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TOTAL MARKS

NATIONAL SENIOR CERTIFICATE EXAMINATION
MAY 2025

LIFE SCIENCES: PAPER 1

EXAMINATION NUMBER

Time: 3 hours 200 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of 43 pages. Please check that your question paper is complete.
2. Read the questions carefully.
3. **Answer ALL the questions on the question paper in the spaces provided and hand it in at the end of the examination. Remember to write your examination number in the space above.**
4. Use the total marks that can be awarded and the space provided for each question as an indication of the detail required.
5. It is in your best interest to write legibly and to present your work neatly.
6. TWO blank pages (pages 41 and 42) are included at the end of the paper. If you run out of space for a question, use these pages. Clearly indicate the number of your answer should you use this extra space. There is a spare copy of graph paper on page 43.

FOR OFFICE USE ONLY: MARKER TO ENTER MARKS

	Q1	Q2	Q3	Q4	Total
Mark					
Marker Initial					
Moderated Mark					
Moderator Initial					
Question Total	**80**	**40**	**40**	**40**	**200**
Re-mark					
Initial					
Code					

N12LISC-1-E

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QUESTION 1

1.1 Select the term in Column B that best matches the description in Column A. Write the letter of the term in the space provided between the brackets. Each letter may be used only once.

	COLUMN A		COLUMN B
[ ]	Scientist who discovered the basic laws of genetic inheritance.	A	*Australopithecus sediba*
[ ]	Organisms with similar characteristics that arose from different common ancestors.	B	*Australopithecus africanus*
[ ]	A mechanism that prevents closely related organisms from interbreeding.	C	Mendel
[ ]	The position of a gene on a chromosome.	D	Convergent Evolution
[ ]	Speciation occurring by quick bursts of evolutionary change followed by long periods of stasis.	E	Lamarck
[ ]	Breeding of animals by selecting desired traits over many generations.	F	Punctuated Equilibrium
[ ]	The most modern species of *Australopithecus* based on fossil evidence.	G	Macroevolution
[ ]	The Taung child is an example of this fossil species.	H	Out of Africa
[ ]	Large-scale evolutionary changes that occur over long periods of time that result in new species forming.	I	Locus
[ ]	A hypothesis stating that modern humans originated in Africa.	J	Artificial Selection
		K	Reproductive Isolation
		L	*Australopithecus afarensis*

(10)

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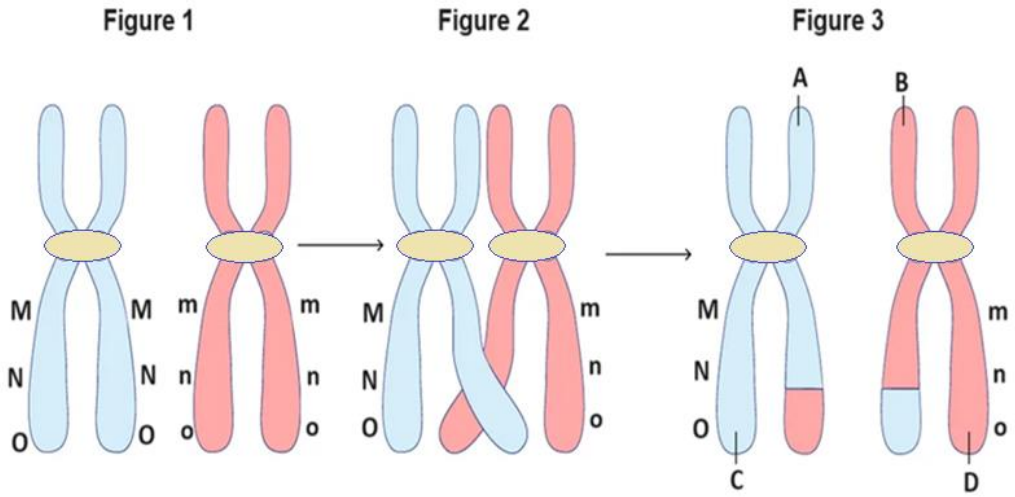
1.2 Six multiple-choice questions follow. Choose the most correct option for each question and write the letter of your choice in the space provided in the table below.

Question	1.2.1	1.2.2	1.2.3	1.2.4	1.2.5	1.2.6
Answer						

Refer to the diagram below to answer questions 1.2.1–1.2.3.

Figures 1–3 showing crossing over of homologous chromosomes



[Source: <https: jackwestin.com>]

1.2.1 During which phase of meiosis does the process in the diagram occur?

A Prophase 1
B Metaphase 1
C Prophase 2
D Anaphase 2 (1)

1.2.2 Which of the chromatids in Figure 3 are recombinant?

A A and B
B C and D
C A and D
D B and C (1)

1.2.3 What is the allele sequence of the chromatid drawn at A?

A M N O
B m n O
C M N o
D M n O (2)

1.2.4 Which of the following most correctly explains how TB bacteria develop drug resistance?

A The drugs triggered mutations in the patient cells which altered their ability to resist TB bacteria.
B The bacteria altered the immune system of TB patients by mutating the DNA of the patient.
C The TB bacterium developed a mutation which reduced their ability to resist drugs.
D A bacterium developed resistance to drugs and reproduced to form more drug-resistant offspring.

(1)

Please read the following extract and refer to it to answer questions 1.2.5 and 1.2.6.

In the waters between Washington state and the Canadian province of British Columbia, a unique population of killer whales is found—the **southern resident orcas, *Orcinus orca***.

However, despite sharing the same habitat with other killer whales, the southern resident orcas have not bred with other killer whale groups in over **30 generations**. It is not due to physical barriers or lack of opportunity.

These southern resident orcas **choose** not to interbreed with other whales. Due to this, the genes of the southern resident orcas have not mixed with other killer whale groups for a long time. This has led to small changes in the southern resident orcas. These changes are both physical (different shaped markings and fins) and behavioural (southern resident orcas feed on fish only while other killer whales eat mostly seals). Over time, it is hypothesised that the southern resident orcas will become a species of their own.

[Source: <www.smithsonian.com>]

1.2.5 What evolutionary mechanism is referred to in the text?

A Allopatric speciation
B Convergent evolution
C Divergent evolution
D Sympatric speciation (1)

1.2.6 Which of the following is responsible for '*the small physical changes*' observed within the southern resident orcas?

A Natural Selection
B Microevolution
C Geographic Isolation
D Outbreeding (1)

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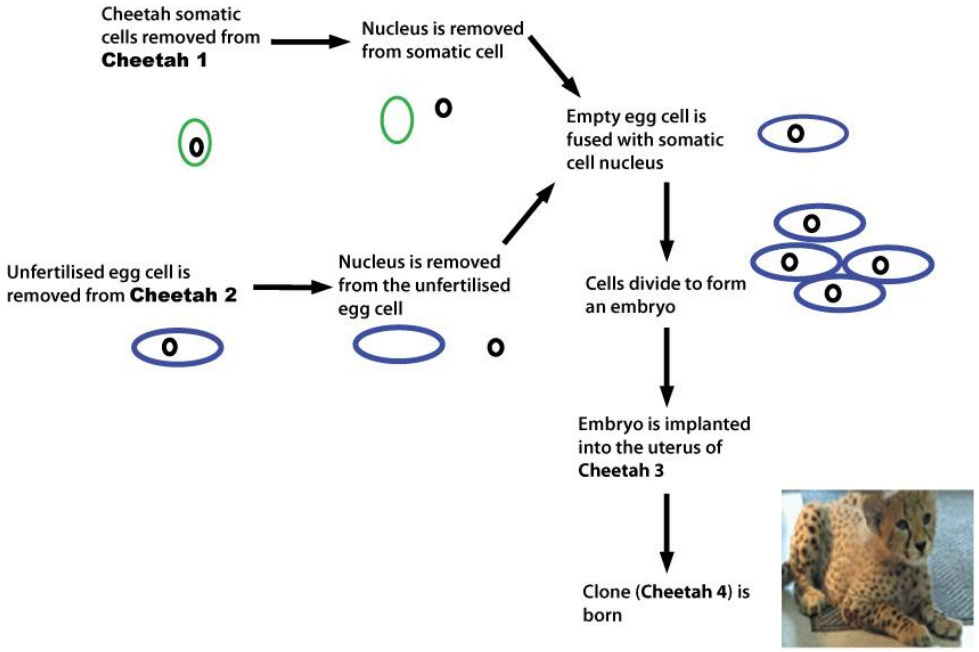
1.3 The process of reproductive cloning is outlined in Figure 4 below.

Figure 4 - Cloning of a Cheetah



[Image: <https://www.flickr.com>]
[Source Diagram: Examiner's Own]

1.3.1 On the diagram above, make the following annotations:

(a) Circle the step of the process where SCNT takes place. (1)

(b) Put an 'M' where mitosis has taken place. (1)

1.3.2 Study the following table that consists of rows and three columns. Each row consists of an item in the first column and two terms in the second column. Decide which term(s) relates to the item. Write down your choice in the space provided in the Answer column, using the following codes:

A Only term A relates to the item.
B Only term B relates to the item.
Both Both terms A and B relate to the item.
None Neither term A nor term B relate to the item.

Item	Term	Answer
To which other cheetah is cheetah 4 genetically identical.	A. Cheetah 1 B. Cheetah 2	
The chromosome number in the nucleus of the somatic cell from cheetah 1.	A. Haploid B. Diploid	
The amount of genetic material contributed by cheetah 3 to cheetah 4.	A. 50% B. 25%	
Disadvantages of cloned individuals.	A. Reduced immunity B. Shorter lifespan	

(4)

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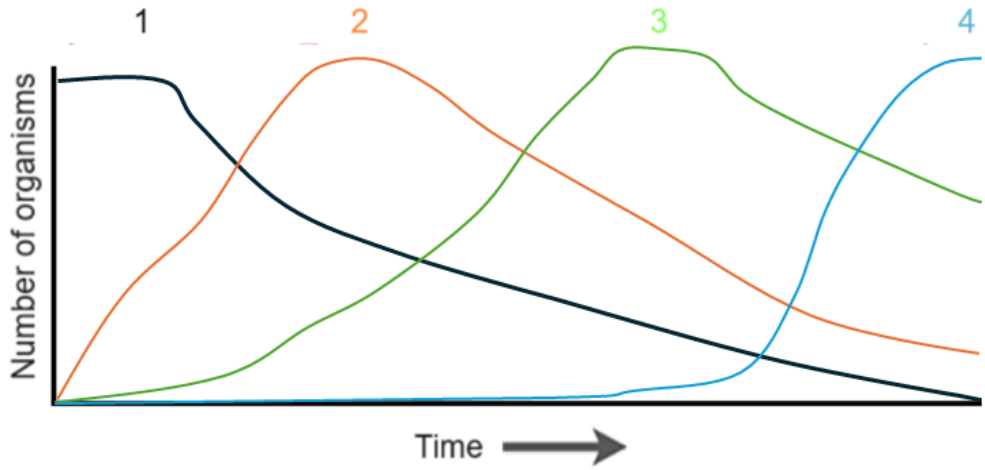
1.4 Ecosystems change over time. Figure 5 below shows an example of this.

Figure 5 - Graph showing the increase and decrease in different plants in an ecosystem over a period of time



Key:
1. Bare Rock
2. Lichens and Mosses
3. Perennials (small plants that survive easily in many conditions and bloom once a year)
4. Large Trees

[Source: <www.wikipedia.com>]

1.4.1 Name the ecological process that is being depicted in the graph.

_____

(2)

1.4.2 Explain the reason for the trends shown by the following graph lines:

(a) The decrease in Line 1

_____

_____

(2)

(b) The increase in Line 2

_____

_____

(2)

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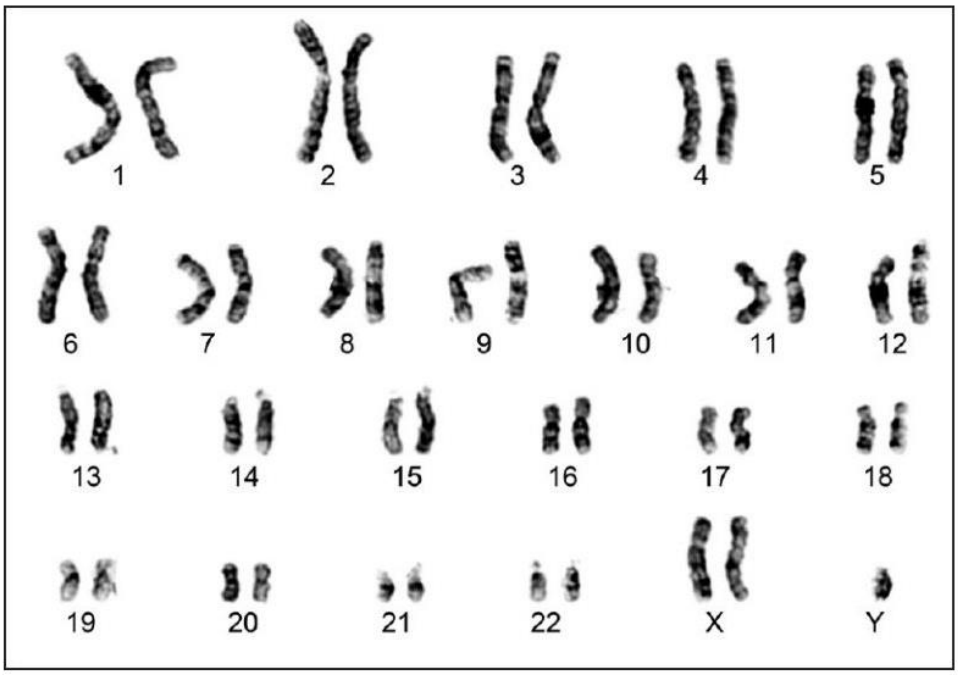
1.4.3 Which of the following most accurately describes the climax community? Write the LETTER of the correct option in the box below.

A The ecosystem will continue to give rise to multiple different types of plant and animal species.
B Secondary succession is occurring due to disturbances in the environment.
C All plant and animal communities will remain stable.
D There are more pioneers than large trees.

(1)

1.5 Study Figure 6 below and answer the questions.

Figure 6 - A karyotype of an individual with a genetic disorder



[Source: <www.pinterest.com>]

1.5.1 Describe how this karyotype is different to a normal human karyotype.

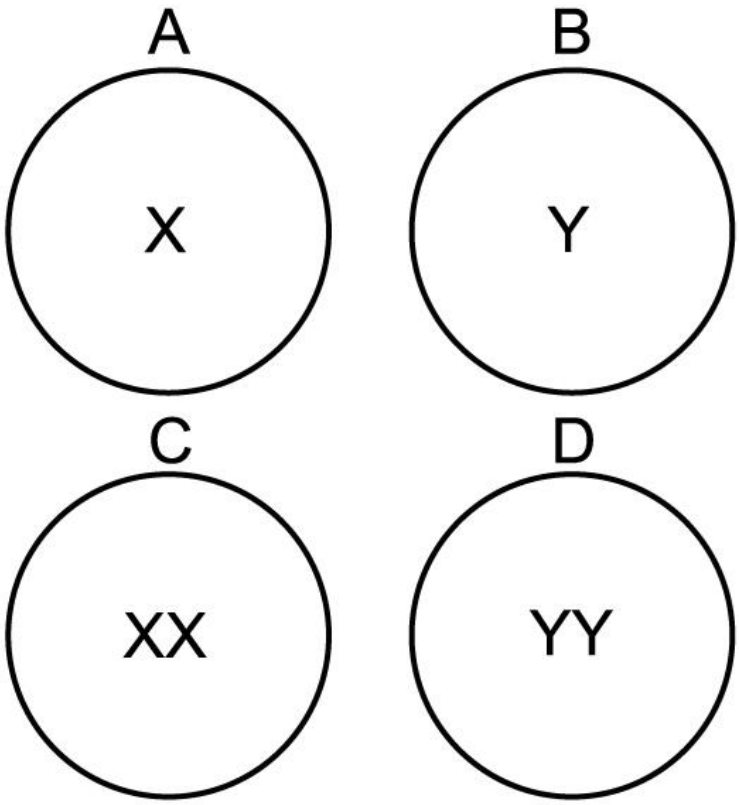
(2)

1.5.2 What is the chromosome number of this individual?

(1)

1.5.3 Four possible gametes (labelled A–D) are shown below. These gametes represent only the sex chromosomes that are found in these cells at the end of meiosis.

Figure 7 - Various gametes representing only sex chromosomes



[Source: Examiner's own drawing]

(a) Write down the letters of the **two** gametes which would fuse to form the individual with the karyotype in figure 6.

_____

(2)

(b) Figure 6 illustrates an example of 'chromosome non-disjunction' in gametes. Explain what this means in relation to the karyotype in figure 6.

_____

_____

_____

(2)

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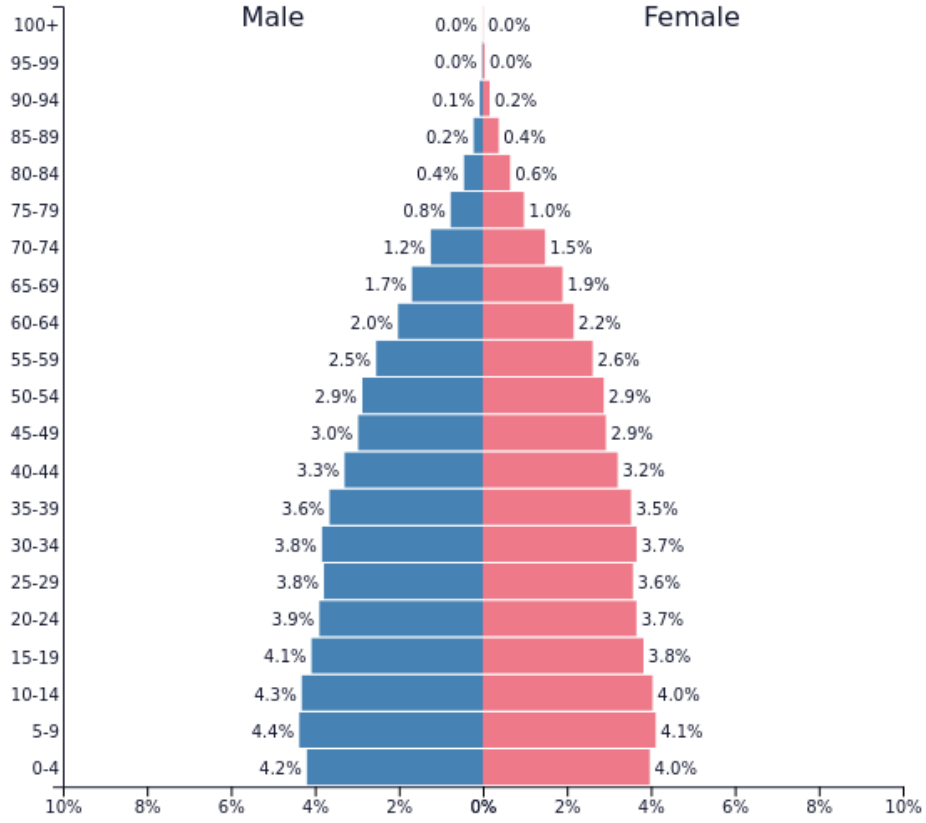
1.6 The graph below shows the world human population in 2023.

Figure 8 - Population pyramid which shows the world population in 2023

The human world population was estimated to be about 8 200 000 000 (8,2 billion) people in 2023.



[Source: <www.populationpyramid.net>]

1.6.1 Circle the appropriate population parameter(s) from the list of terms below that is/are associated with the graph.

Natality Immigration Emigration Mortality

(2)

1.6.2 (a) Which of the following terms describes the type of population pyramid for humans in 2023? Place a tick in the box next to the correct answer.

☐ Growing

☐ Declining

☐ Stable (1)

(b) Give a reason for your answer using information from the graph in figure 8.

_____

_____

(1)

1.6.3 According to the population pyramid, females are more likely to live to an older age, worldwide.

(a) Do you think that South Africa's data is similar to worldwide data? Provide a well-explained reason for your answer.

(2)

(b) Refer to the data in the source and calculate the total number of females in the age bracket 90–94 years. Show all working.

(2)

1.6.4 Human populations are counted by a method called a census survey. Read the text below to answer the questions.

> A census survey is done to calculate the size of human populations and provide valuable information to the government of a country. The public is encouraged to complete surveys so that their data can be captured as part of the census. The last South African census in 2011 cost the country R987 million.

[Source: <www.statssa.gov.za>]

(a) Is the data obtained in a human census reliable? Give a reason for your answer.

(2)

(b) Do you think that the cost of doing a census in South Africa is justifiable? Give a well-explained reason for your answer.

(2)

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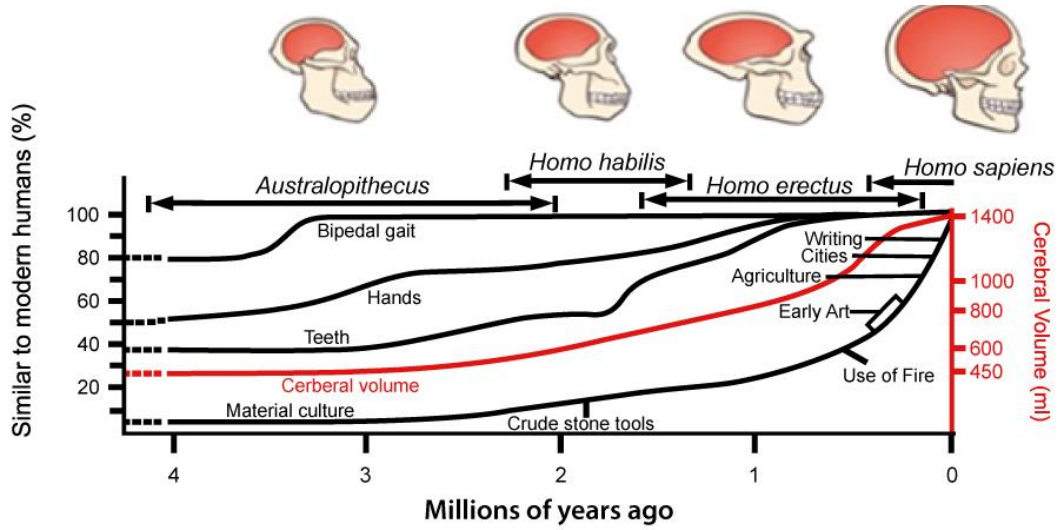
1.7 The graph below shows various changes in hominid characteristics as well as development of aspects of culture over time.

Figure 9 - Graph showing development of hominid characteristics over time



[Source: <adapted from https://socialsci.libretexts.org/>]

1.7.1 The statements in the table below refer to the graph in figure 9. For each statement decide whether:

A The statement is supported by the graph
B The statement is contradicted by the graph
C The statement is neither supported nor contradicted by the graph

Statement	**A, B or C**
Cerebral volume has increased at a constant rate over the last 4 million years.	
From the graph, it could be deduced that cerebral volume is linked to the development of writing and agriculture.	
The first Hominids to be bipedal were from the *Homo* genus.	
Homo habilis were the only hominids that used stone tools.	
Changes in teeth shape and size were due to changes in the diet.	

(5)

1.7.2 Briefly explain how bipedalism, brain size and fire-making are interdependent in the evolution of hominids.

_____

_____

_____

_____

(3)

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1.7.3 Refer to the image below of the lower limbs of two hominids.

Figure 10 - A comparison between the bones in the pelvis, legs and feet of two hominids



[Source: <Britannica.com>]

(a) Which of the hominids (P or Q) is fully bipedal?

_____

(1)

(b) List TWO visible features to support your answer.

_____

_____

_____

_____

_____

(2)

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1.8 Read the information below and refer to it to answer the questions that follow.

Thalassemia is a form of anaemia (a disorder where the patient is not able to carry enough oxygen in their blood). It is caused by a mutation in the beta globin gene, which codes for the protein that makes up red blood cells. People with thalassemia form fewer red blood cells than normal. This leads to symptoms such as fatigue, weakness and paleness.

A part of the Beta Thalassemia coding strand is shown below for both the functional (normal) and mutated gene:

FUNCTIONAL/NORMAL GENE CODING STRAND: CCT ATT AAT CTA
MUTATED GENE CODING STRAND: CCT ATT AGT CTA

Table 1- mRNA Codon table with corresponding amino acids

POSSIBLE mRNA CODONS	CORRESPONDING AMINO ACID
UUU/ UUC	Phenylalanine
UCU/ UCC/ UCA	Serine
GAC/ GAU	Aspartic Acid
GAG/ GAA	Glutamic Acid
UUA/ UUG	Leucine
UAU/ UAC/ UAA/ UAG	Tyrosine
GGU/ GGC/ GGA/ GGG	Glycine

[Source: <https:pubmed.ncbi.nlm.nih.gov>]

1.8.1 Describe the meaning of the term 'mutation'.

_____

_____

(2)

1.8.2 (a) What type of mutation causes thalassemia?

_____

_____

(1)

(b) Describe the exact change that occurred to produce the mutated gene.

_____

_____

(1)

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1.8.3 State the changes that result from the thalassemia mutation to the following:

(a) The codon on the mRNA formed from the mutated DNA coding strand.

_____

(1)

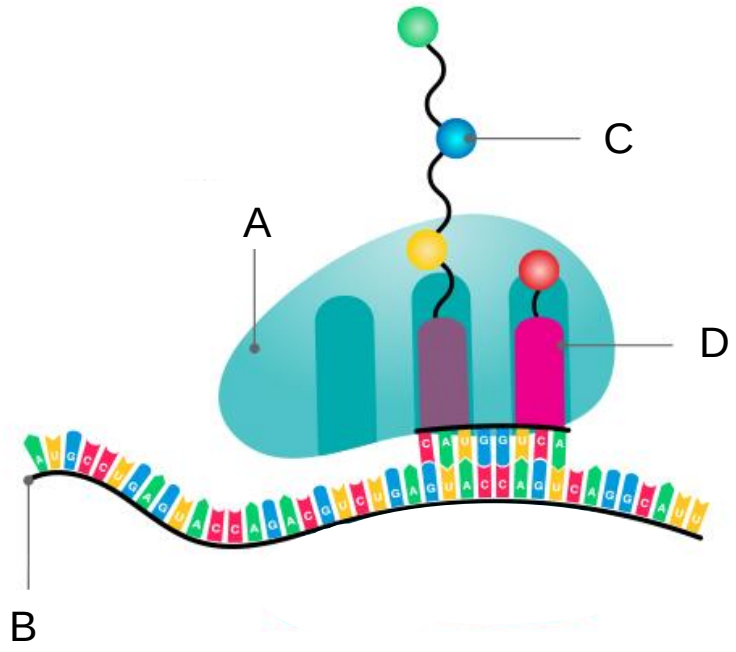
(b) The change in the amino acid in the red blood cells.

_____

(1)

1.8.4 Refer to the diagram depicting a stage in the synthesis of a protein that is shown below to answer the following questions.

Figure 11- Part of the process of protein synthesis



[Source: <https:geeksforgeeks.org>]

(a) Name the stage of protein synthesis that is shown in the image.

_____

(1)

(b) Provide the labels for the following on the diagram.

A: _____

D: _____

(2)

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(c) Describe the role of structure B in this stage of protein synthesis.

_____

_____

_____

(1)

(d) In the space below, draw and label ONE nucleotide to show all its component parts.

(3)

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1.9 The text below contains an extract from a News24 article. Use the text to assist you in answering the questions that follow.

'Skytram' has Franschhoek Residents in a Flap

Residents of Franschhoek have come together to debate the proposal for a R400 million cablecar or 'Skytram' system to be built across two of the mountain peaks within the Mont Rochelle Nature Reserve.

Franschhoek is a famous holiday destination in South Africa and is well-known for its scenic beauty, biodiversity and wine farms.

The project for the Skytram has not been approved yet but investigations have been completed to check if this project could work. These investigations include an Environmental Impact Assessment, amongst others.

Residents of Franschhoek are divided in their views. Some believe that the Skytram will bring more visitors to the town, which would increase tourism. Others believe that the Skytram will destroy the natural environment, threaten biodiversity and ruin the scenic beauty of the area.

The Skytram itself will secure 37 permanent jobs for locals in the area.



The proposed Skytram above Franschhoek town and winelands

[Source: <https:news24.com>]

1.9.1 Describe what is meant by the term Environmental Impact Assessment.

_____

_____

_____

(2)

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1.9.2 Other than the assessments listed in the text, suggest TWO other possible impacts of the Skytram project on the environment that should be investigated.

_____

_____

_____

(2)

1.9.3 In your opinion, should the Skytram project be approved? Support your answer with information from the text and your own knowledge.

_____

_____

_____

_____

(3)
[80]

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QUESTION 2

2.1 Read the information in the textbox below and answer the questions that follow.

King Cheetahs

The King Cheetah is rare and known for its different and beautiful coat markings. It is not a separate species of cheetah it is merely a cheetah that has a unique coat. It contains two copies of a rare gene that code for cream-coloured fur marked with large blotchy spots and three dark, wide stripes extending from neck to tail. A King Cheetah can be produced from two 'normal' cheetah parents.



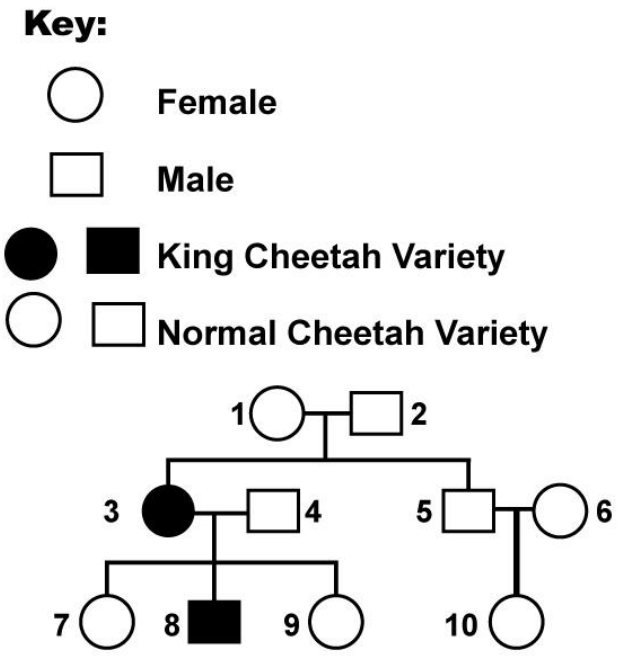
A King Cheetah



A regular cheetah

Figure 12 - Pedigree Chart of King Cheetah Inheritance

The chart below shows the inheritance pattern of the King Cheetah as recorded in a captive breeding experiment.



Genotypes Key:
B- normal cheetah coat
b- King cheetah coat

[Source: <https:cheetah.org>] [Image: <www.flickr.com/photos>]
[Source diagram: examiner's own]

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2.1.1 Give the meaning of the term 'gene'.

_____

_____

(2)

2.1.2 (a) Which of the following terms describes the pattern of inheritance shown by the King Cheetah? Circle the letter of the correct option.

A autosomal dominant
B autosomal recessive
C sex-linked inheritance (1)

(b) Provide a piece of evidence from the information provided to support your choice.

_____

_____

_____

(2)

(c) From the pedigree chart in figure 12, list TWO individuals that are carriers of the King Cheetah gene.

_____

(2)

(d) Provide the **genotype** of individual 3 in the pedigree chart.

_____

(1)

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2.1.3 In the space below, draw a punnet square/genetic cross diagram to show the probability of parents 1 and 2 producing a King Cheetah cub.

Use the letters **B** and **b** in your cross.
Complete the parental genotypes and gamete genotypes and show the probable resulting offspring by means of a Punnett diagram in the space.

Parent genotypes:

Male: _____ Female: _____

Gametes:

Male: _____ Female: _____

Punnett Diagram:

Offspring Genotype Ratios:

_____

Offspring Phenotype Ratios:

_____

(6)

2.1.4 King Cheetahs are very rare and therefore very valuable to game farm owners. Do you think that breeding programmes to selectively produce King Cheetah are ethical? Give a well-explained reason for your answer.

_____

_____

_____

(2)

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2.2 Read the information in the textbox below and answer the questions that follow:

Meat Scandal Rocks South Africa

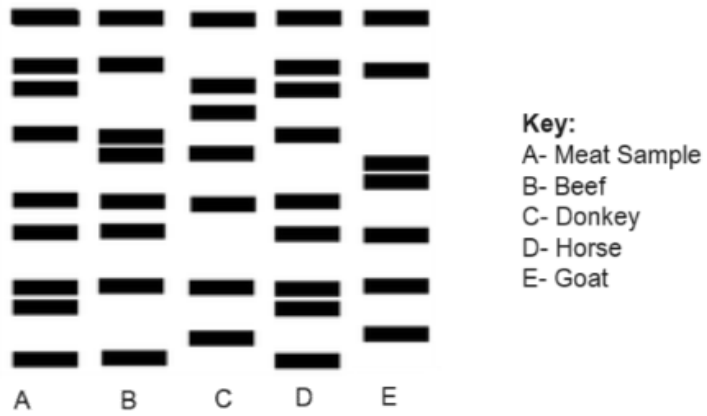
Researchers have found 'fraudulent meat products' across South Africa. The study found that anything from horse, soya, donkey, goat, and water buffalo was found in 95 samples out of a total of 139 samples tested. Meat products tested were minced meats, burger patties and sausages.

The study was published in the *International Food Control Journal*, and was carried out by professors from Stellenbosch University, Department of Animal Sciences.

'Our study confirms that the mislabelling of processed meats is commonplace in South Africa and not only violates food labelling regulations but is also a severe infringement (violation) of consumer rights,' said Professor Hoffman of Stellenbosch University.

A meat sample labelled as 'beef' was tested and compared to other types of meat samples. The figure below shows the results of the test.

Figure 13 - DNA analysis done on meat sample A and other animals for comparison



[Source: <https://www.iol.co.za>]
[Image: <https://www.thekitchn.com>]

2.2.1 Provide the term for the DNA testing analysis that was done in figure 13.

_____

(1)

2.2.2 Besides identifying the origins of meat, state ONE other way in which DNA analysis can be used.

_____

(1)

2.2.3 Before the DNA analysis is done, PCR is carried out on the DNA sample. What does PCR achieve?

_____

(1)

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2.2.4 Which type of meat does sample A contain? Give a reason for your answer.

_____

_____

_____

(2)

2.2.5 The text has described the mislabelling of meat products as a 'severe infringement of consumer rights'.

(a) Provide ONE explained reason to support the statement.

_____

_____

_____

(2)

(b) Provide ONE explained reason to refute (prove wrong) the statement.

_____

_____

_____

(2)

2.2.6 Propose ONE practical measure that could be taken in South Africa to prevent fraudulent meat labelling.

_____

_____

(1)

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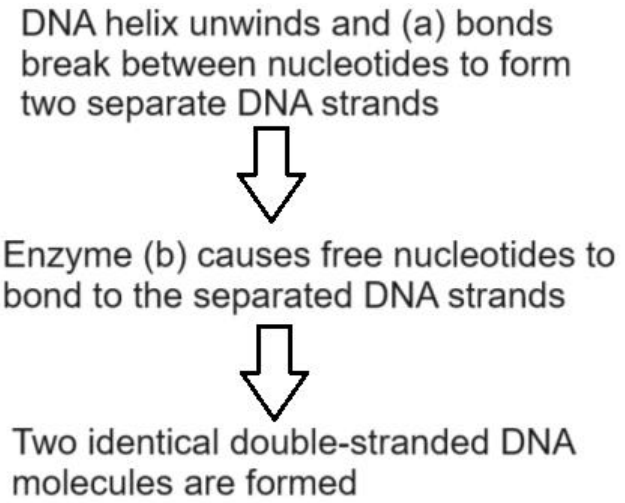
2.3 The following flowchart is incomplete. It shows the important process of DNA replication that occurs in cells before meiosis.

Figure 14 - A flowchart showing DNA replication



2.3.1 Provide the terms for (a) and (b) in the flowchart.

(a) _____

(b) _____

(2)

2.3.2 Explain why it is vital for DNA replication to occur before meiosis.

_____

_____

_____

_____

(3)

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2.4 Read tshe information below and answer the questions that follow.

The Human Genome Project and Cancer

The Human Genome Project opened the doors for many different possibilities in genetics and medicine. This project has helped scientists understand cancer a lot better.

Cancer is known as a 'dread disease'. It is a complicated disease and has many different possible causes. One of the biggest causes of cancer is genetic. Most cancers are normally caused by more than one gene at more than one location. A 'bad' combination of genes is what generally leads to genetic cancers.

Scientists have been able to use the Human Genome project data to identify cancer-causing genes and mutations.

[Source: <https://biology.mit.edu>]

2.4.1 Describe the Human Genome project.

_____

_____

(2)

2.4.2 'Most cancers are normally caused by more than one gene at more than one location'.

(a) What is the term for a trait that is controlled by more than one gene?

_____

(1)

(b) Name an example of ONE other trait that is controlled by more than one gene.

_____

(1)

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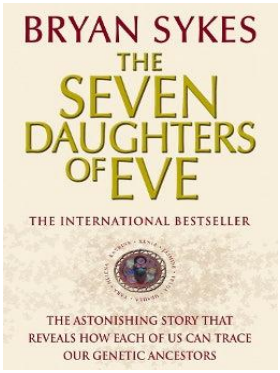
2.5 Read the information below and answer the questions that follow.

The Seven Daughters of Eve is a fictional scientific book. This book claims that most people on earth can be traced to one of **seven** original female ancestors. This claim has been made following numerous DNA analyses done on DNA that is passed only along female lineages.

This DNA is useful in tracing lineage for two reasons. Firstly, it does not undergo crossing over each generation. Secondly, it has a known mutation rate.



[Source: <www.Amazon.com>]

2.5.1 What type of DNA is 'passed only along female lineages'?

_____

(1)

2.5.2 Why is this type of DNA suitable for tracing lineage?

_____

_____

_____

(2)

2.5.3 The book, ***The Seven Daughters of Eve*** is classified as fiction, despite it being based on biological principles. Do you think that books like these are an advantage to the scientific community? Give a well-explained reason for your answer.

_____

_____

_____

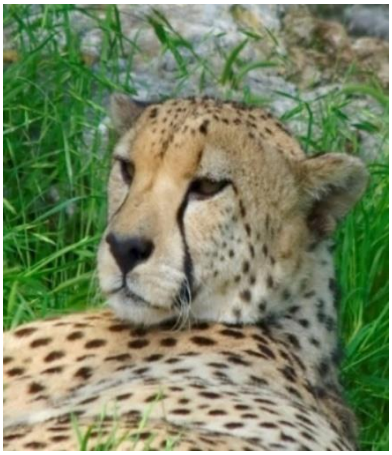
(2)
[40]

QUESTION 3

3.1 Read the information in the textbox below and answer the questions that follow.

Cheating Cheetahs Prosper

In the animal world, it is common to see males sneaking around with many females. Male lions, chimps and elephant seals (along with many others) pair up and mate with multiple females.



A young cheetah male

But now, researchers have revealed that cheetahs do not follow the same behaviour. According to a research study, female cheetahs seem to be at least as promiscuous (having sexual intercourse with multiple partners) as male cheetahs. Female cheetahs often mate with several different males while they are fertile and are then likely to bear a single litter of cubs fathered by multiple males - meaning many of the cubs within a single litter are only half siblings. Female cheetahs also do not mate with the same male from one mating season to the next.

Female cheetahs have also been known to mate with males that are not geographically close to each other - this may further increase the variety of cubs in a single litter.

Conservationists are interested in 'cheetah cheating' because it impacts the cheetah population's level of genetic variation. As a species, cheetahs have famously low levels of genetic variation. This can probably be attributed to the fact that around 10 000 years ago, they nearly became extinct due to the last Ice Age. On top of this, habitat destruction and poaching have also caused the cheetah numbers to become dangerously low. The world cheetah population has come from a very small original group of cheetahs, causing a lack of genetic diversity.

[Source: <www.evolution.berkeley.edu>] [Image: <https:flickr.com/photos>]

3.1.1 What is the evolutionary phenomenon experienced by the world cheetah population? Write only the correct letter in the box.

A	Geographic Speciation
B	Founder Effect
C	Outbreeding

(1)

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3.1.2 From the text, identify TWO ways in which a female cheetah ensures increased genetic diversity in her offspring.

(2)

3.1.3 Due to their small numbers, cheetahs have an increase in homozygosity.

(a) Define the term homozygosity.

(2)

(b) Explain why homozygosity can negatively affect the survival of a species.

(2)

3.1.4 Outbreeding occurs when two genetically different organisms produce offspring.

Suggest a possible advantage and disadvantage of outbreeding.

Advantage:

Disadvantage:

(2)

3.1.5 Explain how **random segregation** of alleles during meiosis assists in increased genetic variation.

(2)

3.2 Read the information in the textbox below.

Investigating if a Cheetah has been a Cheater

Researchers can determine if wild litters of cheetah cubs are from the same father or different fathers by DNA analysis. The most non-invasive way to do this is to analyse the faeces of the cubs (DNA of an organism is found in their faeces) and comparing it to possible fathers. Environmental scientists are interested in determining if female cheetahs mating with multiple males will assist in increasing the cheetah population size over a period of time.

Table 2 - Table showing results to a 'cheating cheetahs' investigation

	Number of offspring in litter	Number of fathers of litter
Female 1	6	3
Female 2	4	3
Female 3	3	1
Female 4	2	2

[Source: Examiner's own data]

3.2.1 Provide an aim for the investigation.

(3)

3.2.2 This study was done by analysing the DNA of cheetah cubs. How is DNA analysis used to determine if a litter of cubs had one or two fathers?

(2)

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3.2.3 Suggest ONE way to improve the reliability of this study.

_____

(1)

3.2.4 Calculate the average number of fathers per cheetah litter. Show all working.

_____

_____

_____

(2)

3.2.5 In your opinion will faeces analysis in the wild always provide reliable DNA information? Give TWO reasons for your answer.

_____

_____

_____

(2)

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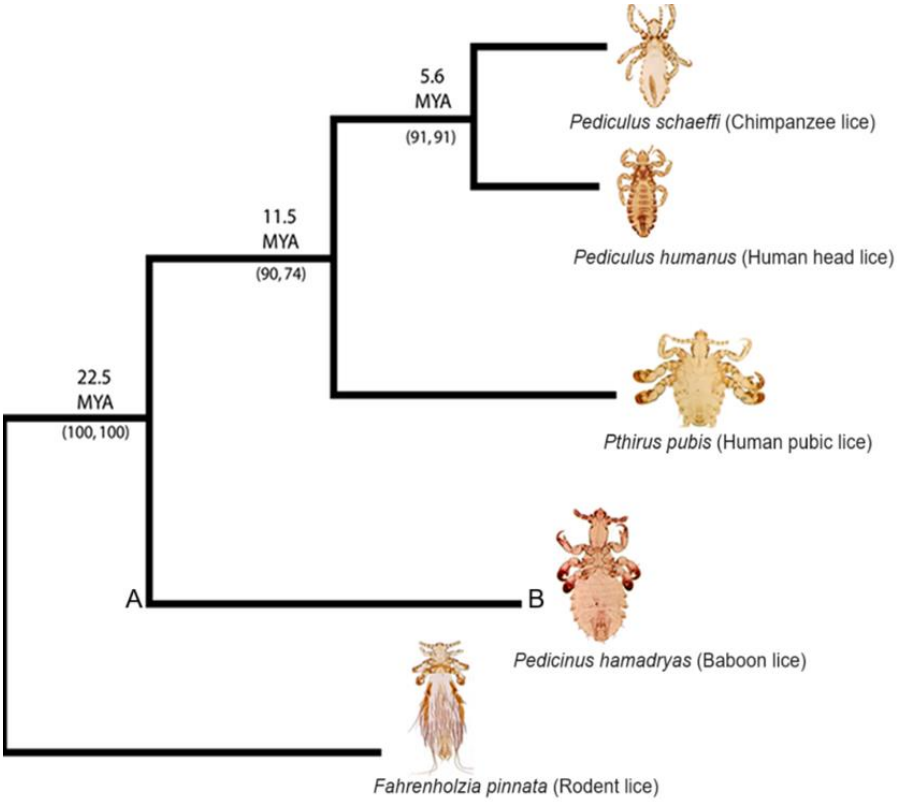
3.3 Read the text below and answer the questions that follow.

Human and Lice Co–Evolution

Humans have been pestered by lice for many years. In fact, human lice have evolved alongside humans. Lice are tiny little insect parasites that feed off human blood from just below the skin. There are many different groups of lice. Lice are specific to their host, and specific to the part of the host they occupy.

Human lice will only live on human hosts. There are two different types of human lice - head lice and pubic lice. Head lice live in the hair of the head whilst pubic lice live in the pubic region around the genitalia. Head lice cannot survive in the pubic area and pubic lice cannot survive in the head hair.

Figure 14 - Diagram showing evolutionary relationship between different species of lice



Measuring/Tracking Evolution:

Evolution can be measured by tracking the rate at which DNA mutations occur. The following line represents the scale of 0,1 nitrogen base mutations in genes.

0.1 nitrogenous base mutations per gene

[Image: <https://journals.plos.org/>]

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3.3.1 Explain how the two types of human lice display resource partitioning.

(2)

3.3.2 Human lice have evolved alongside humans. Use figure 14 to answer the questions below.

(a) When did human and chimpanzee lice ancestors diverge?

(1)

(b) Which type of human lice evolved first?

(1)

3.3.3 Use the scale line in figure 14 to calculate the total number of substitution mutations per gene in baboon lice from point A to point B on the cladogram. Show all working.

(3)

3.3.4. Using the images of the pubic lice and head lice in the source as well as your knowledge of evolution, provide ONE well-explained reason for one of the differences in **appearance** between the two different types of human lice.

(2)

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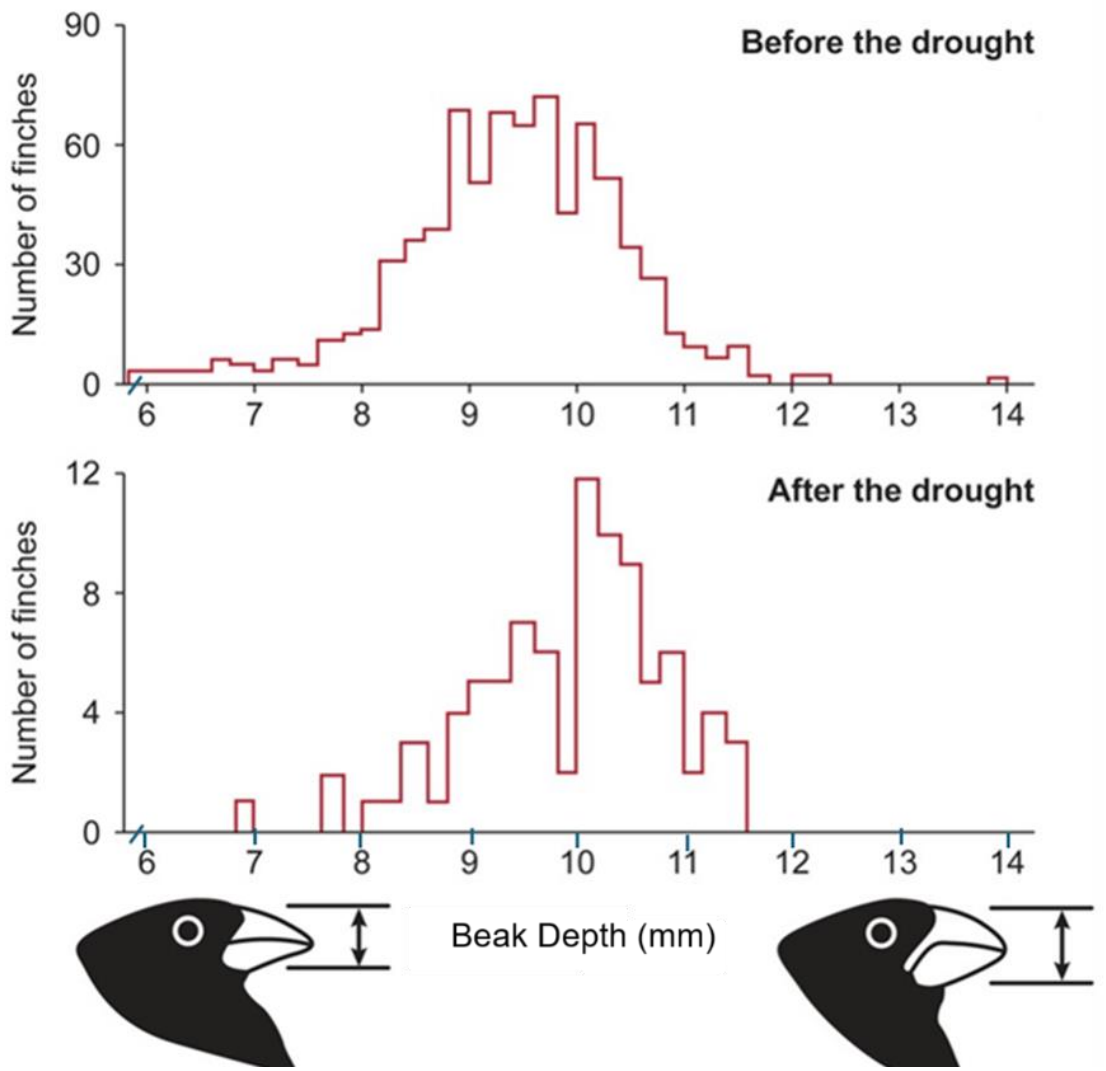
3.4 Read the following information about finches and answer the questions that follow.

Charles Darwin famously studied finch birds across the Galapagos Islands. The beak shapes and depths (size of beak from top to bottom of the beak) of finches determine what type of food the finches can eat, for example large beaks are used for eating fruits and large seeds while small beaks are used for eating small seeds and insects. The availability of food is determined by the environmental conditions such as rainfall. The graph below shows the distribution of various beak sizes in finches before and after a period of drought.

Figure 15 - Distribution of various beak depths before and after a period of drought



[Source: *California State University Evol322 Course Material* <www.csun.edu>]

3.4.1 Explain the information that is conveyed by the shape of the graphs.

_____

_____

_____

(2)

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3.4.2 How many finches had a beak depth of 9 mm before the drought?

_____

(1)

3.4.3 Circle the correct **bold** term in the sentence below:

The selection pressure is the **type of food available / beak depth / finch number**.

(1)

3.4.4 After a drought, there are fewer small seeds and insects available to the finches. It was observed that there were more finches with long beaks in the population after the drought.

(a) Describe how Darwin would explain the change in beak depths in finches when a drought occurs.

_____

_____

_____

_____

_____

_____

(4)

(b) Describe how Lamarck would explain an increase in finch beak depth over time.

_____

_____

_____

(2)

[40]

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QUESTION 4

4.1 The diagram and text below contain information about the social structure of hyenas. Use the information and your own knowledge to answer the questions.

Spotted hyenas are highly social animals. They form complex groups which can become very large. At the top of the hierarchy are females. The oldest female in the group holds the highest rank. A female, her offspring and their children form a group called a matriline. The oldest female's matriline is the highest ranking whilst the second oldest female's matriline is the second highest ranking and so on.

When male hyenas reach puberty, they leave the group they were born into and join another group. New males (immigrants) join the bottom of the hierarchy. Females in a group give mating preference to immigrant males rather than males from their own group. Hyena females mate with multiple males each breeding season.

When spotted hyenas hunt, the whole group works together to take down large prey and defend their kill. When it comes to eating, the dominant female and her offspring eat first, while the immigrant males get fed last or not at all.

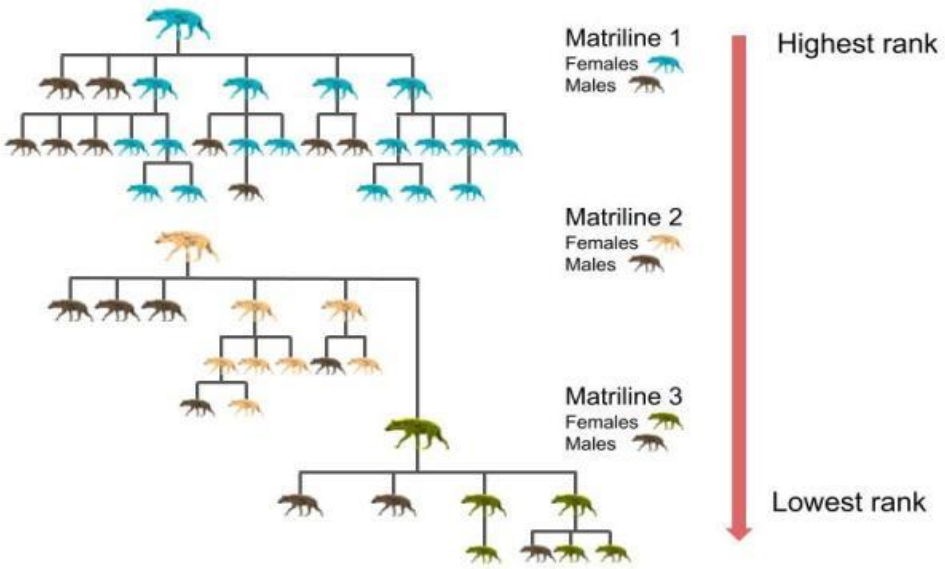

Figure 16 - An example of social hierarchy in a hyena group

[Source: <https://sitn.hms.harvard.edu/>]

4.1.1 Provide the term from the text for the following descriptions:

Description	Term
A grouping that contains a female hyena, her offspring and their children.	
New male hyenas that join a group and go to the bottom of the hierarchy.	

(2)

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4.1.2 How does the matrilineal social structure in spotted hyenas influence the distribution of resources within the group?

(1)

4.1.3 Draw a table in the space below to compare THREE differences between the social organisations of hyenas and wild dogs.

(5)

4.1.4 Spotted hyenas have a large population size in Africa, while wild dog numbers are dangerously low. Suggest ONE well-explained reason why the spotted hyena numbers are so much higher than wild dog numbers.

(2)

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4.2 The table below shows the change in numbers of wild dog in a protected area over a period of 20 years.

Table 3 - The numbers of Wild Dog from 2004 to 2024

Year	Population Size
2004	120
2008	105
2012	135
2016	90
2020	75
2024	45

[Source: Examiner's Own Data]

4.2.1 The data in the table shows a decreasing trend (the numbers of wild dog are steadily decreasing).

(a) Identify the year where the data does not fit the trend described.

_____

(1)

(b) Suggest TWO possible reasons for this change in data.

_____

_____

(2)

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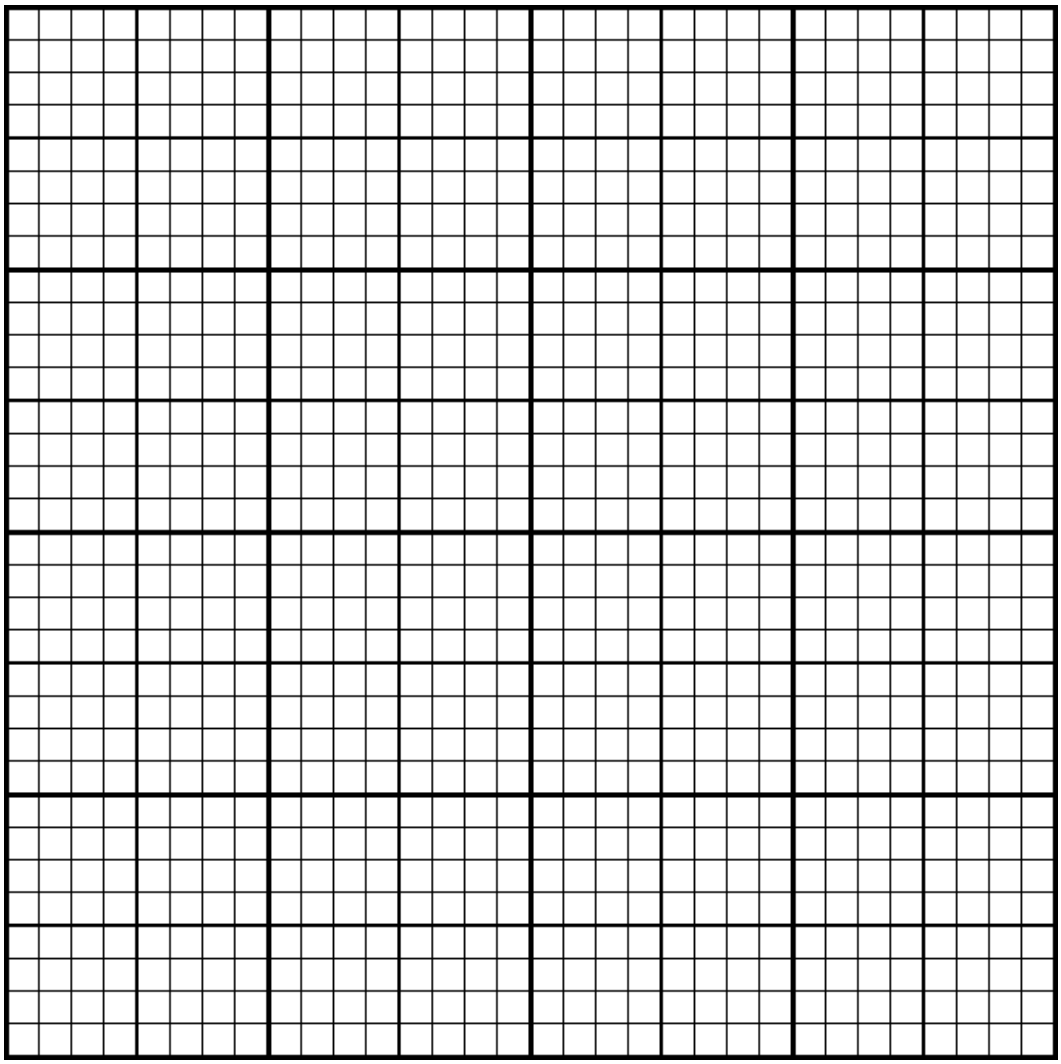
4.2.2 (a) Draw a line graph showing the data in **Table 3** on the graph grid below.



(7)

(b) From your graph, determine the number of wild dog that were present in 2018.

_____

(1)

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4.3 Read the information below and answer the questions that follow:

There are several alien snail species that have invaded the Kruger National Park. The worst of which is the **Tarebia Snail** (*Tarebia granifera*). This snail species occurs widely across the park and is thought to have invaded from the early 2000s. This snail is a freshwater snail which is indigenous to Southeast Asia. These snails are commonly kept in aquariums in homes and pet shops.

The snail thrives in the wild in South African waters and feeds mostly on algae in the water bodies of the Kruger National Park.

The alien **Tarebia Snail** and the indigenous **Bulinus Snail** (*Bulinus truncatus*) both use similar resources to survive. Recent counts of both snail species were conducted. There was a total of 196 Bulinus snails found in one of the lakes of the Kruger National Park. A count of the **Tarebia Snail** was also done. A total of 52 snails were caught, marked and released. A few days later, 31 Tarebia snails were caught again. Of these, 4 were marked.

When grown separately, the Bulinus and Tarebia snails are known to grow and reproduce at a similar rate.

In a natural ecosystem, freshwater snails are consumed by some types of fish and birds.



A Tarebia Snail Shell



A Bulinus Snail Shell

[Source: <https://mg.co.za/the-green-guardian>]

4.3.1 What is meant by an alien species?

_____

_____

_____

(2)

4.3.2 In the space below, draw a simple food chain including the Tarebia Snail in the habitat described in the text.

(2)

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4.3.3 The Tarebia snail population was counted using a sampling method.

(a) Was this a direct or indirect sampling method? Give a reason for your answer.

(2)

(b) Name the sampling method used to estimate the size of the Tarebia snail population.

(1)

(c) Using the data provided, calculate the total number of Tarebia snails that were found in the water body. Show all working.

(2)

(d) Describe TWO precautions that should be taken by scientists when carrying out the sampling method described in the text.

(2)

(e) Name ONE other sampling method that you have studied.

(1)

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(f) Do you think that the relative population sizes of Tarebia and Bulinus snails provide evidence to demonstrate the threat of alien species? Justify your answer.

(2)

4.3.4 Both Tarebia and Bulinus snails compete for the same resources.

(a) Name this type of competition. Give a reason for your answer.

(2)

(b) Is this relationship density dependent or density independent? Explain your answer.

(2)

4.3.5 Suggest how the Tarebia snails came to exist in the rivers in South Africa.

(1)
[40]

Total: 200 marks

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ADDITIONAL SPACE (ALL QUESTIONS)

REMEMBER TO CLEARLY INDICATE AT THE QUESTION THAT YOU USED THE ADDITIONAL SPACE TO ENSURE THAT ALL ANSWERS ARE MARKED.

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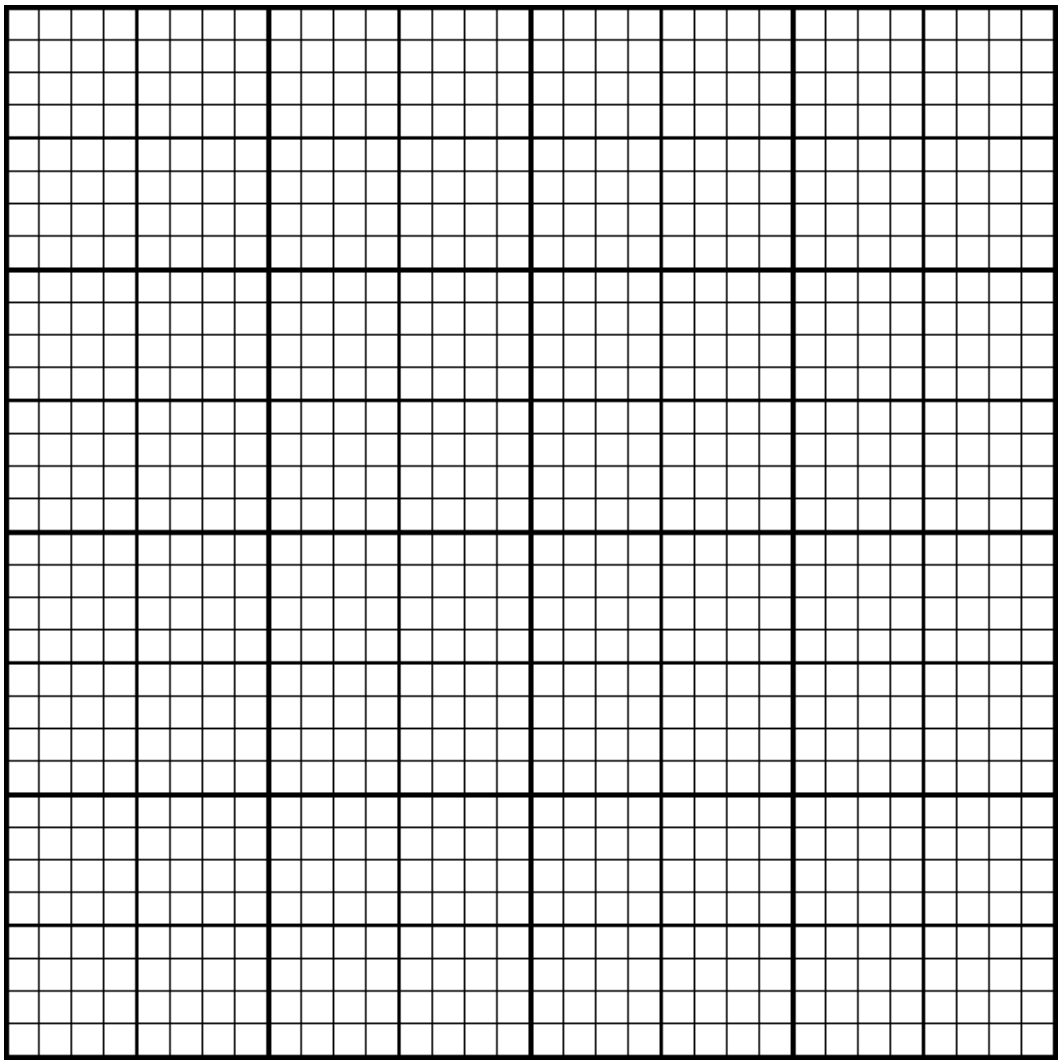
QUESTION 4.2.2. a.



(7)

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