VICTORIAN CURRICULUM AND ASSESSMENT AUTHORITY

Victorian Certificate of Education 2004

SUPERVISOR TO ATTACH PROCESSING LABEL HERE

STUDENT NUMBER

									Letter
Figures									
Words									

BIOLOGY

Written examination 2

Monday 1 November 2004

Reading time: 3.00 pm to 3.15 pm (15 minutes)
Writing time: 3.15 pm to 4.45 pm (1 hour 30 minutes)

QUESTION AND ANSWER BOOK

Structure of book

Section	*Number of questions*	*Number of questions to be answered*	*Number of marks*	*Suggested times (minutes)*
A	25	25	25	30
B	9	9	50	60
			Total 75	90

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners and rulers.
- Students are NOT permitted to bring into the examination room: blank sheets of paper and/or white out liquid/tape.
- No calculator is allowed in this examination.

Materials supplied

- Question and answer book of 27 pages.
- Answer sheet for multiple-choice questions.

Instructions

- Write your **student number** in the space provided above on this page.
- Check that your **name** and **student number** as printed on your answer sheet for multiple-choice questions are correct, **and** sign your name in the space provided to verify this.
- All written responses must be in English.

At the end of the examination

- Place the answer sheet for multiple-choice questions inside the front cover of this book.

Students are NOT permitted to bring mobile phones and/or any other electronic communication devices into the examination room.

SECTION A – Multiple-choice questions

Instructions for Section A

Answer **all** questions in pencil on the answer sheet provided for multiple-choice questions.
Choose the response that is **correct** for the question.
A correct answer scores 1, an incorrect answer scores 0.
Marks will **not** be deducted for incorrect answers.
No marks will be given if more than one answer is completed for any question.

Use the following information to answer Questions 1 and 2.

An autosomal gene controls the shapes of tabby stripes in a cat's fur. It has the alternative alleles

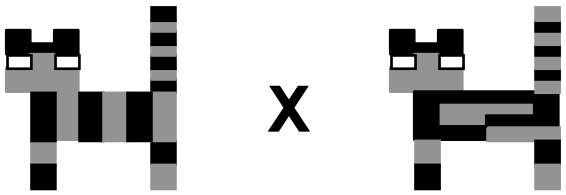
T : vertical stripes of colour (called mackerel tabby)
t : swirly stripes of colour (called blotched tabby).

The patterns are illustrated as follows.

mackerel tabby | blotched tabby

Question 1

Several crosses were carried out between pairs of cats as follows.



mackerel tabby female **X** blotched tabby male

All of the mackerel tabby cats were heterozygous.

In total, the cats produced 100 kittens.

Among these kittens, it would be reasonable to expect

A. approximately 50 mackerel tabby females.
B. approximately 25 blotched tabby females.
C. more mackerel tabby females than mackerel tabby males.
D. more blotched tabby males than blotched tabby females.

Another unlinked autosomal gene that affects coat colour in cats is the Agouti gene. This gene has the alleles

A : tabby pattern shows in cat's fur
a : tabby pattern is not expressed in cat's fur.

A cat that is ***aa*** for the Agouti locus fails to show any stripes, regardless of its genotype at the tabby stripes locus. These cats are solid black in colour.

Question 2

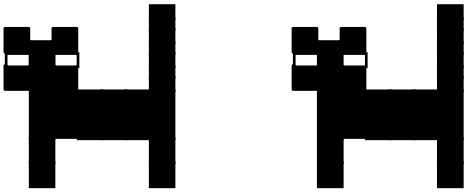
A cross was carried out between cats of the following genotypes.

TT Aa **X** ***tt Aa***

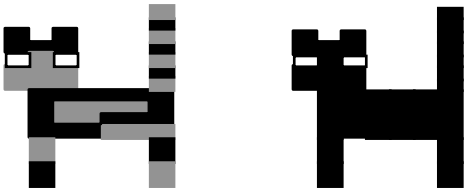
The cats had two kittens.

It is reasonable to expect kittens of the kind shown in

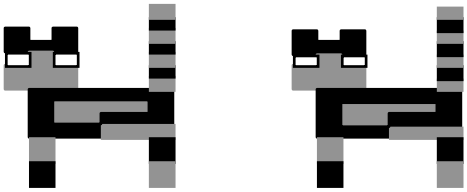
A.



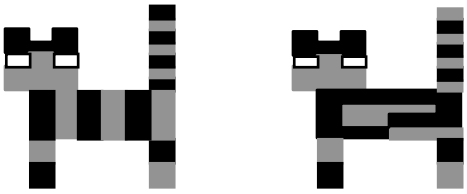
B.



C.



D.



Use the following information to answer Question 3.

Two genes in watermelons with their alternate alleles are

Gene 1	***S***	:	spots
	s	:	solid colour
Gene 2	***B***	:	bitter fruit
	b	:	sweet fruit

The two genes assort independently.

Two plants, both heterozygous at each gene locus, were crossed and 1600 seeds were collected.

Question 3

When plants were grown from these seeds, it would be reasonable to expect that about

A. 100 of the plants produced spotted-coloured, bitter fruit.

B. 300 of the plants produced solid-coloured, bitter fruit.

C. 300 of the plants produced solid-coloured, sweet fruit.

D. 1600 of the plants produced spotted-coloured, sweet fruit.

Use the following information to answer Questions 4 and 5.

Four genes on chromosome number 10 in maize have the pairs of alleles

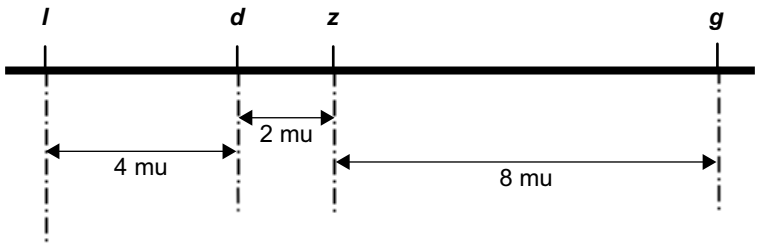
Gene 1 ***L*** and ***l***

Gene 2 ***D*** and ***d***

Gene 3 ***Z*** and ***z***

Gene 4 ***G*** and ***g***

The relative location of these genes on the chromosome is as follows.



The map distances (mu) between the loci are indicated.

With respect to this portion of chromosome number 10, a particular maize plant has the following genotype.

$$\frac{L\ D\ Z\ G}{l\ d\ z\ g}$$

Question 4

When this plant produces gametes, one could expect about

A. 2 per cent recombination between the gene loci ***l*** ***d***.

B. 6 per cent recombination between the gene loci ***d*** ***g***.

C. 8 per cent recombination between the gene loci ***z*** ***g***.

D. 12 per cent recombination between the gene loci ***l*** ***g***.

Question 5

A maize plant of genotype

$$\frac{L\ D}{l\ d}$$

was involved in a test cross.

The genotype of the plant to which it was crossed would be

A. $\frac{L\ d}{l\ D}$

B. $\frac{l\ d}{l\ d}$

C. $\frac{L\ D}{l\ d}$

D. $\frac{L\ D}{L\ D}$

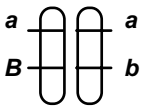
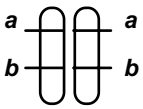
Use the following information to answer Questions 6 and 7.

Two linked genes in humans have the following alleles.

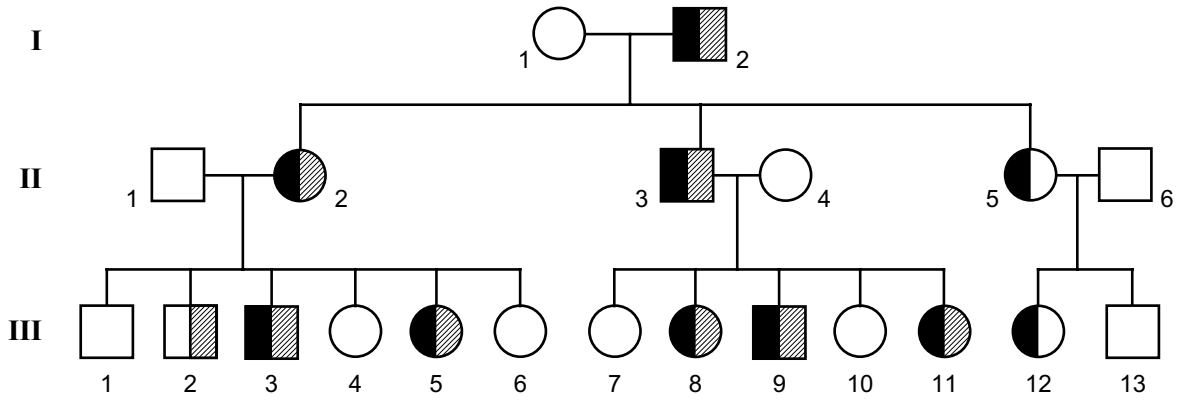
Gene 1 ***A*** : secretor
a : non-secretor

Gene 2 ***B*** : production of protein X
b : no protein X produced

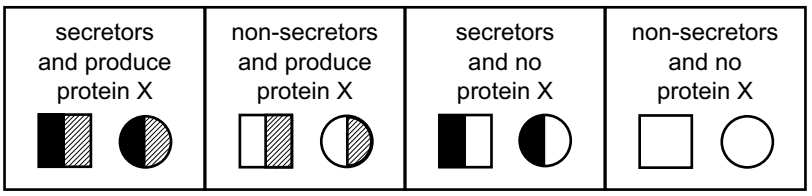
Information regarding these traits in a family was collected and the chromosome composition of each member for these two genes was established. It was found that, in all, there were four different chromosome compositions in the family. The four types are shown in the following table.

	Type one	Type two	Type three	Type four
Genotype				

The pedigree for the family is shown below.



The code for interpreting the symbols is



Question 6

It is reasonable to conclude that the genotype of individual

A. I–1 is type 1.

B. II–2 is type 2.

C. III–2 is type 3.

D. III–12 is type 4.

Question 7

Assuming that all generation III individuals marry partners that are homozygous recessive for these two genes, it is reasonable to conclude that individuals

A. 5 and 6 have an equal chance of having a non-secretor child.

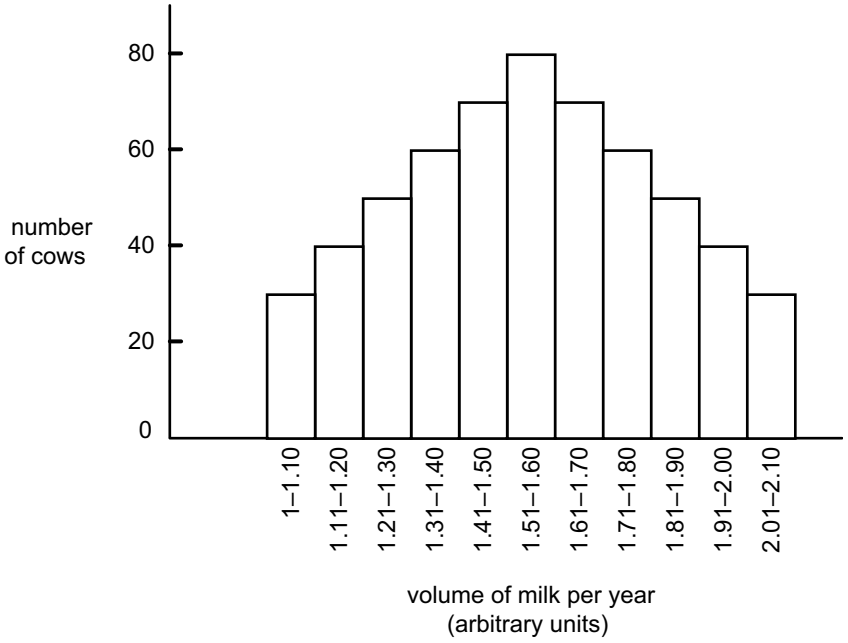
B. 6 and 12 have an equal chance of having a non-secretor child.

C. 5 and 6 have an equal chance of having a child who fails to produce protein X.

D. 6 and 12 have an equal chance of having a child who fails to produce protein X.

Use the following information to answer Question 8.

Milk production in cows is under genetic control. The daily volume of milk produced by each cow in a large herd of cows was recorded and the results graphed. The results were as follows.



Question 8

A trait showing this kind of distribution is

A. not found in humans.

B. called a discontinuous trait.

C. under the control of many genes.

D. not influenced by environmental factors.

Use the following information to answer Questions 9 and 10.

The following nucleotide sequence forms part of the template strand of a gene coding for protein X.

T G G A T G A C ⟵ **DNA template strand**
*

Question 9

The complementary base found at the fourth nucleotide (marked *) in a sequence transcribed from this sequence would be

A. C
B. G
C. T
D. U

Question 10

In a double-stranded molecule formed from this DNA template strand (shown above) the number of deoxyribose sugar units you would expect to find is

A. 4
B. 8
C. 16
D. 32

Question 11

Reverse transcriptase catalyses the production of

A. DNA from an mRNA template.
B. DNA from a protein template.
C. mRNA from a DNA template.
D. tRNA from a DNA template.

Use the following information to answer Question 12.

The list 1–4 below describes events and outcomes of the replication of DNA within a eukaryotic cell.

1. Complementary nucleotides bind to each of the two strands.
2. Sugar phosphate bonds form between the nucleotides.
3. The newly formed DNA molecules are semi-conserved.
4. Unwinding of the DNA molecule forms two single strands.

Question 12

The correct order of these events during DNA replication, with the earliest event first, is

A. 1, 2, 3, 4
B. 1, 4, 3, 2
C. 4, 2, 1, 3
D. 4, 1, 2, 3

Use the following information to answer Questions 13 and 14.

One of the human blood groups is the MN group. There are two alleles, L^M and L^N, at this gene locus which determine the presence of an antigen, M or N, on the surface of the red blood cells. The heterozygote L^ML^N has a different phenotype from each of the homozygotes.

Question 13

If an individual of blood type M and one of blood type MN have children, the number of different phenotypes possible in their offspring is

A. 1

B. 2

C. 3

D. 4

Question 14

The frequencies of the phenotypes of the MN blood group were measured in a European population. Of 100 individuals, 40 were blood type M, 20 were blood type MN and 40 were blood type N.

From this data it is possible to conclude that

A. the frequency of the L^N allele is 0.3.

B. the frequency of the L^M allele is 0.5.

C. there are 60 L^M alleles in this population.

D. there is a total pool of 100 alleles at this locus for this population.

Question 15

Natural selection acts upon an organism's

A. habitat.

B. genotype.

C. phenotype.

D. environment.

Question 16

Convergent evolution may produce similar structures in two different species.

This may lead to

A. analogy.

B. homology.

C. divergence.

D. embryology.

Question 17

Two types of bird were originally thought to be different species. However, recently a group of biologists has agreed that they are the same species.

The biologists must have found out that the two types of bird

A. look alike enough to be thought one species.

B. are separated by a geographical barrier.

C. successfully interbreed in nature.

D. live in the same habitat.

Question 18

Homo neanderthalensis lived in Europe and Western Asia from approximately 250 000 to 28 000 years ago. In comparison to modern day humans the *Homo neanderthalensis* possessed relatively

A. smaller brains.

B. smaller noses.

C. higher foreheads.

D. more prominent brow ridges.

Question 19

Evidence of hominid cultural evolution can be found in the fossil record.

This evidence would include

A. position of the attachment of the spine to the head.

B. length of arm bones in comparison to leg bones.

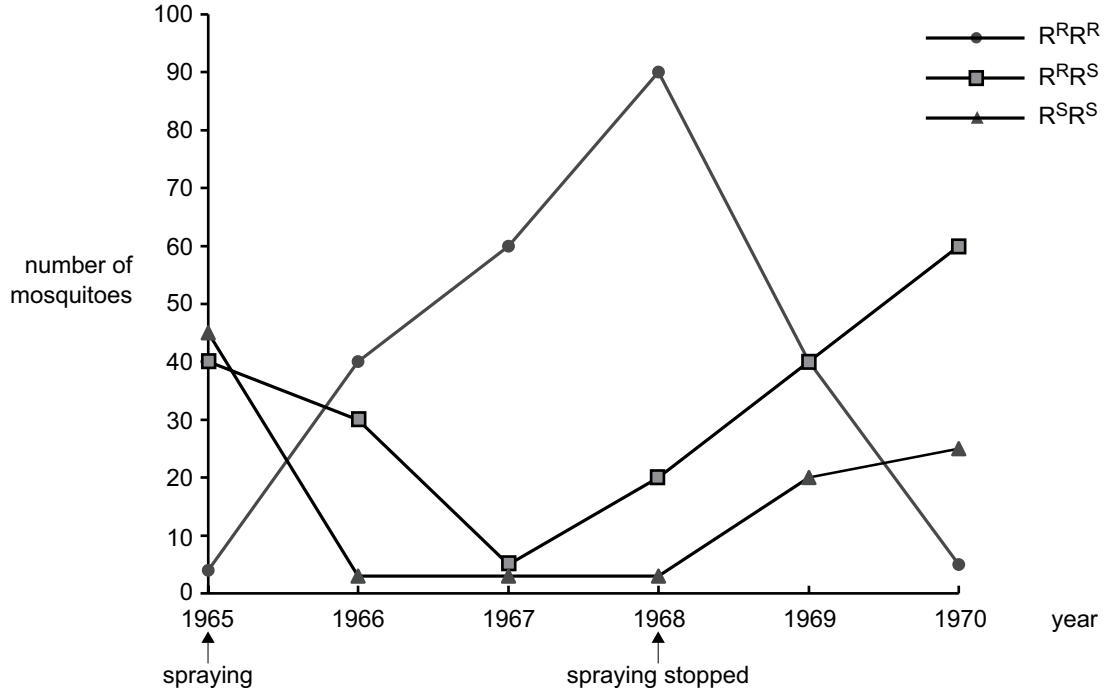
C. number of teeth present in the skull.

D. presence of stone tools.

Use the following information to answer Question 20.

In the mosquito there is a gene locus which has two alleles, R^R= resistant and R^S= sensitive, which are involved in resistance, in particular to the insecticide DDT.

The graphs below show the number of mosquitoes of the 3 phenotypes (and genotypes) collected from 1965, when DDT was first used, through to 1970, two years after the spraying of DDT stopped.



Question 20

From the data it is possible to conclude that

A. the frequency of the R^S allele is greater than the frequency of the R^R allele in 1968.

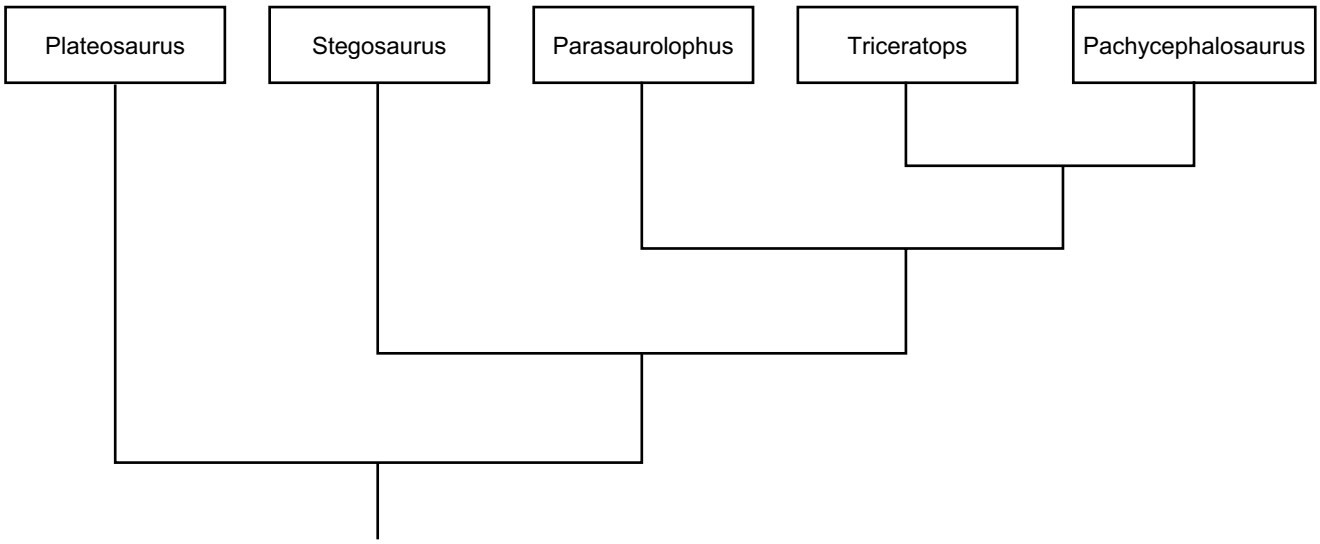
B. many generations after the removal of DDT the R^R allele would disappear from the population.

C. after removal of DDT from the environment in 1968, having the R^R R^R genotype reduces the chance of survival.

D. between 1967 and 1968 in the presence of DDT in the environment, the mosquitoes with the R^R R^S genotype are the most likely to survive.

Use the following information to answer Question 21.

Common structural characteristics between groups of dinosaurs were used to construct a cladogram. The cladogram displaying a suggested evolutionary relationship between the dinosaur groups is shown below.



Question 21

The two groups of dinosaurs with the most structural characteristics in common are

A. Triceratops and Pachycephalosaurus.

B. Parasaurolophus and Triceratops.

C. Stegosaurus and Parasaurolophus.

D. Plateosaurus and Stegosaurus.

Question 22

Homologous chromosomes contain the same

A. DNA sequences.

B. number of guanine and adenine nucleotides.

C. alleles.

D. genes.

Question 23

In some autosomal recessive conditions in humans, the homozygous recessive genotype results in death before reproductive age. Despite this, the allele for the recessive trait is maintained in the population. Maintenance of this allele in the population is most likely the result of

A. mutation.

B. migration between populations.

C. the heterozygote being biologically fitter than either of the homozygous genotypes.

D. individuals with the homozygous dominant genotype leaving more offspring in each generation.

Use the following information to answer Question 24.

The peppered moth, *Biston betularia*, has two forms, a dark form and a light form. The colour of the moth is under the control of a gene locus with two alleles, **B** (dark) and **b** (light). The dark phenotype is dominant. Moths rest during the day on the trunks of trees, and if obvious, will be eaten by birds. Prior to the industrial revolution (pre-1850) the trunks of the trees were covered in a light-coloured lichen. After the industrial revolution the tree trunks were covered in dark soot.

Studies of moths over many years have shown that the frequencies of the **B** and **b** alleles have changed. After 1850 the frequency of the **B** allele steadily increased and reached 0.9 in some industrialised areas of England.

Question 24

From the information it is possible to conclude that

A. the selective agent is the soot on the trees.

B. prior to 1850 there were no **B** alleles in the moth population.

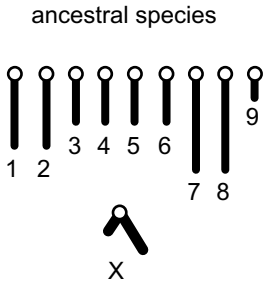
C. the relative fitness of the different coloured moths changed as the environment changed.

D. before the industrial revolution, heterozygous moths would be at an advantage compared to homozygous moths.

Use the following information to answer Question 25.

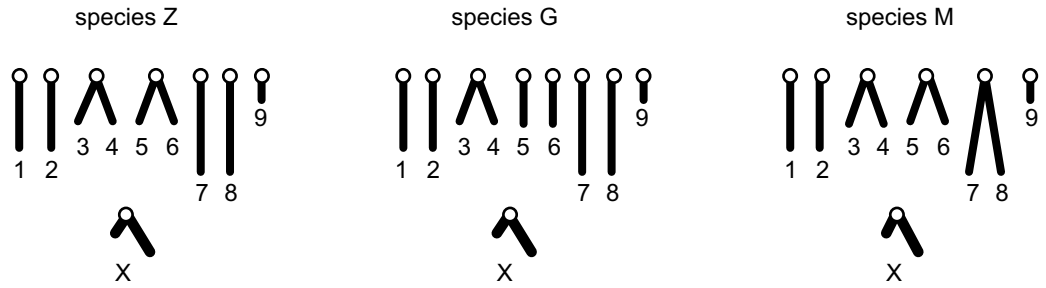
In some Australian insects, new species have arisen through changes that occurred to chromosomes in an ancestral species. Such changes may involve the joining together of chromosomes, the loss of whole or parts of chromosomes, and rearrangement of the genetic material within chromosomes.

One ancestral species has the following haploid set of chromosomes.



As the changes in chromosomes accumulate, a number of different species can result from a single ancestral species.

Three species that have evolved from the ancestral species shown above have the haploid sets of chromosomes shown below.



Question 25

The most likely order of evolution of these species is

A. ancestral species, species Z, species G, species M.

B. ancestral species, species G, species M, species Z.

C. ancestral species, species M, species G, species Z.

D. ancestral species, species G, species Z, species M.

END OF SECTION A

SECTION B – Short-answer questions

Instructions for Section B

Answer this section in pen.

Answer **all** questions in the spaces provided.

Question 1

In some species of locusts the female has a 'diploid chromosome number' of 16.

a. What is meant by the diploid chromosome number?

1 mark

b. In this species a male locust has a diploid number of 15.

What is the chromosome number of each of the two daughter cells produced during a mitotic division in a male?

1 mark

The difference in chromosome number between the sexes is the result of a difference in the number of sex chromosomes (X chromosomes in this case). Female locusts have two X chromosomes (XX) and male locusts have only one X chromosome and no other sex chromosome (XO).

c. At the end of a meiotic division, how many chromosomes would you expect in the gametes of

i. a female?

ii. a male?

1 + 1 = 2 marks

The colour of the locust is determined by a gene on the X chromosome with two alleles.

X^G = grey X^g = green

d. Show the genotypes and corresponding phenotypes, including the sex, of the parents and offspring of a cross of a grey male to a green female.

3 marks

Total 7 marks

Question 2

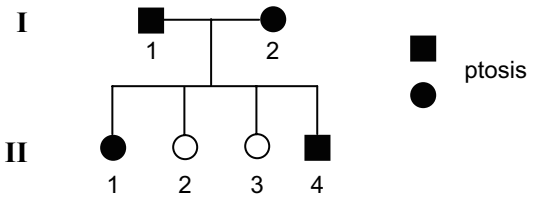
Ptosis is a weakness in the muscles of the eyelid.

a. Using the information in the text box below, construct a pedigree to fit the description of the inheritance of ptosis in the family.

> Bill had ptosis. Bill married Jill who did not have ptosis and they had two children, a boy Ben who was unaffected and a girl Daisy who had ptosis.
>
> Daisy married Bob who did not have ptosis and they had three daughters, two girls with ptosis and one girl without ptosis.

2 marks

b. The pedigree below shows another family in which ptosis was found.



i. Based on the information in this pedigree, what is the most likely mode of inheritance of ptosis?

_____

ii. Provide two pieces of evidence from the pedigree that support this conclusion.

Evidence 1

_____

_____

_____

Evidence 2

_____

_____

_____

1 + 2 = 3 marks

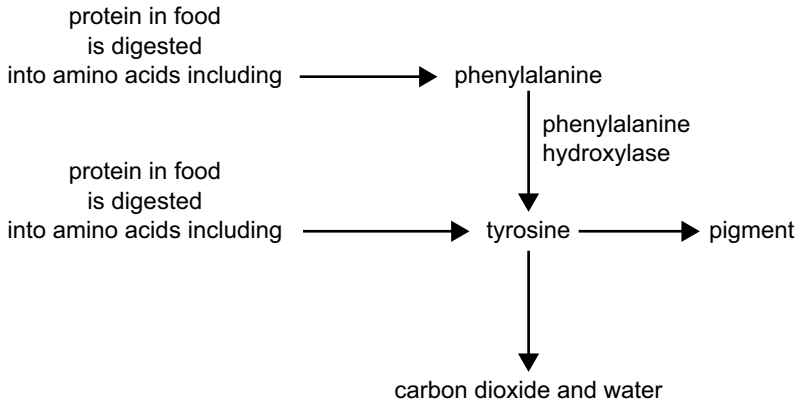
Total 5 marks

Question 3

Phenylketonuria (PKU) is an autosomal recessive disorder in which an affected individual is unable to metabolise the amino acid phenylalanine. The defect is due to the lack of the enzyme phenylalanine hydroxylase. The gene involved has two alleles

P : phenylalanine hydroxylase produced
p : no enzyme produced.

Part of the metabolic pathway involved is as follows.



If phenylalanine hydroxylase is not produced, phenylalanine builds up in body tissues, particularly brain tissue, and results in permanent damage. This damage can be avoided if a baby with PKU is placed on a special diet as soon as possible after birth. Other characteristics, less serious, are also produced in a PKU child.

a. Before treatment of PKU was possible, it was observed that individuals with PKU often had lighter hair and skin colour than their non-affected siblings. With reference to the metabolic pathway above, explain this observation.

_____

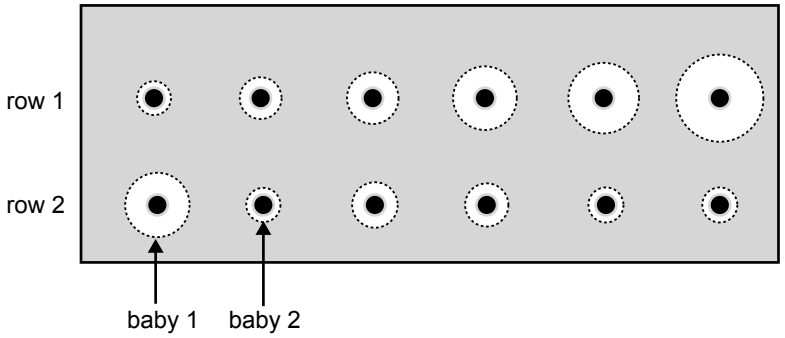
_____

_____

1 mark

The Guthrie test was developed to test a baby's blood for high levels of phenylalanine a few days after birth. In this test, a drop of blood was taken from a baby and placed on special paper and dried. Small discs were cut from the paper and placed on agar containing bacteria that grow well in the presence of phenylalanine.

One of the special agar plates is shown in the following diagram.



Row 1 contains 'control' discs each with a different known level of phenylalanine. The concentration of phenylalanine increases in the discs from left to right.
Row 2 contains sample discs from different babies.

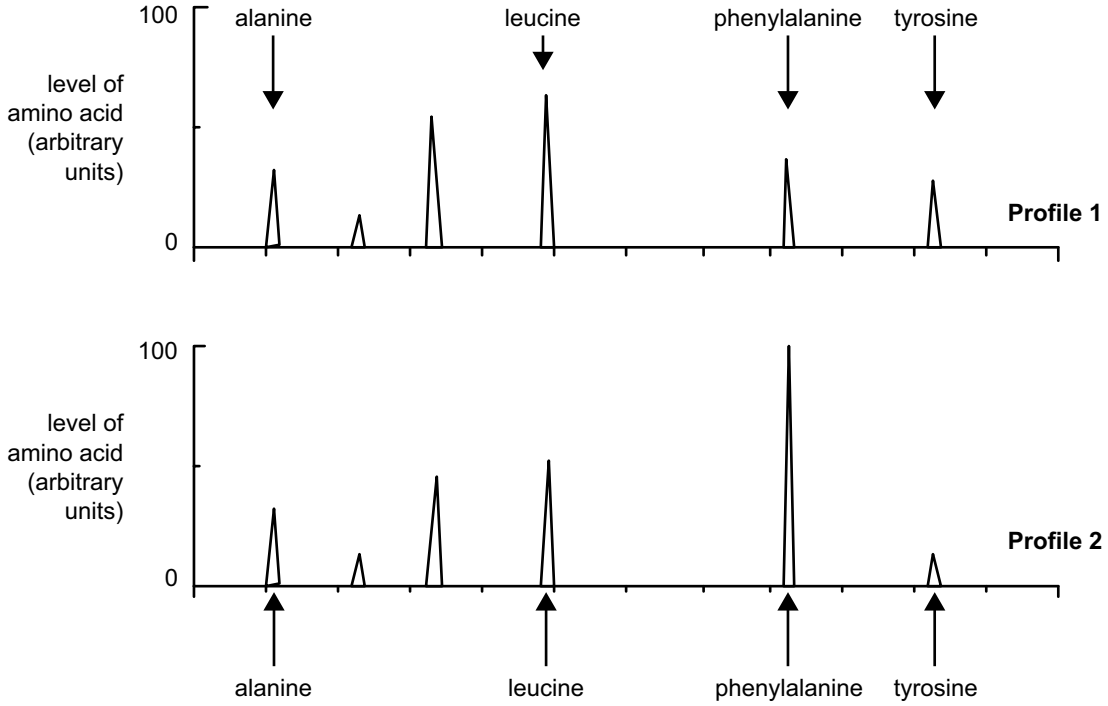
b. **i.** Explain why the control discs in row 1 are included on the plate.

ii. Baby 1 was diagnosed with PKU, whereas baby 2 was diagnosed as not having PKU. Explain why this decision was made given that there is some bacterial growth around the disc from baby 2.

1 + 1 = 2 marks

In the most recent tests for PKU, blood is still taken from a baby a few days after birth but the method of testing has changed. The sample of blood is examined by a machine that gives a visual profile of the amino acids present in the blood.

Two examples of profiles are shown below, one of which is from a baby with PKU. Only some of the amino acids are shown.



c. **i.** Which profile comes from a baby with PKU?

_____

ii. Give two reasons which explain your choice.

_____

_____

_____

1 + 2 = 3 marks

If a baby with PKU is placed on a special diet soon after birth, normal development follows.

d. Explain what kind of gametes, with respect to the PKU gene, such a person produces as an adult.

_____

_____

1 mark

When one country tried to introduce compulsory testing of parents for carrier status of a particular autosomal recessive condition for which no treatment was known, there was overwhelming opposition by the public and the legislation did not proceed.

e. Based on your understanding of inherited conditions, outline one argument that may have been used by the public against the proposed legislation.

_____

_____

_____

1 mark

Total 8 marks

CONTINUED OVER PAGE

Question 4

Below is the DNA sequence from the beginning of a gene coding for an enzyme involved in photosynthesis. The upper line of bases (in bold) represents the template strand.

T A C T T T A A G A G C T T A T C G ◄—— template strand
A T G A A A T T C T C G A A T A G C

a. Write the mRNA sequence that would be transcribed from this DNA sequence.

_____

1 mark

Use the table of part of the genetic code (below) to answer part **b**.

second base

first base	U	C	A	G	third base
U	UUU, UUC Phe UUA, UUG Leu	UCU, UCC, UCA, UCG Ser	UAU, UAC Tyr UAA Stop UAG Stop	UGU, UGC Cys UGA Stop UGG Trp	**U C A G**
A	AUU, AUC, AUA Ile AUG Met	ACU, ACC, ACA, ACG Thr	AAU, AAC Asn AAA, AAG Lys	AGU, AGC Ser AGA, AGG Arg	**U C A G**

b. **i.** The 6th base on the template strand of the sequence above is substituted by C.
What type of mutation is this?

_____

ii. Explain the effect this mutation will have on the amino acid sequence of the protein produced.

_____

_____

_____

1 + 1 = 2 marks

c. The 11th base pair of the sequence is deleted.
Explain the effect that this mutation will have on the amino acid sequence of the protein produced.

_____

_____

_____

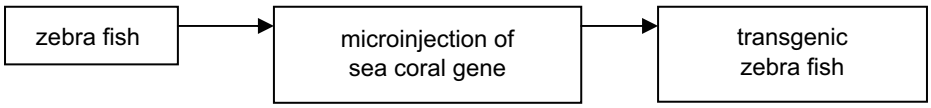
1 mark

Total 4 marks

Question 5

A US company has recently released what is believed to be the first designer transgenic pet.

The 'Glofish' is derived from the zebra fish, which is normally silver with black stripes. The zebra fish has been genetically modified by adding a gene found in a sea coral into zebra fish eggs. The offspring resulting from these modified eggs are reddish in colour and glow or fluoresce under ultraviolet light.



Although the added gene is from a different species, it is expressed in the same way in both the sea coral and transgenic zebra fish.

a. What feature of the genetic code makes it possible for a gene to be transferred from one species to another and to be expressed in the second species?

1 mark

b. What steps are required, within the zebra fish cells, for the sea coral gene to be expressed?

2 marks

c. Predict the chance of survival of the Glofish if it were released into the natural environment of the zebra fish. Explain your answer.

2 marks

Total 5 marks

Question 6

Asthma can be a serious medical condition that affects over 2.2 million Australians. People with asthma may experience shortness of breath and wheezing due to narrowing of the airways within their lungs.

There has been significant debate and research into the cause of asthma. Is it due to genetic influences, or certain factors in the environment, such as air pollution?

To answer this question researchers conducted a study involving twins, in which at least one of each twin pair develops asthma. The results from this study are summarised in the table below.

Type of twin pair	A. Number of twin pairs	B. Number of twin pairs in which one develops asthma	C. Number of twin pairs that both develop asthma	D. Percentage of twin pairs that both develop asthma
Monozygotic (identical twins)	50	25	25	
Dizygotic (nonidentical twins)	100	75	25	

a. In terms of genetic variation, how are identical twins different from nonidentical twins?

1 mark

b. Fill in the missing percentages of twin pairs that both develop asthma in column D of the table above.

1 mark

c. From these results, are identical twins more or less likely to share a tendency to develop asthma than nonidentical twins?

1 mark

d. Prior to this study, the researchers believed that asthma was an inherited condition. However, following the study, they concluded that both genetics and the environment were factors. What evidence from the data suggests that the environment has a role in the development of asthma?

2 marks

Total 5 marks

Question 7

Sickle cell anaemia is a serious inherited blood condition. It leads to tiredness and kidney or heart failure and without treatment children usually die before the age of 10. Sickle cell anaemia is due to a change in the gene which codes for beta haemoglobin. There are two alleles for the beta haemoglobin gene; **HbA** coding for normal beta haemoglobin and **HbS** coding for the changed haemoglobin. An individual with two copies of the **HbS** allele will develop symptoms of sickle cell anaemia.

It is now possible to genetically test people to see if they carry the **HbS** allele. This test uses PCR, the restriction enzyme *MstII* and gel electrophoresis.

MstII is a restriction enzyme that recognises the 7-base sequence in DNA,

C C T G A G G
G G A C T C C

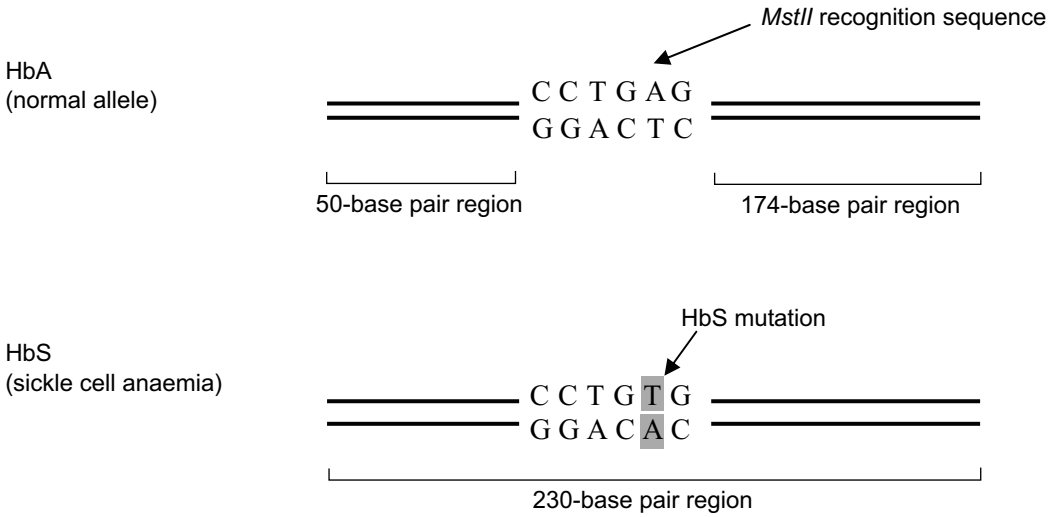
and cuts it between the C and the T to produce

C C T G A G G
G G A C T C C

a. What term is used to describe the ends of the fragments produced by *MstII*?

1 mark

Molecular studies have shown that the sickle cell allele differs only by one base pair from the normal allele. This base change occurs in a 7-base sequence that is recognised by the restriction enzyme *MstII*. This is the only *MstII* site found within the region of the gene that is used in the genetic test.



The PCR products are digested using *MstII*. The resulting fragments undergo gel electrophoresis.

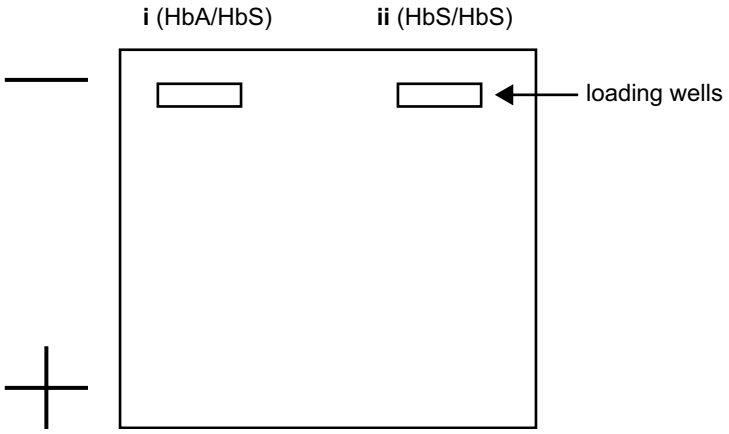
b. How is the action of the *MstII* enzyme affected by the HbS mutation?

1 mark

c. Mark on the picture of the gel below the banding patterns you could expect to see for someone who has each of the following genotypes.

i. HbA/HbS

ii. HbS/HbS



1 + 1 = 2 marks

Total 4 marks

Question 8

Rock wallabies, *Petrogale lateralis pearsonii*, on Pearson Island off the coast of South Australia have had no genetic contact with mainland rock wallabies since they were isolated by rising sea levels at the end of the last glacial period, around 10 000 years ago.

Scientists have taken blood samples from the wallabies and compared the distribution of unique DNA sequences called microsatellites, which are scattered across the wallabies' chromosomes. These microsatellites give a measure of the population's genetic diversity, or lack of it. In this case the microsatellite data showed that the Pearson Island population has low genetic diversity.

The scientists concluded that the Pearson Island population of rock wallabies has been through a genetic bottleneck. A genetic bottleneck is an example of genetic drift.

a. Explain how a genetic bottleneck may lead to a decrease in genetic diversity.

2 marks

Despite the Pearson Island rock wallabies' lack of genetic diversity, the population size has been maintained over many generations. In fact, the wallabies appear to be thriving.

b. Suggest one reason for the wallabies' success despite the lack of genetic diversity within the population.

1 mark

c. The population of rock wallabies on Pearson Island is most closely related to small populations of rock wallabies in southern Western Australia. Some scientists argue that some individuals from the southern Western Australian populations should be released onto Pearson Island.

Give one reason for this suggestion.

1 mark

Total 4 marks

Question 9

Naracoorte Caves are located in southeast South Australia. These limestone caves contain the greatest number, most diverse and best preserved fossils of the Pleistocene Epoch (1.8 million years to 10 000 years ago) in Australia. For more than 300 000 years sediment and animals fell into one particular cave through an opening in its ceiling, forming an enormous cone-shaped pile. Animals that fell in through the hole were unable to escape and died. The pile of sediment and bones eventually grew up to the ceiling and blocked the hole about 15 000 years ago.

The diagram above represents the cone-shaped pile within the cave.

a. In which layer (1 to 5) would you expect to find the oldest group of fossils?

_____

1 mark

b. Scientists sometimes use an index fossil to date a rock layer.
Describe two features of a fossil that would make it useful as an index fossil.

_____

_____

_____

_____

_____

2 marks

c. Outline one other method that the scientists could use to date the fossils in the oldest layer within the cave.

_____

_____

1 mark

d. This cave has been a good environment for the formation and preservation of fossils. Give one reason why fossils have been well preserved in this cave.

1 mark

To date 118 species of vertebrate animals have been found. One of these is the now extinct *Thylacoleo carnifex*, referred to as a marsupial lion because of the cat-like nature of its skull and its carnivorous habit. The scientists have only found hard parts of these extinct animals.

e. Describe a particular hard part that would be useful to the scientists to determine that *Thylacoleo carnifex* was carnivorous.

1 mark

After studying the fossilised hard parts of the *Thylacoleo carnifex*, the scientists have decided that the animal when alive weighed around 120 kilograms and had a very muscular body. Drawings have been made to indicate the animal's appearance.

f. How do the scientists reach a conclusion about the animal's appearance when only the hard parts of the extinct animal are available?

2 marks

Total 8 marks

END OF QUESTION AND ANSWER BOOK