

Trial Examination 2006

VCE Biology Unit 4

Written Examination

Question and Answer Booklet

Reading time 15 minutes
Writing time 1 hour 30 minutes

Student's Name: _____

Teacher's Name: _____

Structure of Booklet

Section	Number of questions	Number of questions to be answered	Number of marks
A	25	25	25
B	6	6	50
			Total 75

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 booklet of 24 pages.
Answer sheet for multiple-choice questions.

Instructions

Write your **name** and **teacher's name** on this booklet and in the space provided on the answer sheet for multiple-choice questions. All written responses should be in English.

At the end of the examination

Place the answer sheet for multiple-choice questions inside the front cover of this booklet and hand them in.

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

Students are advised that this is a trial examination only and cannot in any way guarantee the content or the format of the 2006 VCE Biology Unit 4 Written Examination.

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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.

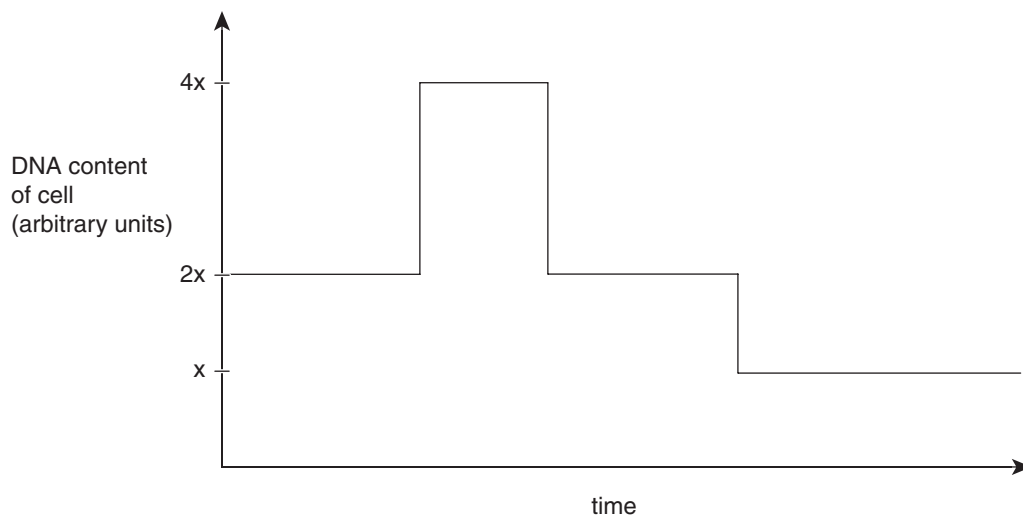
Question 1

In horses, sooty dark bay coat colour (**E**) is dominant to light bay (**e**). Assuming no mutation, it would be reasonable to infer that

- A. a light bay horse must have at least one light bay parent.
- B. all the offspring of a sooty dark bay stallion will be sooty dark bay.
- C. a sooty dark bay horse must have at least one sooty dark bay parent.
- D. the offspring of a sooty dark bay stallion and a light bay mare will be a medium bay colour.

Question 2 refers to the following information.

The graph below shows the changes in the level of DNA over time in a cell undergoing nuclear division.

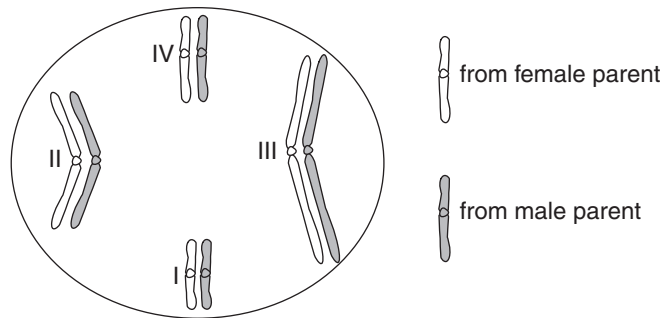
**Question 2**

Which of the following correctly describes the process of nuclear division shown in the graph?

- A. Nuclear division leading to the formation of a skin cell.
- B. Nuclear division leading to the growth of a zygote.
- C. Nuclear division leading to the formation of bacteria.
- D. Nuclear division leading to the formation of a sperm cell.

Question 3

The diagram below shows a sperm mother cell of a male fruit fly *Drosophila melanogaster*. The chromosomes derived from each parent are shaded differently.



What is the probability of a sperm receiving all four paternal chromosomes when this sperm mother cell undergoes meiosis?

- A. 1 in 16
- B. 1 in 8
- C. 1 in 4
- D. 1 in 2

Question 4

Two genes, located on different autosomes, control bulb colour in onions. One gene, *C*, determines whether or not the bulb is coloured. The presence of colour is dominant over white. The second gene determines the colour of the bulb and has two alleles (**R** for red and **r** for yellow).

What would be the expected phenotypic ratio for offspring from the cross **CcRr** × **ccrr**?

- A. 2 red : 1 yellow : 2 white
- B. 1 red : 1 yellow : 2 white
- C. 3 red : 3 yellow : 2 white
- D. 2 red : 1 yellow : 1 white

Questions 5 and 6 refer to the following information.

The colour of a cat's coat is X-linked. The allele X^g produces ginger fur and the allele X^b produces black fur. Females with the genotype X^gX^b have tortoiseshell fur (a mixture of black and ginger). A ginger female and a black male produced a litter consisting of two tortoiseshell females, a ginger male and a tortoiseshell male.

Question 5

The genotype of the tortoiseshell male was

- A. X^gY^b
- B. X^gY
- C. X^bY
- D. X^gX^bY

Question 6

The most likely cause of the genotype produced in **Question 5** was

- A. non-disjunction of the sex chromosomes in the male parent.
- B. non-disjunction of the sex chromosomes in the female parent.
- C. a mutation of the Y chromosome in the male parent.
- D. a translocation involving the sex chromosomes in the female parent.

Question 7

A population of Australian fur seals breeds regularly on an isolated beach on an island off the coast of Western Australia. Of this population, 9% of seals have silver fur, which is a recessive trait. This is a much higher frequency of the silver phenotype than is encountered among populations of seals breeding on the Australian mainland.

The biological phenomenon that best explains the features of the population of fur seals on the island is

- A. a genetic bottleneck.
- B. the founder effect.
- C. geographical isolation.
- D. allopatric speciation.

Question 8 refers to the following information.

In foxes, a gene controlling coat colour has the following alleles:

- W^+ = silver
- W^P = platinum
- W = white-faced silver

The combinations WW , W^PW^P and W^PW are all lethal, i.e. in each case the embryo dies at an early stage of development.

Question 8

You could reasonably expect that

- A. all adult foxes will have at least one W^+ allele.
- B. adult foxes would have one of two possible genotypes.
- C. half the adult foxes will have one W^P allele.
- D. heterozygous adults will have only one possible genotype.

Question 9

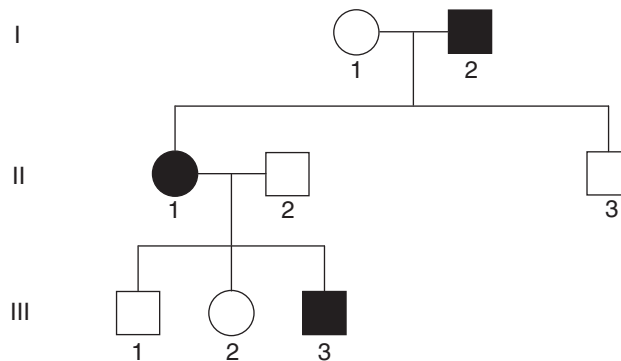
The sequence of bases in mitochondrial DNA (mtDNA) has been used to study relatedness between families of humans and test hypotheses concerning the evolution of humans, hominids and other mammals.

Which of the following statements concerning mtDNA is correct?

- A. mtDNA mutates so rapidly that it cannot be used to study evolutionary relationships between animals.
- B. mtDNA is single-stranded.
- C. mtDNA is a circular molecule similar to the DNA of a bacterial chromosome.
- D. mtDNA is inherited through the paternal line.

Question 10

A genetic counsellor was investigating the pattern of inheritance of a genetic trait in a family. She drew up the following pedigree, where shaded individuals have the trait.

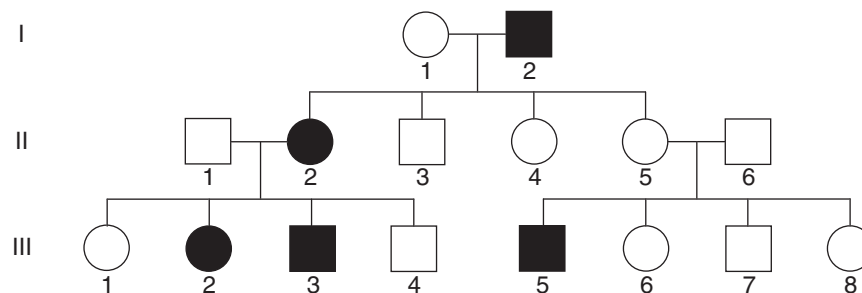


The genetic counsellor could conclude with certainty that the mode of inheritance for this trait is

- A. X-linked dominant.
- B. autosomal recessive.
- C. autosomal dominant.
- D. not X-linked recessive.

Question 11

Syndactyly is a rare genetic condition, inherited as an autosomal dominant trait, where webbing develops between the fingers and toes. Unusually, however, a person who has the defective allele responsible for syndactyly, (**N**), does not always show the trait. The diagram below shows the pedigree of a family with syndactyly.



There was no history of syndactyly in the ancestors of individuals I-1, II-1 and II-6. Assuming that there are no new mutations, it is reasonable to conclude that

- A. individual II-5 has the genotype **nn**.
- B. individuals II-4 and II-5 may have the same genotype.
- C. individual II-1 has the genotype **Nn**.
- D. individuals III-2 and III-5 may have different genotypes.

Question 12

Which of the following enzymes would be needed for DNA replication?

- A. restriction enzymes
- B. RNA polymerase
- C. reverse transcriptase
- D. DNA polymerase

Question 13

Refer to the following template section of single-stranded DNA.

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

Which of the following responses relates to this strand?

- A. The mRNA strand that is complementary is CUGACUGACUGA.
- B. The DNA strand that is complementary is TCAGTCAGTCAG.
- C. It contains 24 units of phosphate.
- D. The first anticodon would be GUC.

Question 14

A eukaryote gene usually provides much more genetic information than is needed to code for a protein. From a gene's transcription to its final translation, which of the following events occur and lead to a decrease in the amount of genetic information that is translated?

- A. Introns removed from the translated DNA.
- B. Exons removed from the transcribed pre-mRNA.
- C. Introns removed from the transcribed pre-mRNA.
- D. Exons removed from the translated mRNA.

Questions 15 and 16 refer to the following information.

Gene therapy is like molecular surgery. Single gene genetic disorders (such as cystic fibrosis and thalassaemia) are potential candidates for gene therapy. Hopefully gene therapy will one day cure these and other diseases. The concept of gene therapy is to insert a previously cloned normal form of the gene into the tissue needed to express that particular gene. There are two main forms of gene therapy.

1) Somatic cell gene therapy

The correct form of the gene is inserted into the body cells that need them and so are only expressed by them.

2) Germ line gene therapy

The correct gene is inserted into a gamete. If this gamete is fused with another gamete to form a zygote, each somatic cell descended from it will carry the correct gene.

Question 15

Based on all the information above and your knowledge of biotechnology, which of the following statements **could** be a consequence of gene therapy?

- A. In each case, the faulty form of the gene is removed.
- B. The correct gene, when inserted, could disrupt other genes.
- C. Only one copy of the correct gene could be inserted into target cells.
- D. The procedure for somatic cell gene therapy would never need to be repeated.

Question 16

Biotechnology experts are inclined to support somatic cell gene therapy and reject germ line gene therapy. Which of the following statements would be the best biological argument as to why this would be the case?

- A. Germ line gene therapy should be rejected because it could lead to a reduction in genetic variation in the future.
- B. Somatic cell gene therapy should be accepted because it could lead to a reduction in genetic variation in the future.
- C. Germ line gene therapy should be rejected because it could lead to an increase in genetic variation in the future.
- D. Germ line gene therapy should be rejected because it is unethical to experiment with gametes under any circumstances.

Question 17

Which of the following would lead to increased genetic variation?

- A. An increase in environmental mutagens.
- B. An extreme environmental change.
- C. Reduced crossover between homologous chromosomes.
- D. Fewer than normal numbers of offspring produced each generation.

Question 18

Natural selection acts on

- A. phenotypes.
- B. genotypes.
- C. alleles.
- D. environmental factors.

Question 19

Breeders have developed a variety of dog called the Chinese hairless crested dog. Which methods were most likely used to produce this variety?

- A. DNA hybridisation
- B. artificial selection
- C. cloning
- D. random breeding

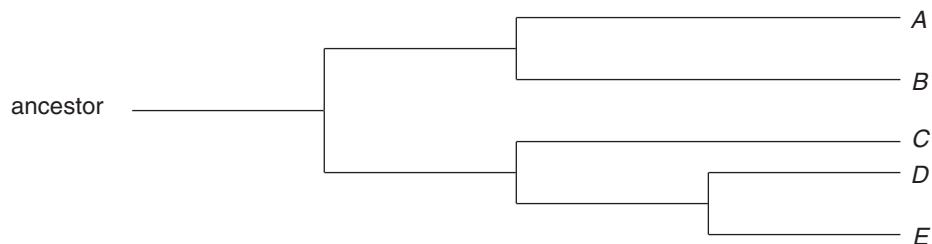
Question 20

There are many different types of animals with backbones and they live in a large variety of environments. However, they have a great many similarities in the bone structure of the vertebrae that make up the backbone. This observation provides evidence for

- A. convergent evolution.
- B. divergent evolution.
- C. extinction.
- D. structural analogies.

Question 21

The following diagram represents an evolutionary tree illustrating the relationships between five organisms (A, B, C, D and E). These are developed from evidence generated from many different areas.



Which of the following statements is consistent with this evolutionary tree?

- A. Organisms A and B are the most closely related organisms.
- B. Organisms C and B are the most closely related organisms.
- C. Organisms D and E are the most closely related organisms.
- D. The length of the horizontal lines in the evolutionary tree represent how long ago the organisms were found.

Question 22

Cytochrome *c* is a protein that serves a very important role during cellular respiration. Cytochrome *c* is found in the mitochondria of every eukaryote. The amino acid sequences of many of these have been determined, and comparing them shows that they are related. The table below shows a comparison of the first 20 amino acids of the cytochrome *c* molecule in four organisms compared to that in humans.

Note: The “–” symbol illustrates the amino acid at that point in the polypeptide chain is the same as that found in the human.

Amino acid number in the polypeptide chain	Human	Pig	Chicken	Wheat	Yeast
1	Gly	–	–	–	–
2	Asp	–	–	Asn	Ser
3	Val	–	Ile	Pro	Ala
4	Glu	–	–	Asp	Lys
5	Lys	–	–	Ala	–
6	Gly	–	–	–	–
7	Lys	–	–	Ala	Ala
8	Lys	–	–	–	Thr
9	Ile	–	–	–	Leu
10	Phe	–	–	–	–
11	Ile	Val	Val	Lys	Lys
12	Met	Gln	Gln	Thr	Thr
13	Lys	–	–	–	Arg
14	Cys	–	–	–	–
15	Ser	Ala	–	Ala	Glu
16	Gln	–	–	–	Leu
17	Cys	–	–	–	–
18	His	–	–	–	–
19	Thr	–	–	–	–
20	Val	–	–	–	–

Which of the following statements is consistent with the data from the table?

- A.** The pig and chicken each have three amino acid differences compared to the human cytochrome *c* and so would have the same differences in the DNA coding for this protein.
- B.** Yeast has 11 amino acid differences and would have a more distant common ancestor to humans than the other organisms in the table.
- C.** The amino acid similarities that all organisms show would only arise as a result of the DNA sequences in those sections being the same.
- D.** Organisms of decreasing similarity with the human would be in the following order: pig (most similar), chicken, wheat and yeast (least similar).

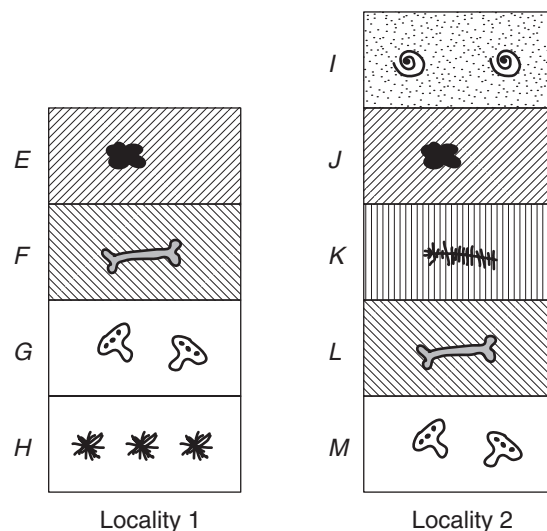
Question 23

When the Isthmus of Panama closed about 3 million years ago, creating a land bridge between North and South America, marine creatures on either side of Central America were separated. Scientists have studied this geological event and its effects on populations of snapping shrimp. They found that shrimps on one side of the isthmus appeared almost identical to those on the other side. Shrimps from opposite sides were also genetically similar. But when they put males and females from different sides of the isthmus together, they snapped aggressively instead of courting. There were no successful matings. The biological process which best explains this is

- A. sexual selection.
- B. reproductive isolation.
- C. genetic drift.
- D. natural selection.

Question 24

The following diagrams represent the strata layers found in two different locations (1 and 2). Each layer is symbolised with a letter (*E* to *M*). A variety of fossils were found in each layer and can be used as a guide to determine the relative age of each layer and each fossil.



What is the correct letter sequence that represents the layers in both locations from oldest to youngest?

- A. H, G, F, J, K
- B. M, H, G, F, E
- C. I, J, K, L, M
- D. H, G, K, J, I

Question 25

Which of the following organisms or parts of organisms are most likely to be fossilised?

- A. Single-celled organisms such as amoeba.
- B. Soft parts such as muscle.
- C. Organic material such as DNA.
- D. Hard bony parts such as teeth.

SECTION B: SHORT-ANSWER QUESTIONS**Instructions for Section B**

Answer this section in **pen**.

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

Question 1

The plant genus *Brassica* contains a number of species useful to humans, including common vegetable and fodder plants such as cabbage, broccoli, swede and canola.

For cabbage (*Brassica oleracea*), selective breeding programmes have been aimed at improving the tightness of the leaf-heads and reducing the levels of glucosilinate in the leaves. Leaf-head tightness is controlled by a single gene, T, and the desirable ‘tight-headedness’ is a recessive trait (t).

Glucosilinate is present in all *Brassica* species. It provides resistance to insect pests and produces the ‘hot’ flavour in mustard seeds. Glucosilinate production is a dominant phenotype controlled by two genes, B and G.

Gene B controls the production of enzyme X while gene G controls the production of enzyme Y. The ability to produce enzyme X (B) is dominant to the inability to produce the enzyme (b). Similarly, the ability to produce enzyme Y (G) is dominant to the inability to produce this enzyme (g). The T, B and G genes show independent assortment.

The two enzymes interact to synthesise glucosilinate in the metabolic pathway shown below.

Substance B is desirable in cabbages, since it produces the distinctive flavour of cabbage and also provides some degree of pest resistance.



- a. i.** A breeder crossed a pure-breeding, glucosilinate-producing cabbage with a cabbage unable to produce either of the two enzymes. Write the genotype of the offspring (F_1) of this cross.

- ii.** Write the genotype of a cabbage plant that will only produce substance B.

1 + 1 = 2 marks

- b.** In order to produce tight-headed, substance B-producing cabbages, the breeder crossed a pure-breeding, loose-headed plant that produces only substance B with a plant that is tight-headed but cannot produce substance B. He finds that none of the offspring plants have the desired tight-headed characteristics, although they all produce substance B.

In view of this, what further cross would you recommend to the breeder? Explain your suggestion by setting out this cross clearly to show the proportion of the offspring that you would expect to have the desired characteristics (i.e. tight-headed, producing substance B).

3 marks

- c. Some useful *Brassica* crops have evolved as the result of hybridisation between species. Hybridisation between the turnip *Brassica rapa* ($2n = 20$) and the black mustard *Brassica nigra* ($2n = 16$) initially produced a sterile hybrid ($2n = 18$). However, spontaneous chromosome doubling in the sterile hybrid has given rise to a new species, the brown mustard *Brassica juncea* ($4n = 36$).

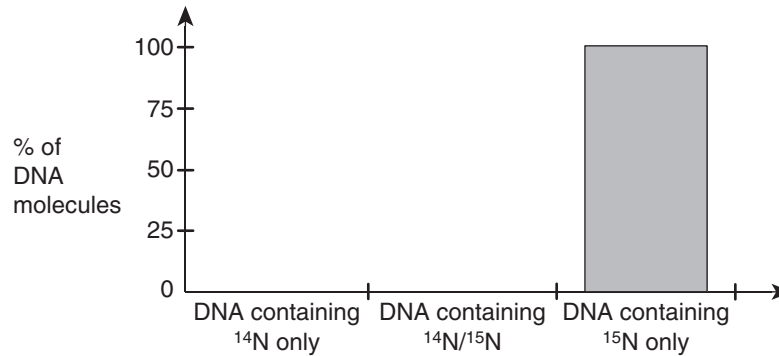
i. What term is used to describe the chromosomal make-up of a hybrid species such as *Brassica juncea*?

ii. Explain why brown mustard plants are able to produce fertile seeds if the original hybrid was sterile.

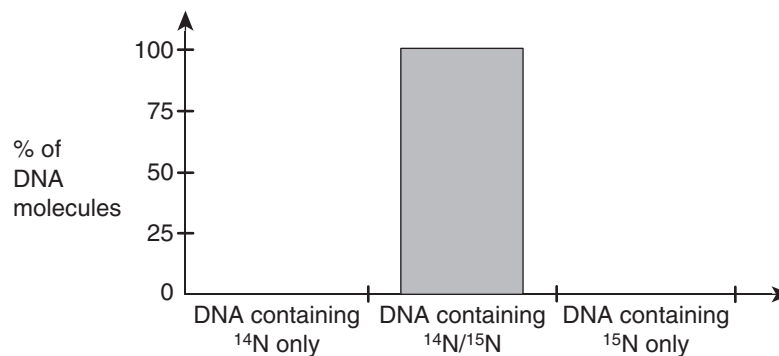
1 + 2 = 3 marks
Total 8 marks

Question 2

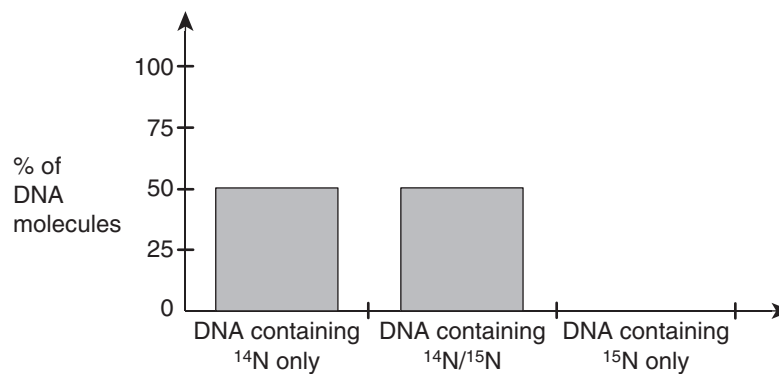
During research into the mechanism of DNA replication, bacteria were grown for many generations on a medium containing only the 'heavy' isotope of nitrogen, ^{15}N . This resulted in all the DNA molecules containing only ^{15}N . This is shown below.

Graph 1

The bacteria were then grown in a medium containing only 'light' nitrogen, ^{14}N . After the time required for the bacteria to replicate once, the DNA was analysed. The results are shown below.

Graph 2

The bacteria continued to grow in the 'light' nitrogen (^{14}N) medium until they had replicated once more. At this point the DNA molecules were again analysed. The results are shown below.

Graph 3

- a. In exactly which part of the DNA molecule is nitrogen found?

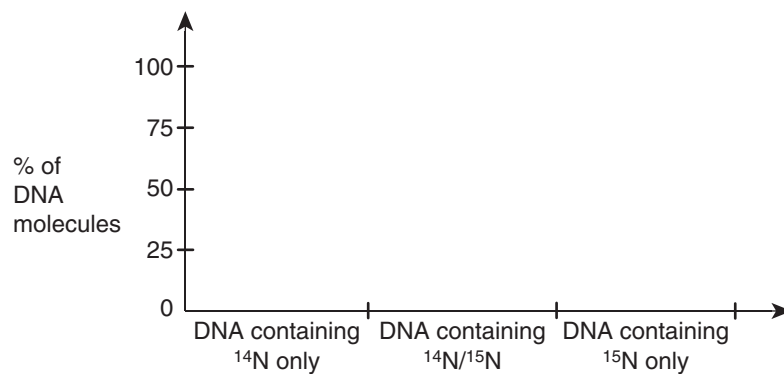
1 mark

- b. Explain how the data in Graphs 2 or 3 supports the semi-conservative hypothesis of DNA replication.

3 marks

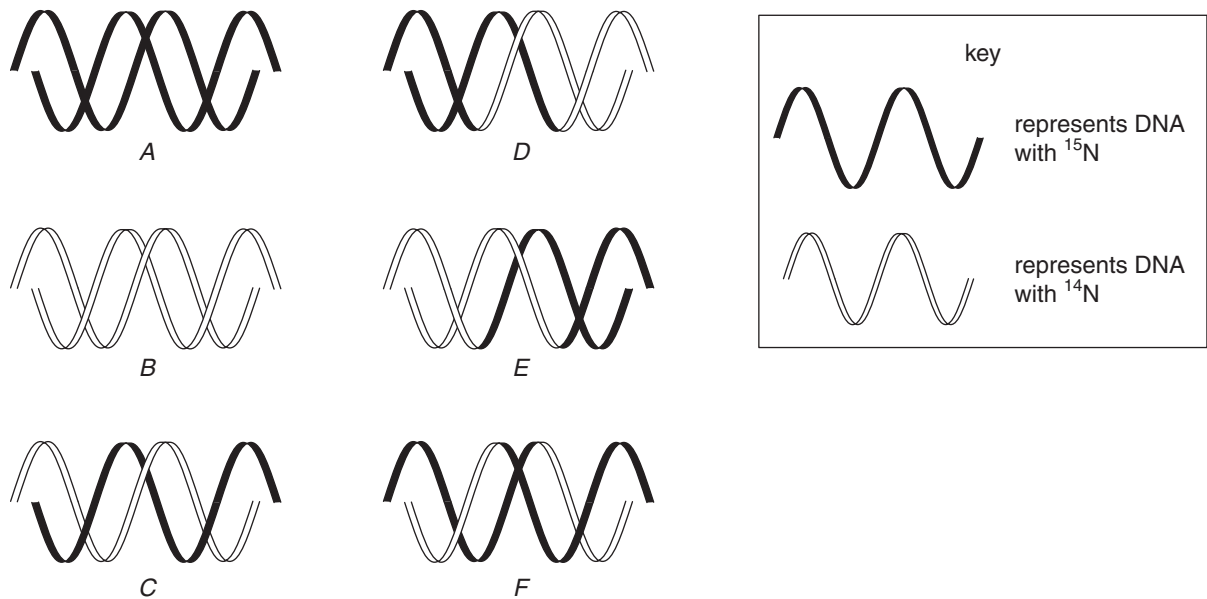
- c. The bacteria then continued to grow in the 'light' (^{14}N) medium for a third generation. The DNA molecules were then collected and analysed a final time. Complete the bar chart below to show the expected composition of these DNA molecules.

Graph 4



1 mark

- d. The diagram below shows simple DNA molecules, indicating the nitrogen content of each. With reference to the diagram, select the letter(s) which best represent(s) the bacterial DNA shown in Graphs 1, 2 and 3.



	Letter(s)
Graph 1	
Graph 2	
Graph 3	

2 marks
Total 7 marks

Question 3

The use of forensic DNA testing is increasing in popularity. It has a wide variety of uses including

- determining the guilt of criminal offenders
- determining the true father of children in paternity cases.

The method used for forensic DNA testing for each of the above examples is similar. The method involves

- DNA extraction
- amplification of DNA
- targeting sections of DNA
- separation of targeted sections of DNA for easy analysis.

a. Outline the method known as PCR that is used to amplify DNA.

2 marks

b. DNA probes can be used to target particular sections of DNA of the individuals being tested. The DNA probe is compatible to a particular section of single-stranded DNA. One such DNA probe is described below.

3' G A T T A C A 5'

The sequence below is part of a single strand of DNA extracted from an individual who is being tested in a forensic DNA testing case.

3' A C A T T A G T G T A A T C G A T T A C A C T A A T G T A A 5'

- Show clearly on the single strand of DNA above where the DNA probe would bind (anneal).
- Explain your answer to part (i).

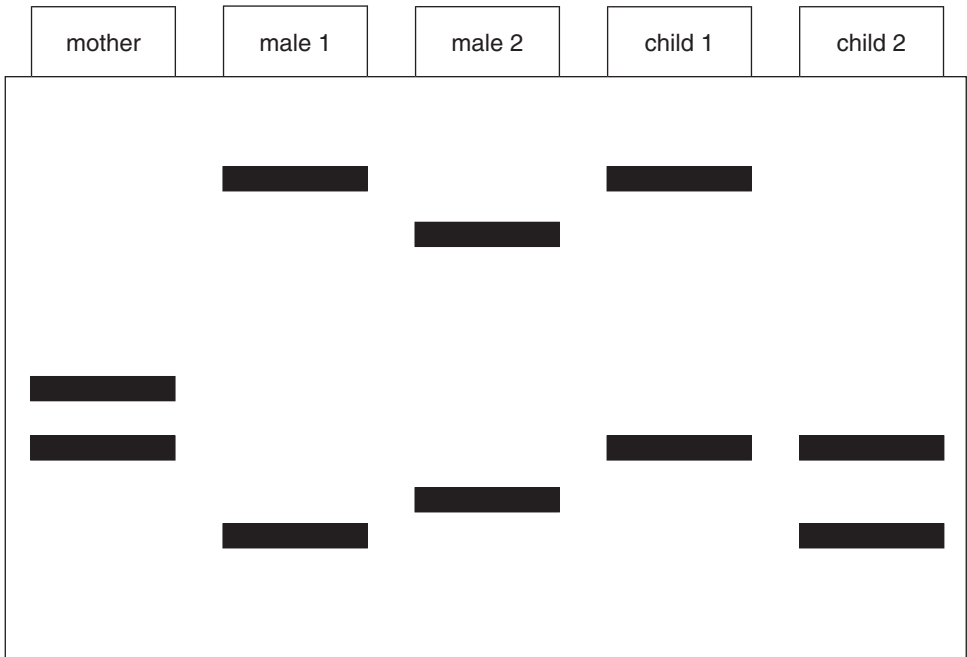
1 + 1 = 2 marks

c. In a paternity case involving forensic testing, a DNA probe similar to the one outlined above was added to DNA extracted from a mother, her two children and two males (one is the father). The DNA probes are designed to target specific sections of DNA known as Restriction Fragment Length Polymorphisms (RFLPs). This particular DNA probe targets one section of DNA that shows large variation in size and the variants can be distinguished after gel electrophoresis.

What is a property of DNA that enables gel electrophoresis to separate the DNA into different sizes?

1 mark

d. A stained gel for the paternity in question is shown below.



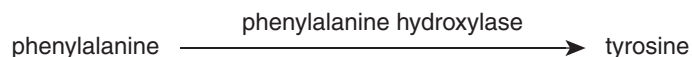
Use evidence from the gel pattern above to show whether male 1 or male 2 is the father of the children.

2 marks
Total 7 marks

Question 4

Phenylketonuria (PKU) is an autosomal recessive disorder affecting 1 in 10 000 humans. If this condition is detected early in life it can be treated with diet modification to reduce the symptoms of the disorder.

The intracellular biochemical reaction of the conversion of phenylalanine to tyrosine is shown below.



In sufferers of PKU, the enzyme phenylalanine hydroxylase (PAH) no longer functions due to a mutation in the gene coding for its synthesis. This leads to a build-up of phenylalanine which subsequently leads to the genetic disorder PKU.

- a. Where within a cell would PAH be synthesised?

_____ 1 mark

- b. Describe the steps involved in the transcription of the PAH gene.

_____ 2 marks

- c. There are many different kinds of mutations that lead to variations in PAH. Each variation will lead to the symptoms of PKU. Generally, the greater the degree of difference between the normal PAH and the version formed from the mutated gene, the more severe the symptoms.

The following DNA base sequence is from a template strand within the normal PAH gene.

3' T T G A T G C A C 5'

Using the DNA strand above and the table of mRNA codons on the next page, show how a single base substitution could lead to a different version of PAH.

2 marks

		second base				
		U	C	A	G	
first base	U	UUU } phe	UCU } ser	UAU } tyr	UGU } cys	third base
		UUC } leu	UCC } ser	UAC } stop	UGC } stop	
		UUA } leu	UCA } stop	UAA } stop	UGA } stop	
		UUG } leu	UCG } stop	UAG } stop	UGG } trp	
	C	CUU } leu	CCU } pro	CAU } his	CGU } arg	U
		CUC } leu	CCC } pro	CAC } his	CGC } arg	
		CUA } leu	CCA } pro	CAA } gln	CGA } arg	
		CUG } leu	CCG } pro	CAG } gln	CGG } arg	
	A	AUU } ile	ACU } thr	AAU } asn	AGU } ser	C
		AUC } met	ACC } thr	AAC } lys	AGC } arg	
		AUA } met	ACA } thr	AAA } lys	AGA } arg	
		AUG } met	ACG } thr	AAG } lys	AGG } arg	
	G	GUU } val	GCU } ala	GAU } asp	GGU } gly	U
		GUC } val	GCC } ala	GAC } glu	GGC } gly	
		GUA } val	GCA } ala	GAA } glu	GGA } gly	
		GUG } val	GCG } ala	GAG } glu	GGG } gly	

d. Other mutations that can cause a change in the normal form of PAH include

- single base substitution
- a single base deletion that codes for a stop signal.

Using the nine base sequence from the normal PAH gene as a starting point, give a DNA sequence that would illustrate a single base deletion coding for a stop signal.

_____ 1 mark

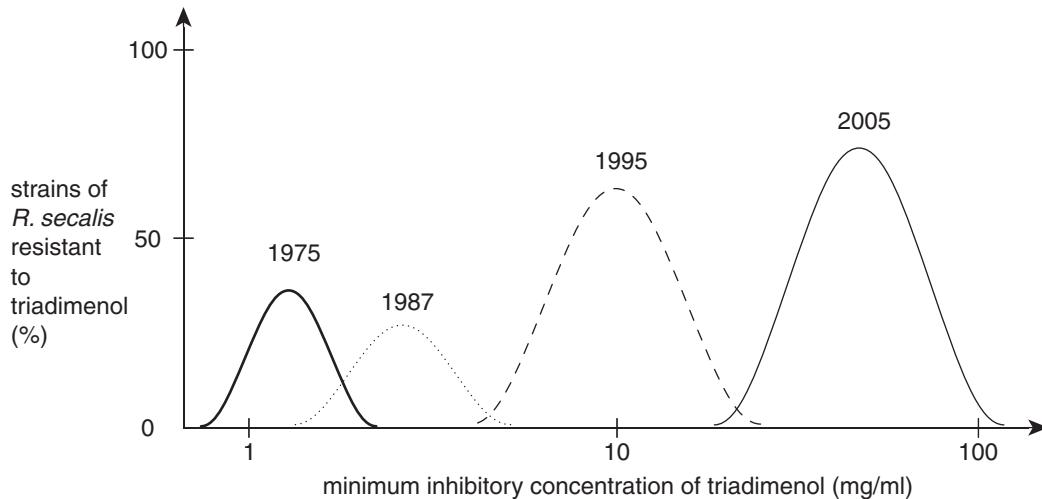
e. If the DNA base sequence from part c. was near the start of the template strand from the PAH gene, which type of mutation would be more likely to lead to more severe symptoms of PKU? Choose either a single base substitution or a single base deletion that codes for a stop signal. Explain your answer.

2 marks
 Total 8 marks

Question 5

Barley is one of the more important agricultural crops for humanity. Farmers who grow barley often use a fungicide called triadimenol. This aims to reduce the impact that a fungus *Rhynchosporium secalis* has on the barley yield.

Over the past 30 years, four studies were conducted tracing the resistance of *R. secalis* against triadimenol. The results of these studies are outlined in the graph below.



- a. Describe the trend seen in the graph.

1 mark

- b. i. What is the selection pressure in this case?

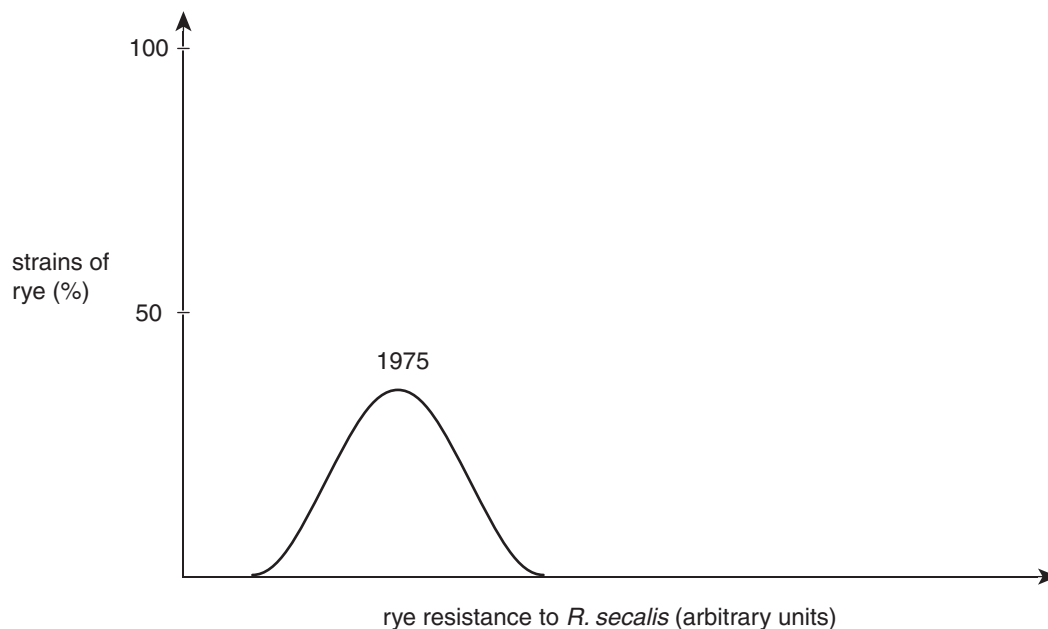
- ii. What fungi are at a selective advantage in this case?

1 + 1 = 2 marks

- c. Outline an experiment that could be conducted on the fungus (*R. secalis*) to test the hypothesis that resistance to this fungicide is inherited as a genetic trait rather than being caused by environmental conditions that the fungus is exposed to. Describe the results of the experiment that would support the hypothesis.

3 marks

- d. Some environmental biologists suggest fungicides have been overused and that the rye plants would have survived and thrived had they not been used.
- i. If in 1975, triadimenol **had not** been used, show on the graph below how rye's resistance to *R. secalis* may have appeared in 2005.



- ii. Explain your answer to part (i) above.

1 + 2 = 3 marks

Total 9 marks

Question 6

Between 2.3 and 1.2 million years ago, Eastern Africa was populated by at least two pre-human species, *Australopithecus boisei* and *Homo habilis*. *A. boisei* is known from four complete or partial fossil skulls, while 11 skulls of *H. habilis* have been found. These pre-humans are only known from the fossil record. The validity of each being a species, distinct from other hominins, has often been questioned.

- a. i. State one condition needed for the fossilisation of *A. boisei* or *H. habilis* and explain the importance of this condition for fossilisation.

- ii. Describe how a scientist would determine the absolute age of a rock layer containing a fossil skull of *A. boisei*.

2 + 2 = 4 marks

- b. Like members of many other *Australopithecus* species, males and females of *A. boisei* show marked differences in skull size and in the length of their canine teeth (sexual dimorphism). *A. boisei* and its descendants did not survive the climatic changes associated with a succession of ice ages.

H. habilis is very similar to *A. boisei* in many ways. The face is still primitive, but it is flatter than in *A. boisei*. The average brain size, 650 cm³, is larger than in *A. boisei*, but brain size varies between 500 and 800 cm³, and overlaps *A. boisei* at the lower end. Again, females are believed to have been smaller than males.

- i. Give two reasons why it would be difficult to assign a newly discovered fossil skull to either of these particular species.

- ii. Describe one other skeletal feature of a fossil hominin, not mentioned in the text, which could be used to compare with other fossil hominins. Explain the significance of the feature you have described.

2 + 2 = 4 marks

- c. *H. habilis*, ‘handy man’, is so-called because of the wealth of tools that have been found with its fossils. The brain shape is also more human-like. The bulge of Broca’s area, essential for speech, is visible in one *H. habilis* brain cast, indicating that the species may have been capable of rudimentary speech. *H. habilis* is more likely to be a direct evolutionary ancestor of modern humans than *A. boisei*. This is because the characteristics of *H. habilis* provide a better basis for cultural evolution.

- i. What is meant by cultural evolution?

- ii. Explain two characteristics of *H. habilis* which provide “a better basis for cultural evolution”.

1 + 2 = 3 marks

Total 11 marks

END OF QUESTION AND ANSWER BOOKLET