education

MPUMALANGA PROVINCE

REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

LIFE SCIENCES P2

SEPTEMBER 2024

MARKS: 150

TIME: 2½ HOURS

This question paper consists of 15 pages.

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INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. Answer ALL the questions.
2. Write ALL the answers in your ANSWER BOOK.
3. Start the answers to each question at the top of a NEW page.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Present your answers according to the instructions of each question.
6. ALL drawings should be done in pencil and labelled in blue or black ink.
7. Draw diagrams or flow charts only when asked to do so.
8. The diagrams in this question paper are NOT necessarily drawn to scale.
9. Do NOT use graph paper.
10. You may use a non-programmable calculator, protractor and a compass.
11. Write neatly and legibly.

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SECTION A

QUESTION 1

1.1 Various options are provided as possible answers to the following questions. Choose the answer and write only the letter (A-D) next to the question numbers (1.1.1 to 1.1.10) in the ANSWER BOOK, e.g. 1.1.11 D.

1.1.1 During transcription CAGT form?

A CTCA in RNA.
B CTCA in DNA.
C GUCA in RNA.
D GUCA in DNA.

1.1.2 At the start of DNA replication:

A The old strands move to find new strands before bonding.
B The two DNA molecules combine.
C The two strands condense tightly for transfer of nitrogenous bases.
D The two strands of the double helix unwind.

1.1.3 The events below represent the steps during meiosis:

(i) Chromosomes split at the centromere and sister chromatids separate.
(ii) Homologous chromosomes pair.
(iii) Homologous chromosomes separate.
(iv) Homologous chromosomes form bivalents.

Which ONE of the following combinations shows the correct order of the events in meiosis?

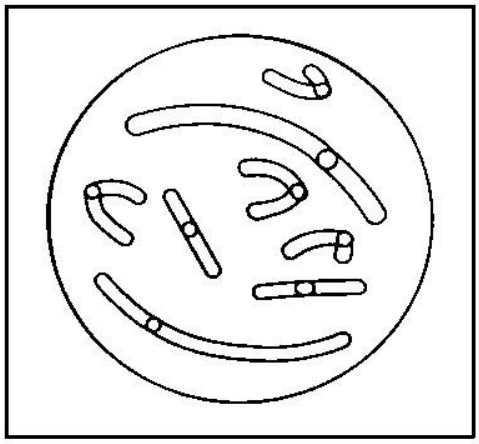
A (iv), (iii), (i), (ii)
B (ii), (iv), (iii), (i)
C (iii), (iv), (i), (ii)
D (ii), (iii), (i), (iv)

1.1.4 Which ONE of the following results in gametes having a single allele for a particular characteristic?

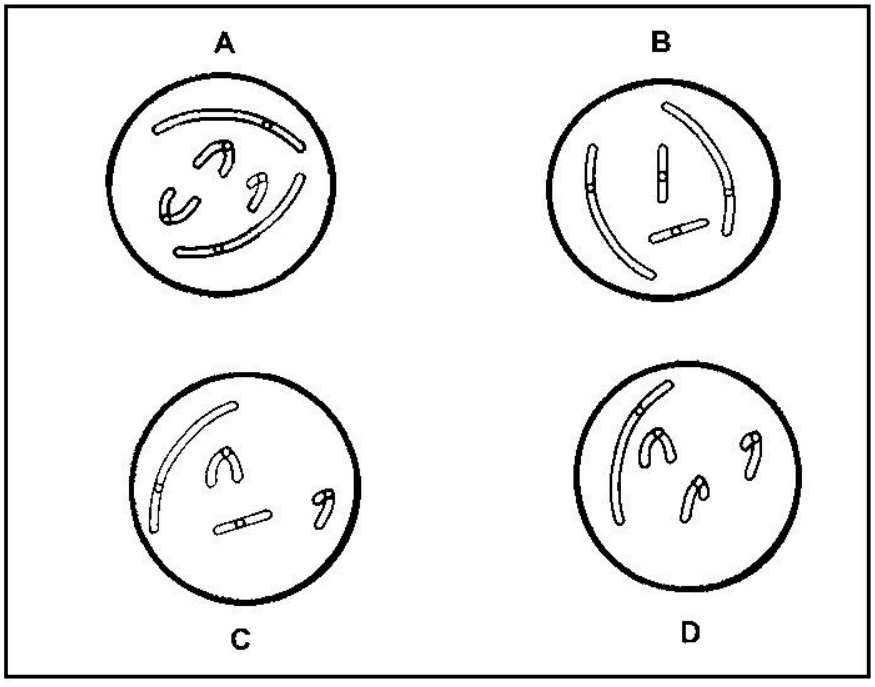
A The chromosome number is halved during Meiosis II
B Mendel's principle of segregation.
C Mendel's principle of independent assortment.
D The 'Law' of dominance.

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1.1.5 The following diagram shows a cell with chromosomes that are about to undergo meiosis.



Which of the following diagrams correctly represents the chromosomes of a gamete that has been formed at the end of meiosis?



1.1.6 A cross between a black mouse **(B)** with long tail **(S)** and a tan mouse **(b)** with short tail **(s)** produced the following offspring:

Black mouse with long tail	121
Black mouse with short tail	40
Tan mouse with long tail	42
Tan mouse with short tail	14

What are the genotypes of the parents?

A BbSS x Bbss.
B BbSs x Bbss.
C BbSs x BbSs.
D BbSS x BBss.

1.1.7 Individuals of the same specie…

A possess complementary chromosomes.
B are unable to interbreed and produce fertile offspring.
C are reproductively isolated from one another.
D share the same habitat.

1.1.8 The fossil known as Lucy was classified in the genus…

A *Paranthropus.*
B *Homo.*
C *Australopithecus.*
D *Ardipithecus.*

1.1.9 Which of the following indicates that Darwin's and Lamarck's theories are similar?

A Evolution happens very rapidly
B Evolution depends on changes in the environment
C Population as a whole change
D Acquired characteristics of organisms are passed from parents to offspring

1.1.10 The scientist who discovered Lucy is…

A Tim White.
B Robert Broom.
C Richard Leakey.
D Donald Johanson. (10 x 2) **(20)**

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1.2 Give the correct **biological term** for each of the following descriptions. Write only the term next to the question number (1.2.1 to 1.2.9) in the ANSWER BOOK.

1.2.1 A monomer consisting of phosphate group, sugar and a nitrogenous base

1.2.2 A part of a DNA molecule that acts as a pattern for the building of mRNA

1.2.3 A cell that contains only one chromosome of each homologous pair

1.2.4 One of the two identical strands of a replicated chromosome

1.2.5 A type of dominance that creates an intermediate phenotype

1.2.6 The use of biological process to make products that humans desire

1.2.7 A genetic cross involving two different characteristics

1.2.8 The change in inherited traits over successive generations in populations of organisms

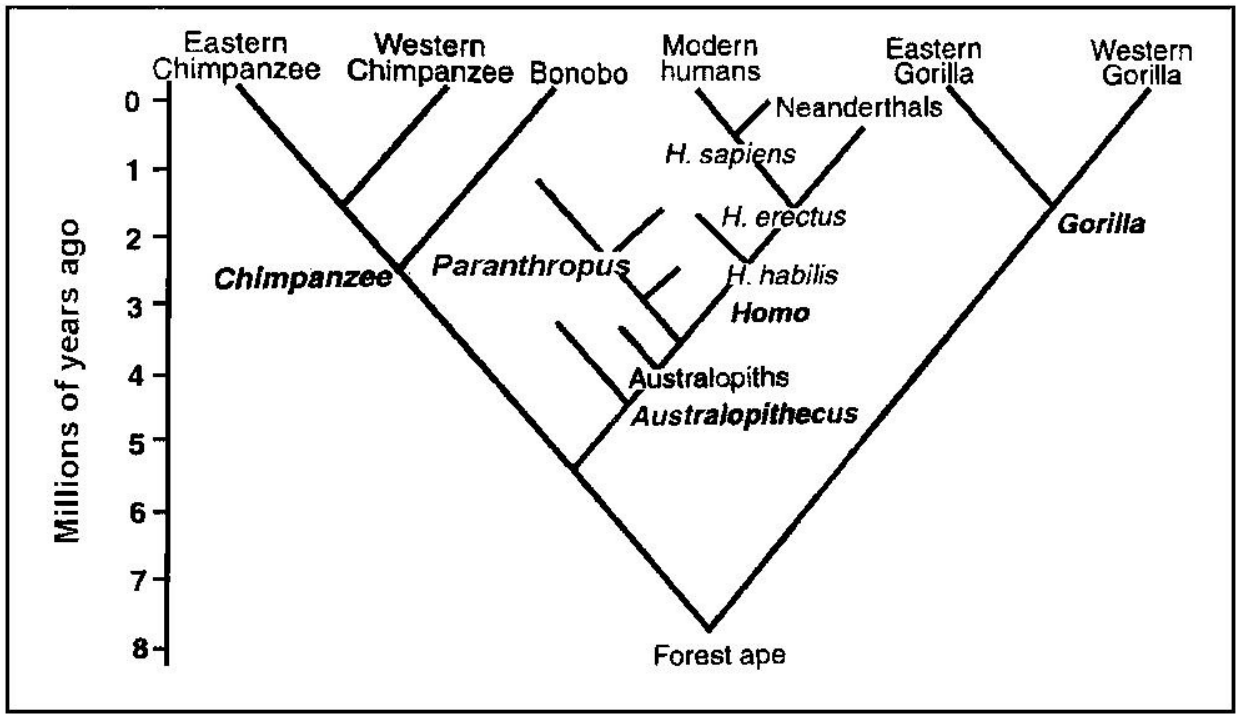
1.2.9 The outward projection of the face in hominids (9 x 1) **(9)**

1.3 Indicate whether each of the statements in COLUMN I apply to **A ONLY**, **B ONLY**, **BOTH A AND B or NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B** or **none** next to the question number (1.3.1 to 1.3.4) in the ANSWER BOOK.

	COLUMN I		COLUMN II
1.3.1	The cell organelle that contains chromatin	A: B:	Mitochondrion Ribosomes
1.3.2	Sequencing of amino acids according to mRNA	A: B:	Translation Transcription
1.3.3	All the alleles of all the individuals in a population	A: B:	Genome Gene pool
1.3.4	Characteristics that may be used to build a phylogenetic tree	A: B:	Similarity of DNA sequence Fossil evidence

(4 x 2) **(8)**

1.4 The diagram below shows the suggested phylogenetic tree of human evolution.



1.4.1 Identify the family represented in the phylogenetic tree. (1)

1.4.2 Give the name of the most recent relative of modern humans. (1)

1.4.3 Approximately how long ago did the hominin line branch off from that of the chimpanzee. (1)

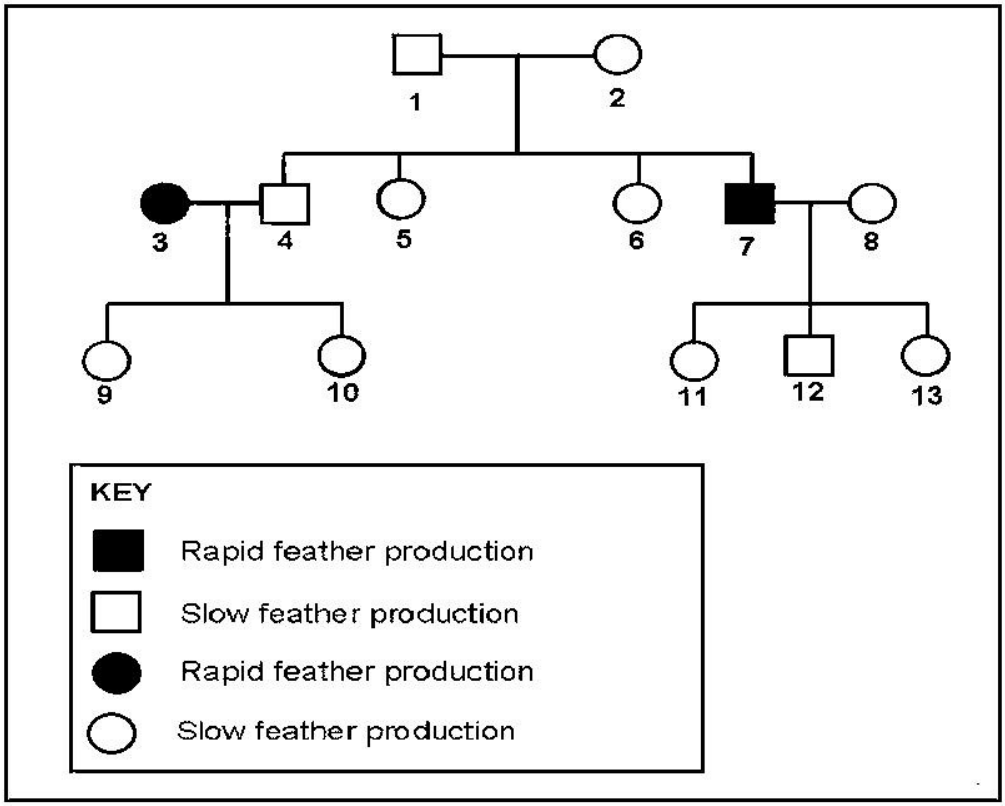
1.4.4 Give the common name of the species *H. habilis*. (1)

1.4.5 Name THREE genera represented in the diagram. (3)
(7)

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1.5 In chickens, a gene on the X chromosome controls the rate of feather production. The allele for slow feather production, **B**, is dominant to the allele for rapid feather production, **b**.

The diagram below shows the results produced from crosses carried out by a farmer.



1.5.1 How many males have slow feather production? (1)

1.5.2 Give the phenotype of chicken **3** (1)

1.5.3 Give the possible genotype of chicken:

(a) **5** (1)

(b) **7** (1)

1.5.4 A genetic cross between two chickens produced four possible offspring. Two of them were males with rapid feather production and two were female with slow feather production.

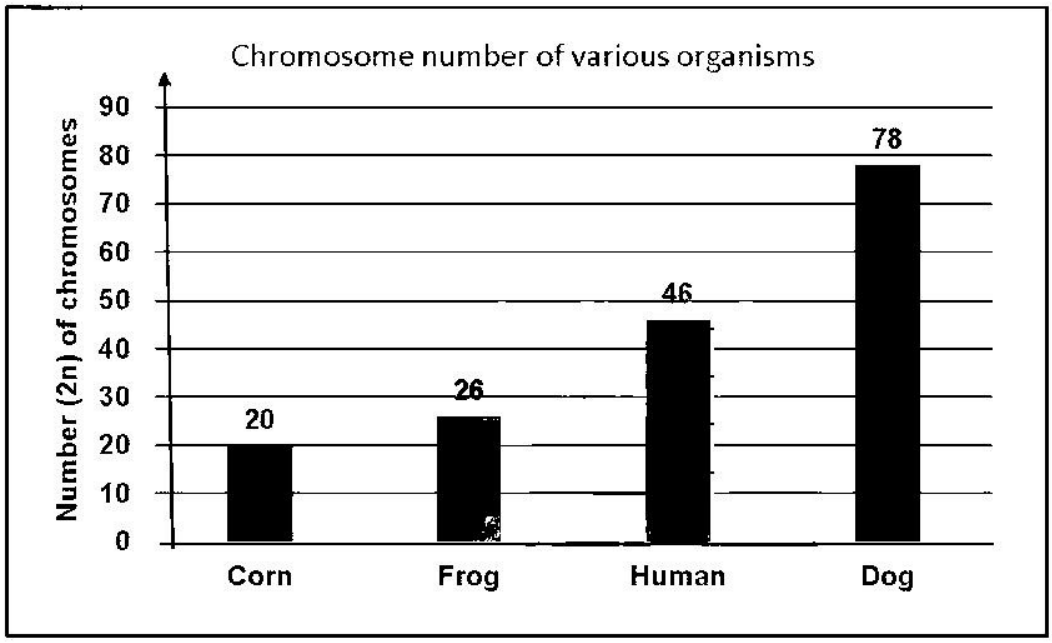
Give the genotypes of the parents. (2)
(6)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 The graph below shows the chromosome number in each somatic cell of four different organisms.



2.1.1 Describe what is meant by somatic cells. (1)

2.1.2 How many chromosomes will be present in:

(a) Frog cells during telophase I in meiosis (1)

(b) Stem cells of human (1)

2.1.3 Which organism has **10** chromosomes in one of its gametes? (1)

2.1.4 Name the male organ where the gametes are produced in QUESTION 2.1.3. (1)

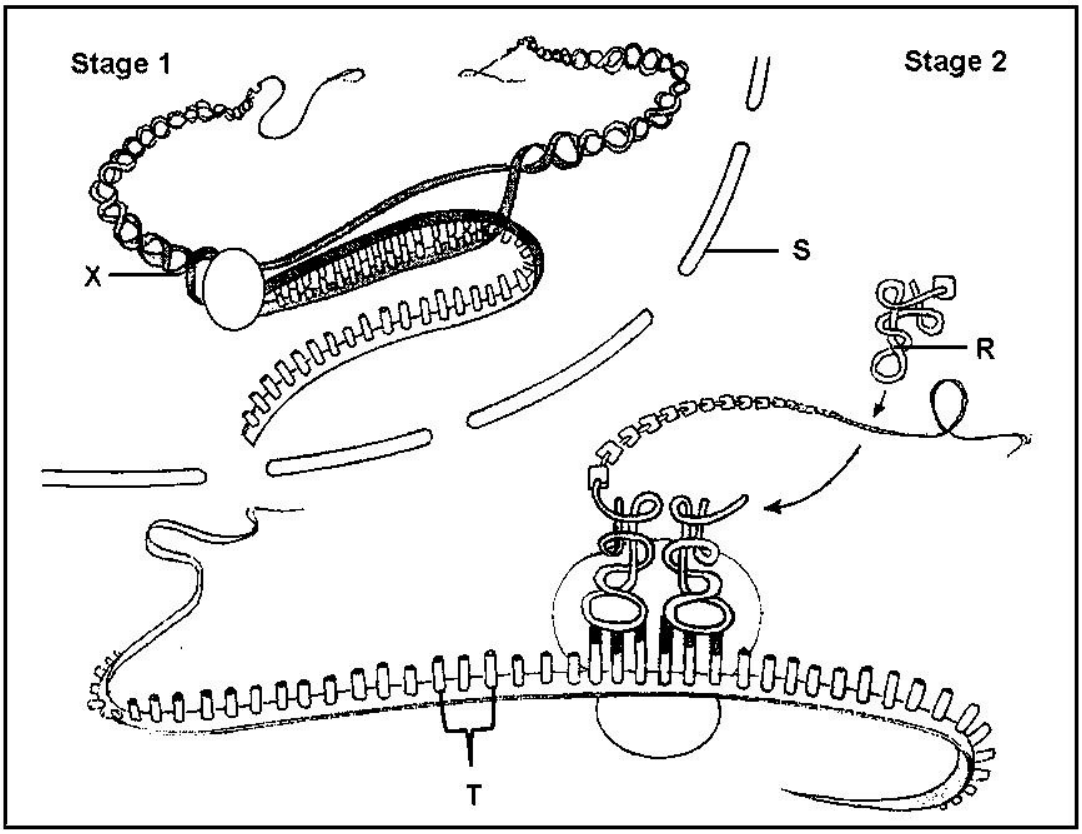
2.1.5 Name and describe the phase of meiosis where the halving of chromosomes number begins. (4)

2.1.6 Explain why an ovum of a dog has **39** chromosomes. (4)

2.1.7 Explain ONE way in which this process is biologically important. (2)
(15)

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2.2 The diagram below is a schematic representation of a process that takes place in all living cells.



2.2.1 Name:

(a) The process taking place in the diagram (1)

(b) Structure **S** (1)

(c) The type of sugar that forms part of the structure **X** (1)

2.2.2 Give the collective name of nitrogenous bases **R**. (1)

2.2.3 Explain the role of molecule **R** during the process in QUESTION 2.2.1 (a). (4)
(8)

2.3 A mutation has occurred on a section of mRNA.

Amino acid	Serine	Proline	Glycine	Threonine	Alanine
Codons	UCU	CCU	GGA	ACU	GCA
	UCC	CCA	GGG	ACC	GCG

Figure 1:	AGG	CGT	CCT	GGA
Figure 2:	Serine	Glycine	Glycine	Proline

2.3.1 Use information from the table and in figure **1** to give the last three amino acid sequence (Read from the left) (2)

2.3.2 How many DNA nitrogenous bases code for the amino acids from the table? (1)

2.3.3 Name and describe the type of mutation that has occurred between figure **1** and **2**. (2)

2.3.4 Use the information in the table, figure **1** and **2** to describe the effect of this mutation on the protein formed. (4)
(9)

2.4 Blood groups are controlled by multiple alleles.

2.4.1 How many alleles for blood groups does an individual have? (1)

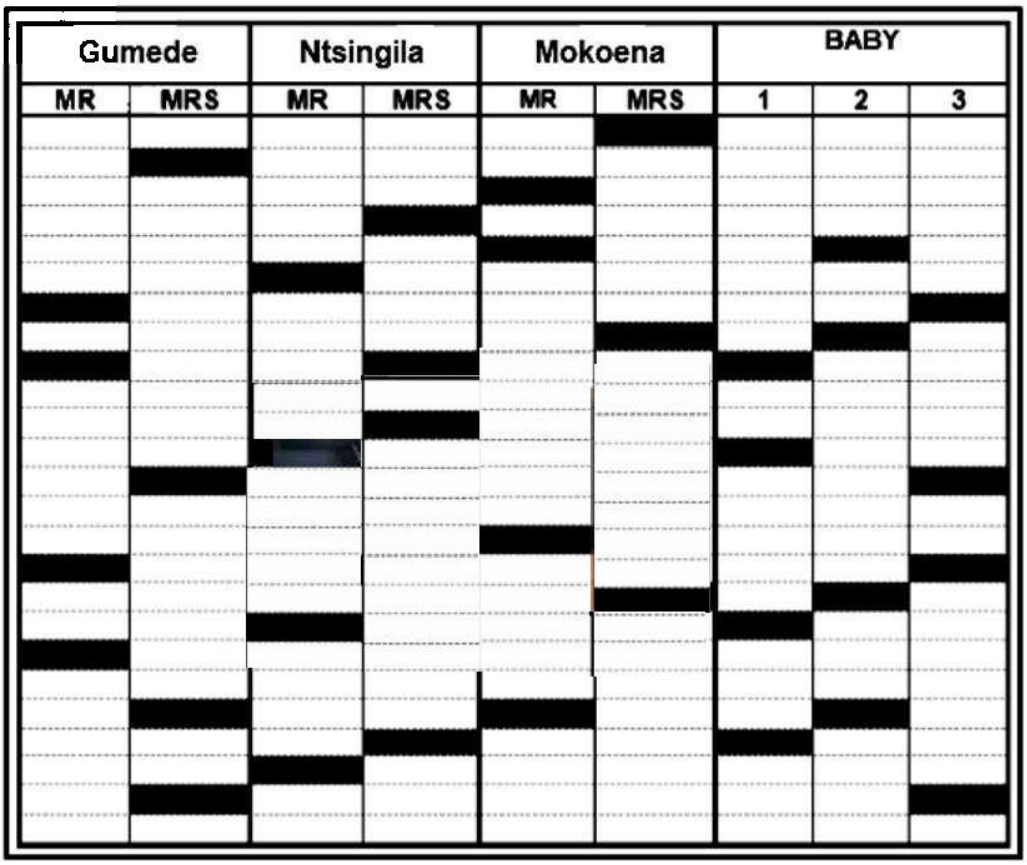
2.4.2 Write down all the possible alleles. (2)

2.4.3 Explain how these alleles through different genetic dominances form four different blood groups. (5)
(8)

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2.5 Three ladies each gave birth to a baby boy in a hospital. The babies were accidentally swopped.

The diagram below shows a technique used in paternity testing and the results of each parent and their baby boys.



2.5.1 Identify the technique used. (1)

2.5.2 Give ONE source that can be used as DNA sample for paternity testing. (1)

2.5.3 Identify the biological parents of baby **1**. (2)

2.5.4 Which baby belongs to Mr and Mrs Gumede? (2)

2.5.5 Explain your answer to QUESTION 2.4.4 (2)

2.5.6 Give TWO other uses for this technique. (2)
(10)
[50]

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QUESTION 3

3. 1 The following series of extracts **(1, 2 and 3)**, explains the poaching and subsequent evolution of the African elephant population in one of Mozambique's national parks. Answer QUESTIONS **3.1.1 - 3.1.8** based on the extracts.

Extract 1

Between 1977 and 1992, a civil war in Mozambique led to the poaching of elephants. Armies need money to fight, and ivory from elephant tusks was a way to get it. The elephant population in Gorongosa National Park in Mozambique was home to 2542 elephants before the war in 1972. By the year 2000, that number had fallen to just 242. Currently there are about 800 elephants.

3.1.1 Calculate the percentage decrease in the elephant population due to the war. Show all calculations. (3)

3.1.2 Draw a bar graph to represent the information in the extract above. (6)

Extract 2

The development of tuskless elephants in the Gorongosa National Park inspired further research.

Poaching led to a rise in the development of tuskless elephants. However, the researchers only identified tuskless *female* elephants, never males.

In humans there is an X-linked dominant syndrome causing females to have less developed or no top jaw incisor teeth, while the males that carry this allele die in the uterus (miscarriage).

Elephant tusks are modified incisor teeth. In Gorongosa, the team collected blood samples from seven tusked and 11 tuskless female elephants, then analysed their DNA for differences. The human data gave them an idea where to look.

3.1.3 Name this effect of mutation that resulted in the miscarriage of male elephants. (1)

3.1.4 Identify the evidence for evolution found in this research. (2)

3.1.5 Explain the impact of the inheritance of tusklessness in elephants on the possible offspring of a heterozygous female elephant. (5)

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Extract 3

Due to rapid evolution half the females are born without tusks while before the war less than a fifth were tuskless. Of all the offspring born, three quarters were female.



Elephant with tusks



Tuskless elephant

3.1.6 Identify the evolution theory that best explains the rapid evolution in the span of one generation. (1)

3.1.7 Using the information from all three extracts, explain how natural selection led to the evolution of tuskless elephants in the Gorongosa National Park. (7)

3.1.8 Predict and explain the trend you will expect to see in the elephant population size over the next few generations due to this mutation. (3)
(28)

3.2 The development of new species is referred to as speciation.

Describe the process of speciation through geographic isolation. **(7)**

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3.3 Read the extract below regarding the development of cooking skills.

> Cooking makes food easier to digest, allowing for the extraction of more nutrients from food while expending less energy. Scientist in Israel found proof of our human ancestors cooking fish 600 000 years ago. Teeth of a species of carp (fish) were subjected to temperatures required to cook fish, but not as hot as temperatures directly inside a fire would be. This indicates the fish were placed above or next to the fire for cooking rather than being discarded in the fire or burned accidentally.

3.3.1 How can the evidence in the above extract be considered proof of human brain development over time? (2)

3.3.2 Explain how the ability to cook food may have led to the change in facial appearance of humans over time? (6)
(8)

3.4 Human ancestry can be traced back to Africa, with various fossils found in South Africa.

3.4.1 Name the theory mentioned above. (1)

3.4.2 Which lines of evidence can be used to support this theory mentioned in QUESTION 3.4.1? (2)

3.4.3 What is the series of fossil sites collectively called where Mrs Ples was found? (1)

3.4.4 To which genus does Mrs Ples belong? (1).

3.4.5 Give the names of TWO other fossils found in South Africa that belongs to the same genus as Mrs Ples. (2)
(7)
[50]

TOTAL SECTION B: 100
GRAND TOTAL: 150

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