a small number of resistant rabbits existed before the introduction of the myxoma virus
- relatively more resistant rabbits survive to pass on myxoma resistance alleles to next generation
- over several generations the frequency of resistant rabbits increases.

b. (0.33/1)
There are more virus particles in the blood to be picked up and carried by mosquitoes to another host and this increases the chance of transmission/dispersal of the virus.
c. (0.40/2)
Fewer virus particles around so rabbits live longer and therefore virus lives longer. There is an increased chance for the virus of finding a new host.

Many students could give a comprehensive answer to part a. The increase in frequency of resistant rabbits occurring over time was the point most frequently missed. A few students incorrectly suggested that the introduction of the virus caused a mutation in the rabbit, which then caused the rabbits to have resistance to the virus. Incorrect answers in parts b. and c. referred to the advantage to the rabbit rather than the virus.

Question 5

ai. (0.86/1)
1
aii. (0.29/1)
Human and chimpanzee share a recent common ancestor or are the most closely related; therefore you expect a closer similarity in DNA and amino acid sequences.
b. (0.65/2)
Because several amino acids can have more then one codon (or the genetic code is degenerate/redundant) there can be differences in the DNA sequence for the same amino acid sequence.
c. (0.41/1)
In HBA globin glu codons **G**AA or GAG
In HBC globin lys codons **A**AA or AAG
Therefore the change has been G to A or guanine to adenine.
d. (0.97/2)
glu **G**AA – **U**AA which is a stop codon
The translation of the mRNA would stop after amino acid 6 or the polypeptide is shortened.

In part aii. marks were not awarded if the response stated 'a common ancestor'. A mouse, rabbit and chimpanzee will all share a common ancestor if the fossil record is reviewed over a sufficient time period. A statement that related the human to the chimpanzee was required for the mark to be awarded.

In part c. some students had the change the wrong way around, an A to a G. Others referred to the change in amino acid sequence instead of the change in the RNA sequence.

In part d. most students indicated that the new codon was a stop codon. Many explanations of the effect this had on a globin synthesis were not clearly expressed. Incorrect responses included 'stopping amino acid synthesis' or 'altering the function of the polypeptide produced'.

Question 6

a. (0.80/3)
- an ancestral species of *Niveoscincus palfreymani* became isolated or a species which had continuous distribution between Tasmania and Pedra Branca Rock (PBR) became isolated on PBR when sea levels rose
- as a result of no interbreeding (or no gene flow) between PBR and Tasmania
- genetic differences accumulate over time (with different selective pressures) and the new species results, i.e. *Niveoscincus palfreymani.*

b. (0.53/1)
Any of: elimination of feral species, rats or cats **or** set up captive breeding program **or** selective breeding programs.

Questions that require detailed explanation continue to challenge students. Many students could clearly describe the effect of different selective pressures on two populations of skinks; fewer could explain the origin of the two populations. The most common incorrect answer given in part b. was 'breeding with another species'.

Question 7

a. (0.61/2)
Two of:
- unsuitable habitat for the plant species
- not in that region pre 228 mya (not correct to say not found before 228 mya because it was found in other areas)
- unsuitable climate in the region for fossilisation of the pollen
- not found yet during sampling.

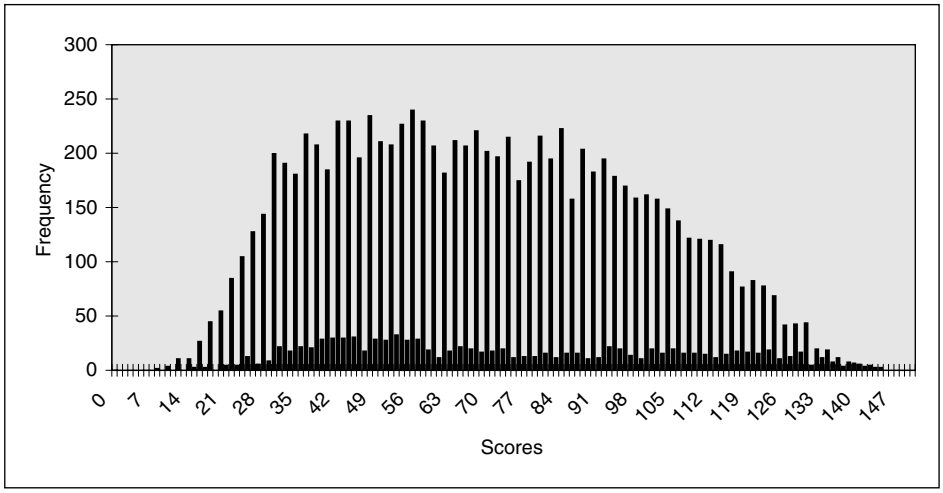
b. (0.27/1)
One of:
- potassium/argon
- argon/argon
- lead/lead
- uranium/lead
- rubidium/strontium
- thorium/lead.

Students need to be reminded that some questions require specific answers that refer to the information that has been given in the question. In part a., marks were not awarded for answers such as 'plants not found' or 'pollen not fossilised'. The pollen from the plant had been found in strata from a variety of places throughout the world. Some students stated the plant that produced the pollen became extinct. This displays a misunderstanding of the timeline. The most common incorrect answer to part b. was carbon dating.

GA BI033 BIOLOGY WRITTEN EXAMINATION 2

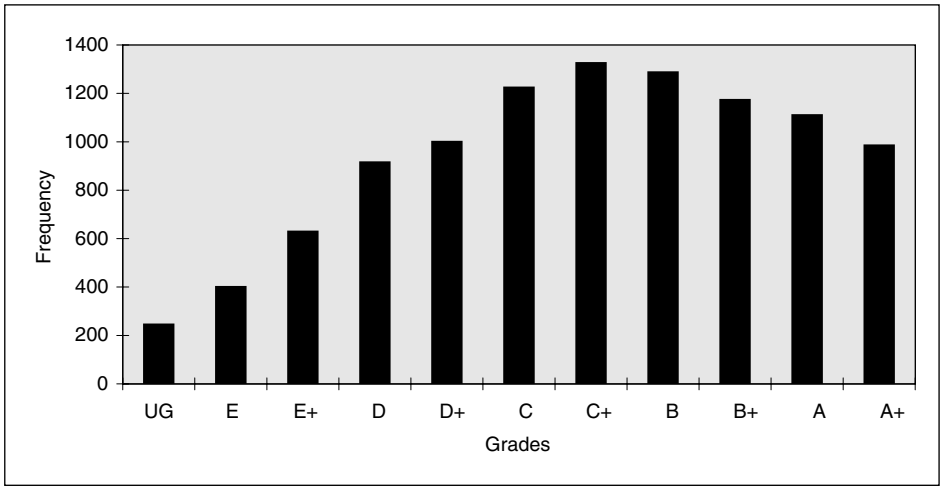
HISTOGRAM OF TOTAL SCORES 2000

Count 10282 Mean 69.82 Standard Deviation 28.83 NA Result 442



HISTOGRAM OF TOTAL GRADES 2000

Count 10282 Mean 5.90 Standard Deviation 2.68 NA Result 442



ENROLMENTS		%
Female	7585	70.7
Male	3137	29.3
Total	10722	

GLOSSARY OF TERMS

Count Number of students undertaking the assessment. This excludes those for whom NA was the result.

Mean This is the 'average' score; that is all scores totalled then divided by the 'Count'.

Standard Deviation This is a measure of how widely values are dispersed from the average value (the mean).