Scientists, by using special DNA probes labelled with a fluorescent dye, can reveal homologous chromosomes or homologous areas of chromosomes and thereby infer evolutionary relationships between species. This is called chromosome painting. When human chromosomes labelled with dye are used to probe chimpanzee, gorilla and gibbon chromosomes several matches were identified as shown in the table below.

	Homologous chromosomes fluorescing		
Human chromosome	Chimpanzee	Gorilla	Gibbon
1	1	1	Parts of 5,7 9 and 19
2	12, 13	12, 11	Part of 1,10,12 and 16
3	2	2	Part of 4,7,10 and 12
4	3	3	Part of 2, 3 and 18
5	4	4,19	Part of 6,8 and 18
6	5	5	Part of 3 and 20
7	6	6	1
8	7	7	Part of 7 and 9
9	11	13	Part of 8 and 13
10	8	8	Part of 2 and 3
11	9	9	11
12	10	10	Part of 7, 10 and 14
13	14	14	Part of 4
14	15	18	17
15	16	15	15
16	18	17	Part of 6 and 8
17	19	4,19	Part of 8, 13 and 16
18	17	16	Part of 5
19	20	20	Part of 10, 14 and 16
20	21	21	21
21	22	22	Part of 15
22	23	23	Part of 8

c Suggest how closely each species above is related to humans. Use the data above to explain your answer.

(2 marks)

Total 5 marks

END OF EXAMINATION

Acknowledgements - Websites
http://kennethtls.blogspot.com/2010/11/gender-crisis.html
http://palaeo.gly.bris.ac.uk/palaeofiles/whales/mysticeti.htm
http://michelc.blog4ever.com/blog/photos-cat-86755-1948362942-vertebres_fossiles_moulages.html
http://www.pratique.fr/coelacanthe-survivant.html
http://www.wired.com/wiredscience/2010/12/written-in-stone-excerpt/all/1
http://www.dna-sequencing-service.com/dna-sequencing/transfer-rna/attachment/transfer-rna/
http://www.science3point0.com/genegeek/2010/12/13/mixed-up-chromosomes/
http://www.anthro4n6.net/lucy/

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Student name

BIOLOGY
Unit 4
Trial Examination

QUESTION AND ANSWER BOOK

Total writing time: 1 hour 30 minutes

Structure of book

Section	Number of questions	Number of marks
A	25	25
B	9	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 book of 21 pages with a detachable answer sheet for multiple-choice questions inside the front cover.

Instructions

- Detach the answer sheet for multiple-choice questions during reading time.
- Write your **name** in the space provided above on this page and 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 book.

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ABN 61 527 110 823

SECTION A - Multiple Choice Questions

Specific instructions for Section A

This section consists of 25 questions. You should attempt **all** questions.

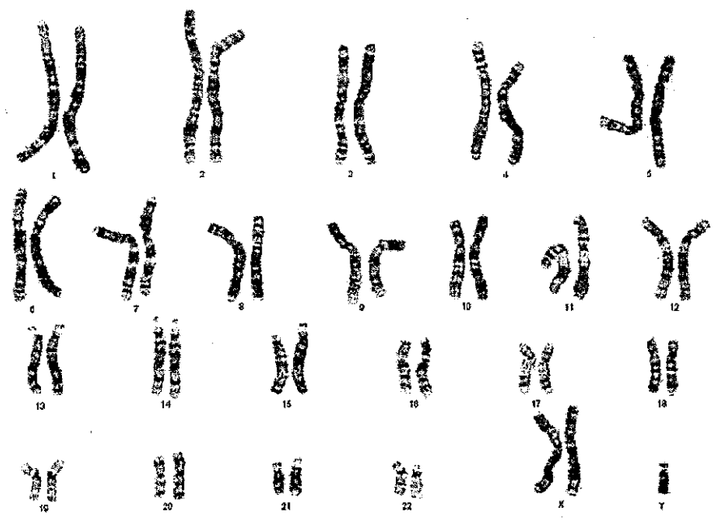
Each question has four possible correct answers. Only **one** answer for each question is correct. Select the answer that you believe is correct and indicate your choice on the Multiple Choice Answer Sheet by shading the letter that corresponds with your choice of the correct answer.

If you wish to change an answer, erase it and shade your new choice of letter.

Each question is worth **one** mark. **No** mark will be given if more than one answer is completed for any question. Marks will **not** be deducted for incorrect answers.

Question 1

The following karyotype is from a human baby with a genetic abnormality.



This abnormal karyotpe would be due to:

A. non-disjunction in either the mother or the father during gamete formation.
B. non-disjunction in the mother only during gamete formation.
C. non-disjunction in the father only during gamete formation.
D. polyploidy during gamete formation in the mother or father.

Question 2

MELAS syndrome is a group of rare muscle and brain disorders (encephalopathies) that are due to mutations in the mitochondrial DNA. Such a condition is inherited:

A. from either parent to children.
B. from mother to sons only.
C. from mother to children only.
D. from father to children only.

STAV Publishing
2011

BIOLOGY
Unit 4 Trial Examination
MULTIPLE CHOICE ANSWER SHEET

STUDENT NAME:	

INSTRUCTIONS: **USE PENCIL ONLY**

- Write your name in the space provided above.
- Use a **PENCIL** for **ALL** entries.
- If you make a mistake, **ERASE** it – **DO NOT** cross it out.
- Marks will **NOT** be deducted for incorrect answers.
- **NO MARK** will be given if more than **ONE** answer is completed for any question.
- Mark your answer by **SHADING** the letter of your choice.

	ONE ANSWER PER LINE		ONE ANSWER PER LINE
1	A B C D	14	A B C D
2	A B C D	15	A B C D
3	A B C D	16	A B C D
4	A B C D	17	A B C D
5	A B C D	18	A B C D
6	A B C D	19	A B C D
7	A B C D	20	A B C D
8	A B C D	21	A B C D
9	A B C D	22	A B C D
10	A B C D	23	A B C D
11	A B C D	24	A B C D
12	A B C D	25	A B C D
13	A B C D		

Question 3

A gene in tomatoes has an allele **P** that produces anthocyanin pigment resulting in a purple stem. The alternative allele **p** produces no pigment and results in a green stem. On a different chromosome a gene with a dominant allele **C** results in deep cuts in the edge of the leaf and the alternative allele **c** gives a smooth edge. If two plants that are heterozygous for these genes are crossed it would be reasonable to state that:

A. all purple stemmed and deep cut leafed plants would have the same genotype.
B. there would be equal numbers of all phenotypes.
C. the genotype of a green stemmed, cut leafed plant must be **ppCC**.
D. theoretically three quarters of the plants would have purple stems and three quarters would have deep cut leaves.

Question 4

During transcription:

A. both introns and exons are copied.
B. only introns are copied, exons are not.
C. only exons are copied, introns are not.
D. a polypeptide is formed from exons only.

Question 5

A pure-bred animal with black fur is crossed with a pure bred animal with brown fur. The offspring have both brown and black fur. The type of inheritance involved is:

A. incomplete dominance.
B. polygenetic.
C. co-dominance.
D. complete dominance.

Question 6

During the process of DNA replication:

A. the leading strand replicates from 5′ to 3′continuously and the lagging strand replicates from 3′ to 5′in sections.
B. the leading strand replicates from 3′ to 5′continuously and the lagging strand replicates from 5′ to 3′in sections.
C. the leading strand replicates from 5′ to 3′continuously and the lagging strand replicates from 5′ to 3′in sections.
D. the leading strand replicates from 3′ to 5′continuously and the lagging strand replicates from 3′ to 5′ in sections.

Question 7

Foxes, *Vulpes vulpes,* have a gene that controls coat colour that has three alleles as shown below.

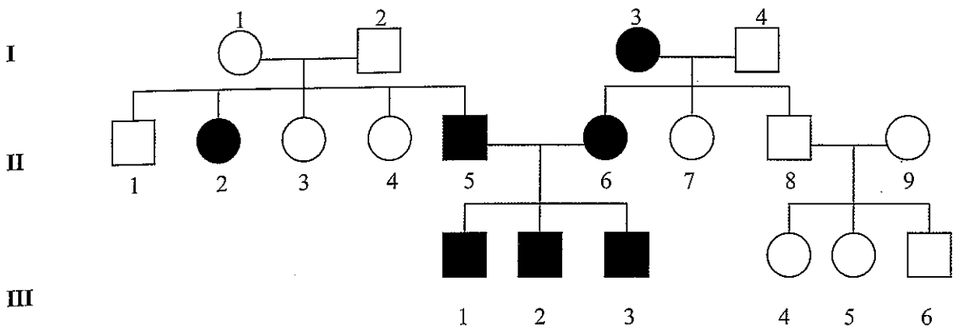
W^S	codes for silver coat
W^P	codes for platinum coat
W^W	codes for white face and silver coat.

Genotypes W^WW^W, W^PW^P, and $W^W W^P$ are all lethal and the embryos die before birth. A cross between two heterozygous adult foxes that have a different genotype would produce viable offspring with the following genotypes:

A. W^SW^S , W^SW^P and W^SW^W only.
B. W^SW^P, W^PW^W and W^SW^W only.
C. W^SW^W, W^SW^P, W^PW^W and W^SW^S only.
D. $W^S W^P$ and $W^S W^W$ only.

Question 8

The pedigree below shows the inheritance of the condition called galactoaemia, in which the individual is unable to metabolise galactose, the sugar found in milk. Shaded individuals show the trait.



The inheritance shown here is:

A. autosomal recessive
B. X-linked recessive
C. autosomal dominant
D. unable to determine from this pedigree

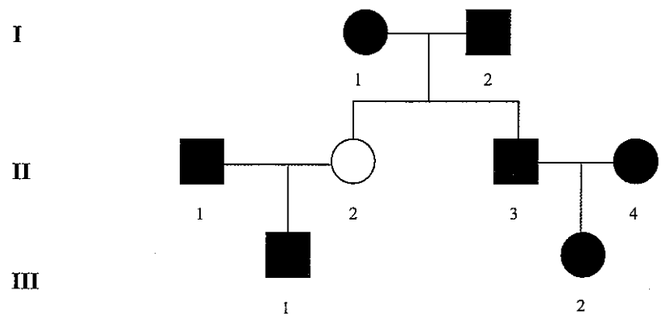
Question 9

Polyploidy is:

A. continuous variation in a particular phenotype of a population.
B. more than two alternative alleles for a particular gene.
C. a cell or an organism in which the number of complete sets of chromosomes is greater than two.
D. a group of genes that act together to produce a particular phenotype.

Question 10

Black hair in guinea pigs is due to a dominant allele **B** and white hair by the recessive allele **b**. The following pedigree shows animals that are black (shaded) and those that are white (unshaded).



In this pedigree it is known that both **II 1** and **II 4** are homozygous black. Based on this information if the individuals **III 1** and **III 2** are mated the probability of them producing a white haired guinea pig would be:

A. 1/6
B. 3/16
C. 0
D. 1/4

Question 11

In corn the endosperm of the corn kernel can be yellow or white. Yellow is governed by the dominant allele **Y** and white by the allele **y**. In a random sample of 1000 kernels from an isolated a field of corn the following numbers were found.

Genotype	Genotype numbers
YY	490
Yy	420
yy	90

The allele frequency of the **Y** allele and the **y** allele would be:

	Y	y
A.	0.7	0.3
B.	0.49	0.42
C.	0.91	0.09
D.	0.61	0.31

Question 12

DNA can be found in eukaryotic chromosomes, prokaryotic chromosomes and plasmids. Referring to the different sources of DNA, it can be stated that:

A. DNA in plasmids is single-stranded, whereas DNA in prokaryotic chromosomes is double-stranded.
B. plasmids are found in prokaryotes only.
C. plasmid DNA has only a few genes but they are essential for the life of the organism.
D. plasmid DNA can reproduce itself independently of the main chromosome.

Question 13

A gene pool is:

A. all the alleles in a family pedigree.
B. all the genes in an individual.
C. the genes in a metabolic pathway.
D. all the alleles in a population.

Question 14

When cells die, this:

A. is accompanied by recycling of all dead cell organelles.
B. is called necrosis which is programmed cell death.
C. could involve cells that are healthy but are no longer needed.
D. is always under genetic control.

Question 15

Plant height in tobacco plants is controlled by a series of genes at different loci. Consider only three of these loci, each with two alleles as shown:

Locus 1	A, a
Locus 2	B, b
Locus 3	C, c

The height of the plant is determined by the number of uppercase alleles, regardless of the locus. The more uppercase alleles the taller the plant as each allele contributes the same number of centimetres to the final height. It would be reasonable to expect that:

A. plants with genotypes AabbCc and AAbbcc would be the same height.
B. a cross between parents AAbbCC and aaBBcc could produce the tallest offspring.
C. a cross between parent plants that are heterozygous at each locus will only produce plants that are intermediate in height.
D. plants must have the same genotype in order to be the same height.

Question 16

In 2011, a 23 year old American woman, Carlina White, who had been stolen from the hospital as a 3 week old baby and raised by another family, was reunited with her biological family after a DNA test showed that she was their missing child. The 'DNA test' used would be:

A. DNA hybridisation
B. PCR
C. Gel electrophoresis
D. DNA profiling

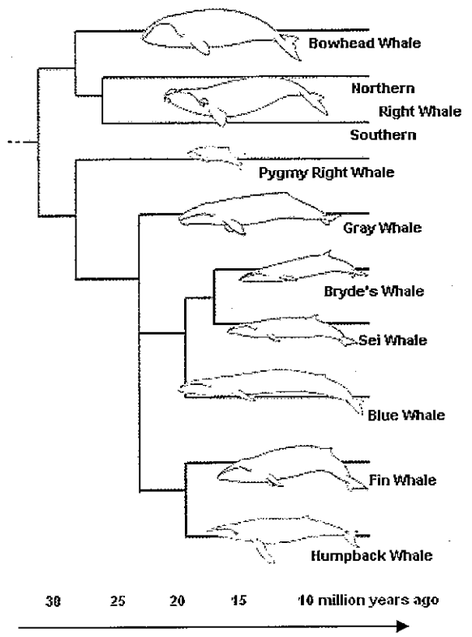
Question 17

The recessive allele for Tay-sach disease persists in the Ashkenazi Jewish population without killing the population because natural selection works:

A. only on recessive phenotypes.
B. only on dominant genotypes.
C. on genotypes not phenotypes.
D. on phenotypes not genotypes.

Question 18

Part of the phyogenetic tree for whales is shown below.



The most closely related whales would be:

A. the Northern Right whale and the Southern Right whale.
B. Bryde's whale and Sei whale.
C. the Fin whale and the Humpback whale.
D. the Pygmy Right whale and the Bowhead whale.

Question 19

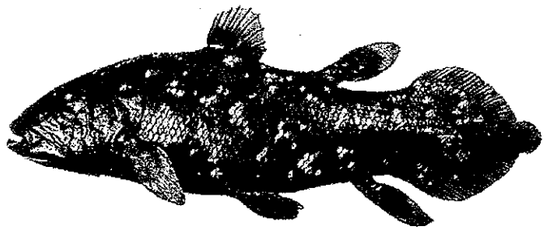
In the late 1970s, in the small town of Limone sul Garda in northern Italy, scientists found that a high percentage of the population had high levels of cholesterol and yet they did not show the arterial damage that usually occurs with such a condition. All these people had the same mutation in the ApoA-1 Milano gene where the amino acid arginine replaced cysteine. All carriers of this gene could trace their ancestry back to a couple who lived in the town in 1644. The town was fairly isolated until a road went through in 1932.

This is an example of:

A. a genetic bottleneck
B. genetic drift
C. the founder effect
D. convergent evolution

Question 20

The coelacanth is a deep water fish found off the coast of southern Africa. The diagrams below show a fossil of the fish and a modern day specimen which is almost identical after 50,000,000 years.

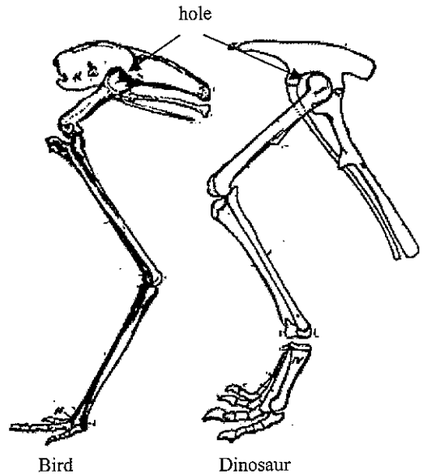


It would be reasonable to state that:

A. there has been no evolution of this species.
B. this species has not been subjected to natural selection.
C. the environment of this species has remained relatively constant over this time period.
D. 50,000,000 years is too short a time for significant evolution to be demonstrated.

Question 21

Birds and dinosaurs have a hole in their hip socket, allowing the legs to descend straight down from the hip.



This hole is an example of:
A. an analogous structure.
B. an homologous structure.
C. convergent evolution.
D. a vestigial structure.

Question 22

Which of the following is the best evidence that evolution has occurred in recent times?

A. The average life expectancy in western society has increased over the last 100 years.
B. The average male height in Australia has gone from 1.72 metres to 1.78 metres in 70 years.
C. The incidence of many inherited diseases has increased over the last 50 years.
D. The birth-rate in Australia has decreased in the last 20 years.

Question 23

An index fossil:

A. must have a wide geographical distribution and a short range through time.
B. must have a narrow geographical distribution and a long range through time.
C. is one that shows a gradual change of an organism over time.
D. can be used to determine the absolute age of other fossils by comparison.

Question 24

Scientists studying Japanese macaque monkeys found that they played with stones (such as rolling them, throwing them, pounding them on a hard surface.) Scientists also observed that infant monkeys in close proximity to their mothers developed stone-handling abilities earlier in life than those infants whose mothers did not show stone-handling behaviour. The stone-handling behaviour changed with each generation as individual macaques contributed their own patterns of stone-handling behaviour. This is an example of:

A. cultural evolution genetically passed down from mother to infant.
B. biological evolution genetically passed down from mother to infant.
C. biological evolution due to natural selection.
D. cultural evolution involving acquired traits being passed down.

Question 25

The Multiregional hypothesis for evolution of modern humans is supported by the tenant that:

A. *Homo sapiens* ultimately migrated out of Africa and replaced other *Homo* populations without interbreeding.
B. after *Homo erectus* migrated out of Africa the different populations became reproductively isolated, evolving into separate species.
C. all living humans derive from the species *Homo erectus* that left Africa nearly 2 million years ago.
D. variation in mitochondrial DNA would be greater in African populations than in other populations of *Homo sapiens*.

END OF SECTION A

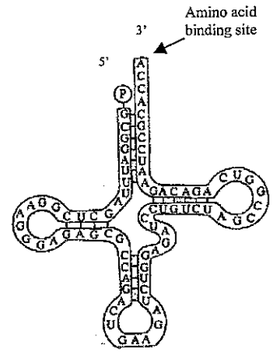
SECTION B - Short Answer Questions

Specific instructions for Section B

This section consists of 9 questions. There are 50 marks in total for this section.
Write your responses in the spaces provided. You should attempt **all** questions. Please write your responses in **blue** or **black ink**.

Question 1

The diagram below represents a molecule found in the cytosol of the cell.



a Name the molecule shown above.

(1 mark)

This molecule is involved in an important process in the cell. Critical to this process is the sequence of bases called the anticodon of this molecule.

b **i** Name the main process that this molecule is involved in, in the cell.

ii Name the bases that form the anticodon of this molecule.

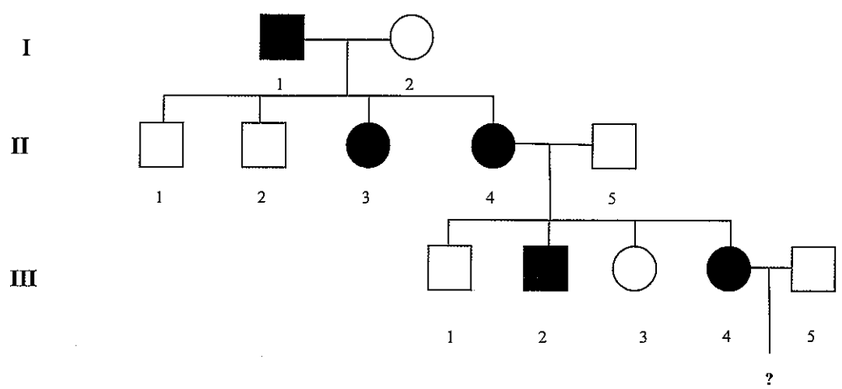
(1 + 1 = 2 marks)

c Describe the sequence of events that occur in the process named in **b i** above.

(3 marks)
Total 6 marks

Question 2

Xg antigen is a red blood cell surface antigen. The gene that codes for this antigen is on the short arm of the X chromosome. Below is a pedigree showing the inheritance of this gene in a family.



a Is this X-linked inheritance dominant or recessive? Explain your answer by referring to the pedigree.

(2 marks)

b What is the probability that individual **II 3** is heterozygous for this condition? Explain your answer.

(1 mark)

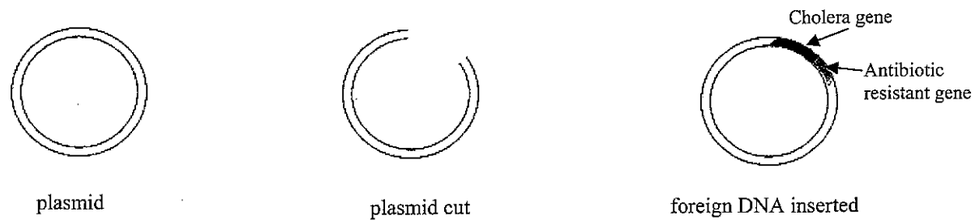
c Individuals **III 4** and **III 5** would like a son. What is the chance that they will have a son who has the Xg antigen on his red blood cells? Show your working.

(2 marks)

Total 5 marks

Question 3

The transfer of genes from one species to another, using bacterial plasmids, has many applications. One application being investigated is the manufacture of edible vaccines using bananas. A section of DNA from a cholera bacterium is inserted into a plasmid in the bacteria *Agrobacterium tumefaciens*. The diagram below shows the process involved making a vaccine against the infectious disease, cholera.



Along with the cholera DNA, an antibiotic resistant gene is also added next to it.

a Name the type of technology that is involved in the transfer of DNA from one organism to another.

(1 mark)

b What is used to join the cholera DNA into the plasmid?

(1 mark)

c Why is an antibiotic resistant gene inserted into the plasmid, along with the DNA from the cholera bacteria?

(1 mark)

d What term is used to describe a eukaryoyic organism, such as the banana, that has DNA from another species added into it?

(1 mark)

The *Agrobacterium* infects banana plant cells in nature. In the laboratory *Agrobacterium*, containing the foreign DNA, are used to infect banana cells. These cells are then cloned and grown into banana plants. The bananas produced by these plants produce the cholera proteins that will bring about the immune response in someone who eats the banana. Potatoes have been used in the past as edible vaccines but bananas are considered a better source of edible vaccines for humans.

e Suggest why it is better to use bananas rather than potatoes for humans.

(1 mark)

f Give one objection that some members of the public might have for this procedure.

(1 mark)

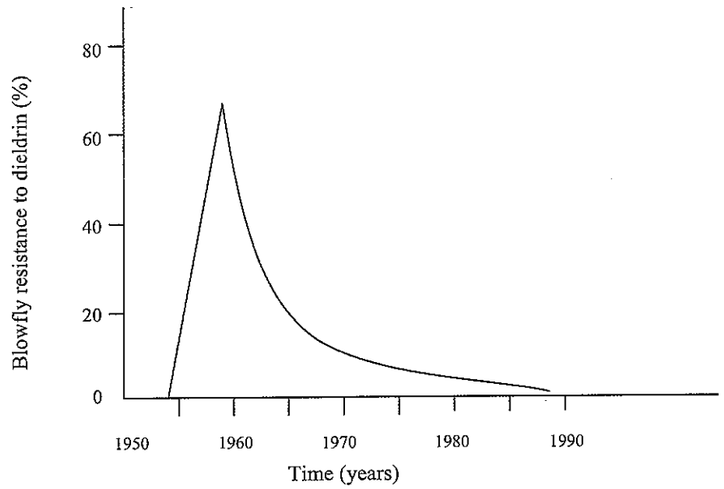
g Suggest a problem associated with this method of vaccination.

(1 mark)

Total 7 marks

Question 4

The blowfly, *Lucilia cuprina,* causes the condition flystrike in Australian sheep. Fly larvae infect sheep causing open wounds that can result in the death of the sheep. To prevent flystrike, sheep are dipped in insecticide. Originally the insecticide dieldrin was used. The graph below shows the change in dieldrin resistance in the blowfly. Dieldrin was withdrawn from use in 1958.



a What happened to the percentage resistance from 1955 to 1958?

(1 mark)

Resistance to dieldrin is due to a single gene **R**, with alleles $\mathbf{R^R}$ and $\mathbf{R^S}$. Only those individuals that are homozygous $\mathbf{R^SR^S}$ are fully susceptible to dieldrin.

b Outline what happened to the population regarding this gene from 1955 to 1958.

(2 marks)

c Suggest why there is a steep decline in percentage resistance from 1960 to the present.

(2 marks)

At present, over 50 years later, there are still a small percentage of individual flies that carry the $\mathbf{R}^{R}$ allele.

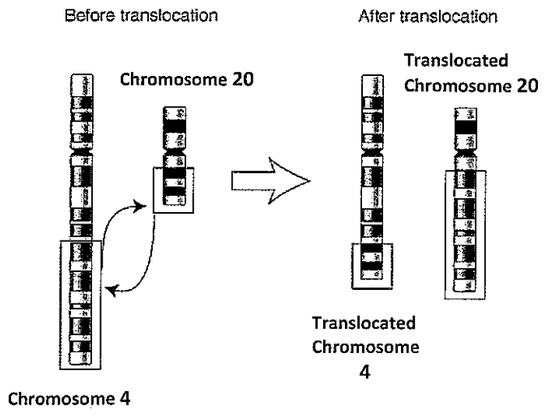
d Suggest a possible reason for this observation.

(1 mark)

Total 6 marks

Question 5

Reciprocal translocations occur in about 1 in 930 people. These translocations can occur between any of the chromosomes and involve pieces of any size. The diagram below shows a reciprocal translocation between chromosomes 4 and 20. Most reciprocal translocations occur spontaneously during gamete formation.



a Why would people with this translocation be phenotypically normal?

(1 mark)

The diploid number for humans is 46.

b What would be the haploid number for a person with the reciprocal translocation depicted?

(1 mark)

A male has the translocation shown.

c List the combination of these chromosomes that could be present in the gametes of this male.

(2 marks)

The cMYC gene codes for a protein that normally binds to the DNA of some other genes and brings about transcription of that gene.

d What is transcription?

(1 mark)

A common translocation that occurs is when part of chromosome 8, containing the cMYC gene is translocated to chromosome 14. In its new position, the cMYC gene is positioned next to a promoter gene for production of B lymphocytes. The protein product of the cMYC gene is produced continuously.

e What is a probable outcome for the person with this translocation?

(1 mark)

Total 6 marks

Question 6

The following table shows the order of bases in a segment of DNA of five related species numbered 1 to 5. The bold, enlarged lettering shows the changes in the bases.

Species	DNA bases
1	TCCAGCTCGT GC**C**TCGATGA **A**GACTAAGTG ATACCATAA**G** GACT
2	TCCAGCTCGT GC**C**TCGATGA **A**GACTAAGTG ATACCATAA**G** GACT
3	TCCAGCTCGT G**T**ATCGATGA CGACTAAGTG ATACCA**A**AAA GACT
4	TCCAGCTCGT G**T**ATCGATGA CGACTAAGTG ATACCA**A**AAA GACT
5	TCCAGCTCGT G**T**ATCGATGA CGACTA**C**GTG ATACCATAAA GACT

a Name the technique that scientists use to get this data.

(1 mark)

b What term is given for a change in a single DNA base?

(1 mark)

c How can this data be used to infer evolutionary relationships between species?

(1 mark)

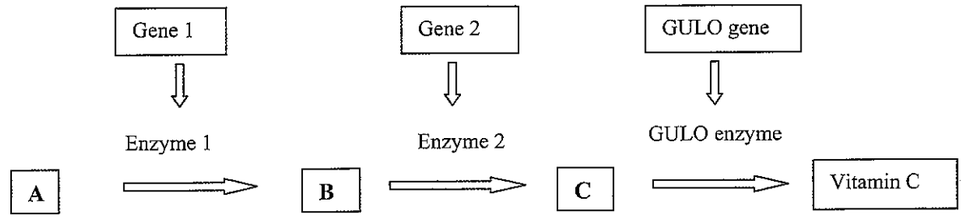
d Using this data draw a possible phylogenetic tree to show a possible inferred evolutionary relationship between these 5 species and a common ancestor.

(2 marks)

Total 5 marks

Question 7

A pseudogene is a DNA sequence that is nearly identical to that of a functional gene but contains one or more mutations that make it non-functional. One such gene, the GULO gene, is needed for the production of the enzyme GULO or L-gulonolactone oxidase which is needed in the pathway leading to the production of vitamin C as shown below.



Primates, as distinct from most mammals, are not able to produce vitamin C due to a mutation in the GULO gene.

Below is a portion of the functioning GULO gene in a rat and the non-functioning pseudogene in 3 primates.

Rat	TACCCCGTAGAGGTGCGCTTCACCCGAGGCGGATGACATTCTGCTGAGCCCC
Human	TACCTGGTGGGGGTACGCTTCACCTGGAG–GGATGACATCCTACTGAGCCCC
Chimp	TACCTGGTGGGGCTACGCTTCACCTGGAG–GGATGACATCCTACTGAGCCCC
Orang-utan	TACCCGGTGGGGGTGCGCTTCACCCAGAG–GGATGACGTCCTACTGAGCCCC

a Explain how this mutation, common to all the primates shown, results in the inability to form vitamin C.

(2 marks)

b Give an inference that can be made using this DNA sequence that provides strong evidence that humans and primates had a common ancestor.

(1 mark)

Vitamin C is an essential co-factor for many enzymatic reactions.

c Suggest why such a mutation had no effect on the survival of early primates.

(1 mark)

Total 4 marks

Question 8

Cane toads were introduced into Australia in 1935, and owing to the fact that there were no regional predators, they multiplied exponentially and now occupy a large area of Queensland and the Northern Territory. These toads produce a toxin that is poisonous to many animals, including many snakes, that would otherwise have been predators and held their numbers in check. Scientists investigated the effect of the cane toads on some Australian snake species. They measured the body size, the head size and the gape size (size of their open mouths) of snakes currently in the wild and compared this data with the same measurements of these snakes in museum specimens collected before 1935. They found that the snakes that were more vulnerable to the toad toxin showed an increase in body size and a decrease in head and gape size since 1935.

a What might be the benefit of both body size and head/gape size to the snakes in this environment?

(2 marks)

b Name the process that has given rise to this change in snake anatomy.

(1 mark)

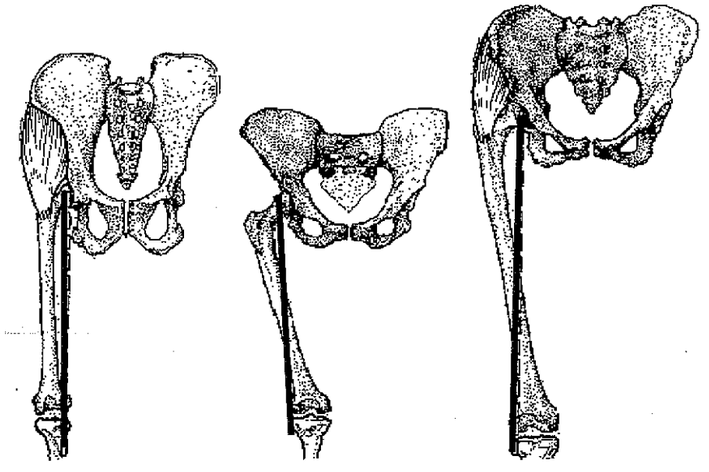
c Explain how the process named above has occurred in these populations of snakes over the last 50 plus years.

(3 marks)

Total 6 marks

Question 9

The diagrams below show part of the skeletons of a human, a chimpanzee and an Australopicine.



A B C

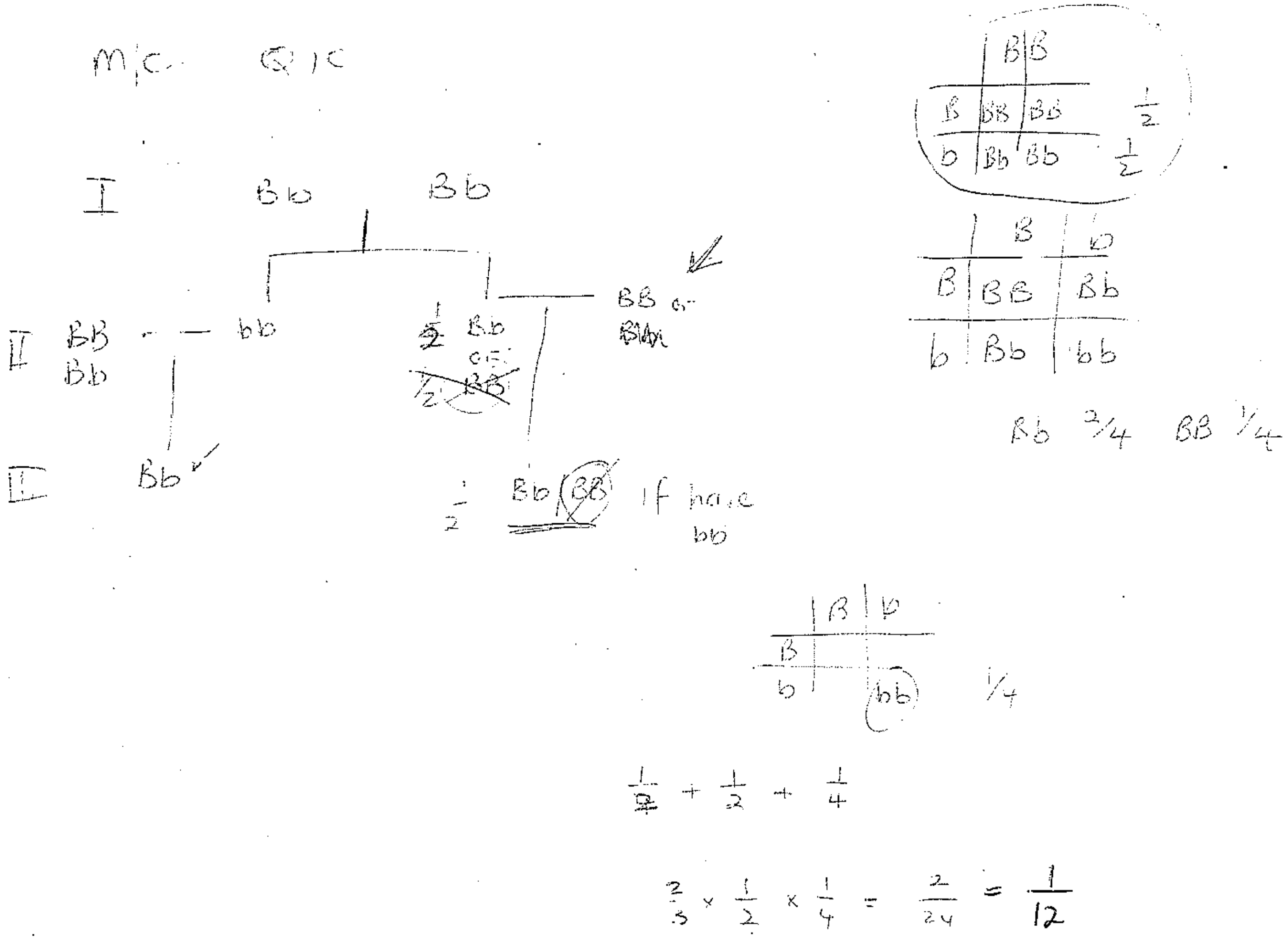
a Complete the table to indicate which diagram belongs to which skeleton.

Skeleton	Diagram letter
Human	
Chimpanzee	
Australopicine	

(1 mark)

b Which of these individuals were capable of upright locomotion? Explain your answer using evidence from the diagrams.

(2 marks)



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TEACHERS, PLEASE NOTE:

In marking the Exam, teachers should keep in mind that the language used in the suggested answers is sometimes more sophisticated than a student would offer, since these answers are written for teachers' information in their correction of the Exam.

*The answers suggested here might not be the only correct responses possible. Teachers must use their professional judgement in awarding marks for other answers offered. However, in accordance with the VCAA practice, students who give a correct response, and then offer a contradictory incorrect response within the same part of the question, should **not** be awarded any marks for the correct part of the response. Also in accordance with the VCAA practice, no half marks should be given.*

SECTION A - MULTIPLE CHOICE QUESTIONS (1 mark each: 25 marks)

1	A	16	D
2	C	17	D
3	D	18	B
4	A	19	C
5	C	20	C
6	C	21	B
7	A	22	C
8	A	23	A
9	C	24	D
10	A	25	C
11	A		
12	D		
13	D		
14	C		
15	A		

SECTION B - WRITTEN RESPONSES

Question 1

a Transfer RNA — 1 mark

b i Translation (1)

ii GAA (1) — 2 marks

c
- The mRNA code is read as it passes along the ribosome (1).
- Transfer RNA anticodons with the specific amino acid, attach to the mRNA complimentary codons according to base pairing (1).
- A protein/polypeptide is produced (1).

3 marks

Total Question 1: 6 marks

Question 2

a This inheritance is X-linked dominant (1)because if it was X-linked recessive then all the sons of II4 would have the condition as both her X chromosomes would have to be affected and all sons get their X chromosome from their mothers (1). — 2 marks

b Based on the fact that it is X-linked dominant, II3 must be heterozygous only as she received one X from each parent and her mother does not have the condition. — 1 mark

c The probability of individual III4 and III5 having a son is ½. The probability of that son receiving the X chromosome with the Xg antigen from the mother is ½ (1). Therefore the probability of having a son with the Xg antigen is ½ x ½ = 1/4 (1). — 2 marks

Total Question 2: 5 marks

Question 3

a Recombinant DNA technology — 1 mark

b DNA ligase — 1 mark

c This enables screening to select the cells that are resistant to antibiotics as these cells will also contain the inserted cholera genes. — 1 mark

d Transgenic — 1 mark

e The bananas are eaten raw, whereas potatoes are eaten cooked and as the vaccine is a protein, it could be denatured in the cooking process. — 1 mark

f This is an example of transgenic organisms and some members of the public are against having transgenic organisms in the environment. **Or** This has not been tested in humans longterm. — 1 mark

g It is very hard to gauge the dose of the vaccine as some bananas may make more of the protein than others. **Or** Plasmids can randomly become non-functioning over time. — 1 mark

Total Question 3: 7 marks

Question 4

a The percentage of resistant phenotypes increased from 10 to ~60% — 1 mark

b Those individuals who carried the R^R allele as either a heterozygote or homozygote showed varying resistance to dieldrin, therefore they would survive (1) and pass that R^R allele onto the next generation and hence resistance to dieldrin became more frequent in the population (1). — 2 marks

c After 1958, when dieldrin was withdrawn, those with the R^R allele no longer had a selective advantage (1) and may not have been able to survive as well as the R^SR^S individuals and thus left fewer offspring (1) therefore the percentage resistance in the population fell. — 2 marks

d A few resistant flies still exist in the population 50 years later as it takes a long time for an allele to disappear from a population unless strongly selected against. — 1 mark

Total Question 4: 6 marks

Question 5

a These individuals have the full complement of genes just in a different arrangement so will be phenotypically normal. — 1 mark

b 23 — 1 mark

c Gamete 1 translocated 20 + translocated 4
Gamete 2 translocated 20 + normal 4
Gamete 3 normal 20 + translocated 4
Gamete 4 normal 20 + normal 4 — 2 marks

d The process of copying genetic instructions present in the DNA to messenger RNA. — 1 mark

e As the cMYC gene produces a protein that promotes transcription, there would be continuous transcription of the production of B lymphocytes which is a type of cancer. — 1 mark

Total Question 5: 6 marks

cmyc gene ↑ transcription next to gene for B lymph.

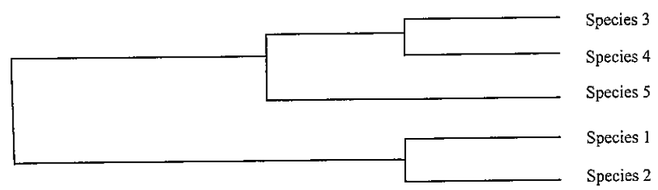
Question 6

a DNA sequencing — 1 mark

b Point mutation — 1 mark

c The more point mutations between the species, the more time has passed since a common ancestor. — 1 mark

d



2 marks

Total Question 6: 5 marks

Question 7

a *This mutation is a deletion and will therefore result in a frame shift after the deletion (1) as the code is read 3 nucleotides at a time. The amino acids after the deletion will probably not be the same and the protein formed, in this case the enzyme, will not be able to function (1).* *2 marks*

b *There is the same genetic defect, a deletion at the same spot for each species. For each species to experience the same mutation independently would be most unlikely. Therefore a common ancestor can be inferred.* *1 mark*

c *Early primates would have had a diet rich in Vitamin C by eating lots of fruit, therefore they were able to survive without having to form their own vitamin C.* *1 mark*

Total Question 7: ***4 marks***

Question 8

a *Snakes that have larger bodies are able to cope with the breakdown of the toxin from the toads more readily than smaller bodied snakes (1). If they have a smaller head and gape, the snakes would only be able to ingest small toads that would have less poison (1).* *2 marks*

b *Natural selection.* *1 mark*

c *There would be variation in body size and head size in the population of snakes (1). The poisonous cane toads were the selection pressure as those snakes with the smaller gapes could only eat small toads and those with bigger bodies could tolerate the poison better (1). The snakes with larger bodies and smaller heads survived and reproduced and passed those alleles onto the next generations (1).* *3 marks*

Total Question 8: ***6 marks***

Question 9

a

Human	*C*
Chimpanzee	*A*
Australopicine	*B*

1 mark

b *Australopicines and humans are capable of upright locomotion (1) because their weight-bearing axis is directly below the hip enabling them to lift one leg off the ground and place it in front of the other (1).* *2 marks*

c *The more homology between whole chromosomes the more closely related the species (1). Compared with humans, the chimpanzees have the greatest homology, followed by the gorilla. The gibbon only has full homology on 5 chromosomes; the human chromosomes have homologous areas on many different chromosomes indicating that gibbons are more distantly related to humans than the chimpanzee or the gorilla (1).* *2 marks*

Total Question 9: ***5 marks***

Total Section B: ***50 marks***

Total examination: ***75 marks***

END OF SUGGESTED SOLUTIONS