Province of the
EASTERN CAPE
EDUCATION

Iphondo leMpuma Kapa: Isebe leMfundo
Provinsie van die Oos Kaap: Department van Onderwys
Porafensie Ya Kapa Botjahabela: Lefapha la Thuto

NATIONAL SENIOR CERTIFICATE

GRADE 12

SEPTEMBER 2026

LIFE SCIENCES P2

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 the 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 MUST be done in pencil and labelled in blue or black ink.
7. Draw diagrams, tables 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 must use a non-programmable calculator, protractor and a compass, where necessary.
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, for example 1.1.11 D.

1.1.1 The main purpose of the process of cloning is that it produces…

A cells that show variation.
B organisms with identical gonosomes.
C new genetic mutations in organisms.
D organisms with identical genes.

1.1.2 A phase of cell division that introduces genetic variation into gametes is …

A prophase II.
B prophase I.
C metaphase I.
D crossing-over.

1.1.3 A possible genotype in the inheritance of blood groups is …

A B.
B A.
C ii.
D O.

1.1.4 The genotype of a gamete resulting from crossing plants which are homozygous dominant for round seed shape **(R)** and also homozygous for tall stem height **(T)** will be …

A RRTT.
B RT.
C rt.
D RrTt .

1.1.5 The difference between gonosomes in human males and females is that …

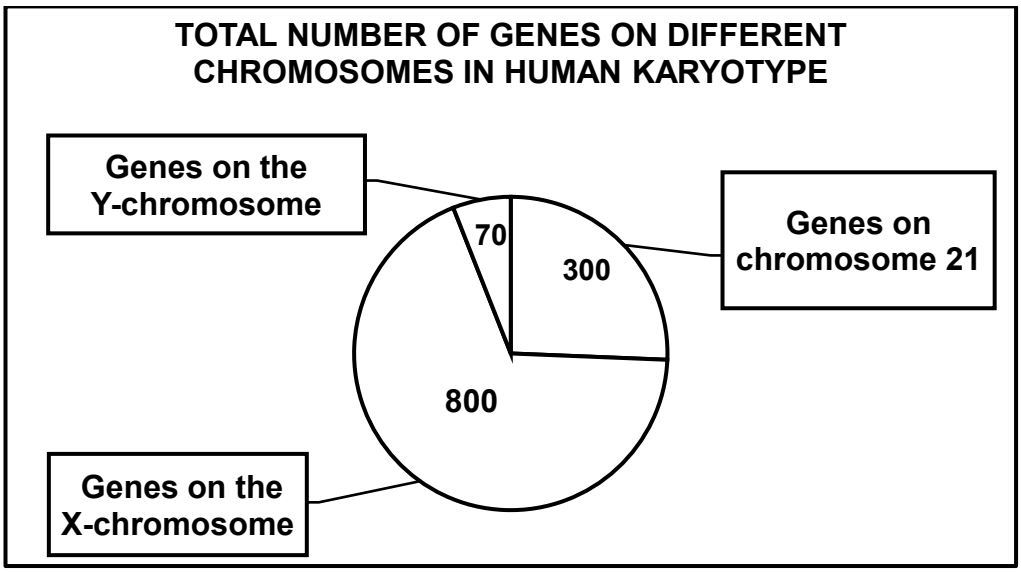
A females gonosomes are of the same size.
B males have XX gonosomes.
C females have XY gonosomes.
D male gonosomes are of the same size.

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1.1.6 A cell organelle containing genetic material which is used as evidence in the 'Out-of-Africa' hypothesis' is the…

A mitochondria.
B nucleus.
C ribosome.
D cytoplasm.

1.1.7 The pie chart below shows the number of genes in different chromosomes in the human karyotype.



Which information contained in the table below represent the CORRECT information based on the pie chart?

	TYPE OF CHROMOSOME	% CONTRIBUTION
A	Autosome	300
B	Gonosome	870
C	X-gonosome	25,6
D	Male gonosome	5,98

1.1.8 The father has a genetic condition and the mother has no family history of the genetic condition.

Which allele for a sex-linked inheritance will result in only the female offspring inheriting this genetic disorder?

A X^d
B X^D
C X^dX^d
D X^DX^d

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1.1.9 Which complementary base pairing is incorrect during transcription?

A C – G
B A – T
C A – U
D G – C

1.1.10 Scientists hypothesised that children with a family history of *autism* are more likely to develop *autism spectrum disorder* (ASD). ASD is a genetic condition characterised by a wide range of symptoms like challenges in communication, social interaction and repetitive behaviours.

Which of the following factors should be kept constant to ensure validity in this investigation?

A Presence of ASD
B Number of children in the investigation
C Family history
D Age of the children (10 x 2) (20)

1.2 Give the correct **biological term** for EACH of the following descriptions. Write only the term next to the question numbers (1.2.1 to 1.2.8) in the ANSWER BOOK.

1.2.1 A nucleic acid that carries the coded information to the ribosomes during protein synthesis

1.2.2 A sex-linked inheritance caused by the absence of proteins that comprise of either the red or green photoreceptors in the eye

1.2.3 The functional molecule produced from a sequence of amino acids during translation

1.2.4 Cells that are undifferentiated and have the potential to form any tissue or organ in the body

1.2.5 A nucleotide component that attaches to the hydrogen bond

1.2.6 The birthplace where most of the hominin fossils were found

1.2.7 The triplet of nitrogenous bases on the tRNA molecule

1.2.8 The type of evidence in human evolution that uses tools, artefacts, cutlery and art to show advances in human evolution (8 x 1) (8)

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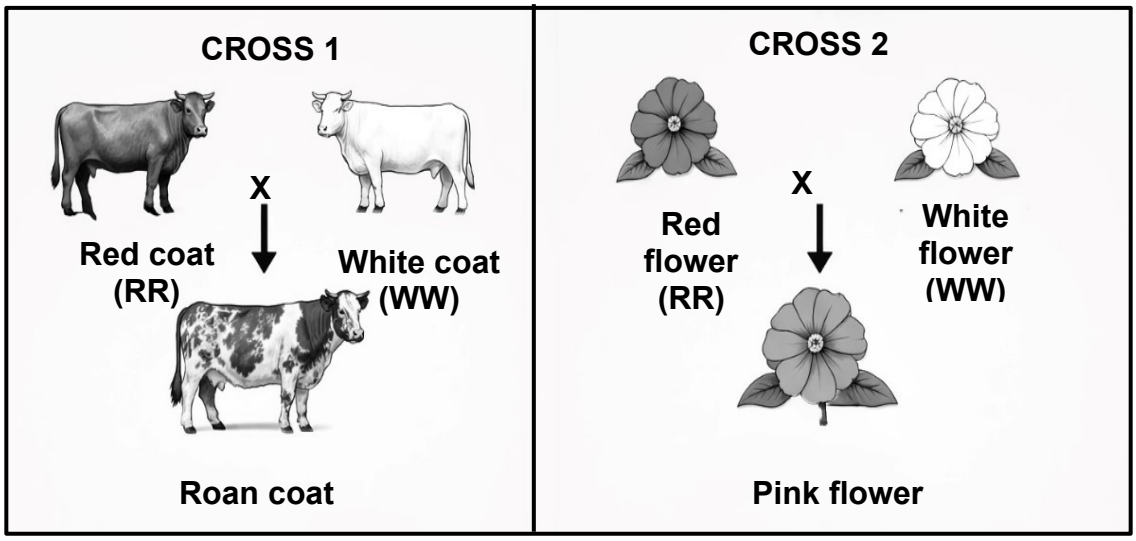
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1.3 Indicate whether each of the descriptions in COLUMN I, applies to **A ONLY**, **B ONLY**, **BOTH A and B**, or **NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B**, or **none** next to the question numbers (1.3.1 to 1.3.3) in the ANSWER BOOK.

COLUMN I		COLUMN II
1.3.1	A source of variation	A: Discontinuous B: Random mating
1.3.2	The natural shape of a DNA molecule	A: Double stranded B: Single stranded
1.3.3	The cause of haemophilia	A: Gene mutation B: Chromosomal mutation

(3 x 2) (6)

1.4 The diagrams below illustrate two different patterns of dominance observed in cattle and flowers.



1.4.1 Identify the type of dominance represented by:

(a) Cross **1** (1)

(b) Cross **2** (1)

1.4.2 Give the genotype of the F_1 offspring for each cross. (1)

1.4.3 Name the:

(a) Type of cross represented by these diagrams (1)

(b) Intermediate phenotype shown above (1)

(c) Mendelian law that refers to the separation of the alleles during gamete formation (1)

1.4.4 Give the phenotypic ratio of the offspring resulting from crossing two Roan cows with each other. (2)

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1.5 A farmer in East Africa wants to improve milk production and disease resistance in his Ankole herd. He then selects only cows that produce the most milk and are disease resistant to breed each year for six (6) generations.

The table below shows the results of these changes in traits over the generations.

GENERATION	AVERAGE MILK YIELD (LITRES/DAY)	% COWS RESISTANT TO DISEASE
1	20,0	40%
2	20,4	45%
3	20,8	55%
4	21,2	65%
5	21,7	75%
6	22,0	85%

1.5.1 Name the process that is performed by this farmer on the Ankole cows. (1)

1.5.2 State TWO desirable characteristics in the Ankole cows considered by the farmer. (2)

1.5.3 Give the generation that shows the highest:

(a) Increase in average milk yield (1)

(b) Vulnerability to death due by diseases in Ankole cows (1)

1.5.4 The results indicate a gradual change in both average milk yield and disease resistance in Ankole cows over the generations.

Name the type of:

(a) Evolution that is consistent with these results (1)

(b) Variation that exists in these desirable traits (1)

(c) Graph that would be most suitable for presenting these results (1)

TOTAL SECTION A: 50

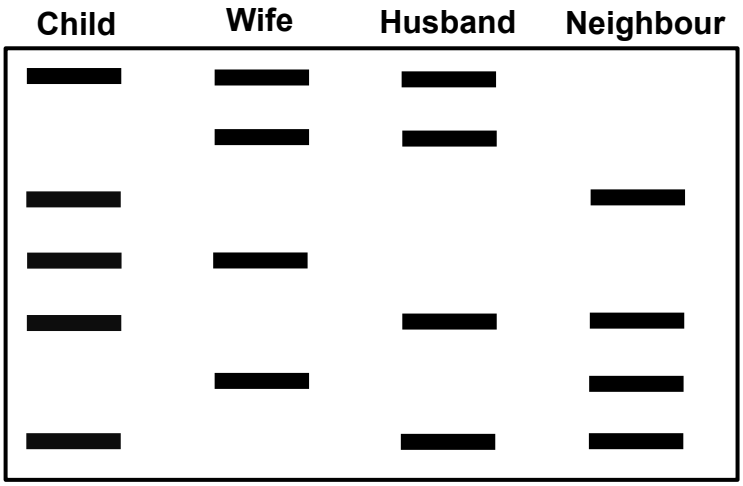
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SECTION B

QUESTION 2

2.1 The diagram below shows DNA profiles of four individuals obtained through a biochemical process involving blood samples.



2.1.1 Give the number of DNA bands/bars that this child obtained from his mother. (1)

2.1.2 Which man (**husband** or **neighbour**) is the biological father of this child? (1)

2.1.3 Explain your answer to QUESTION 2.1.2. (3)

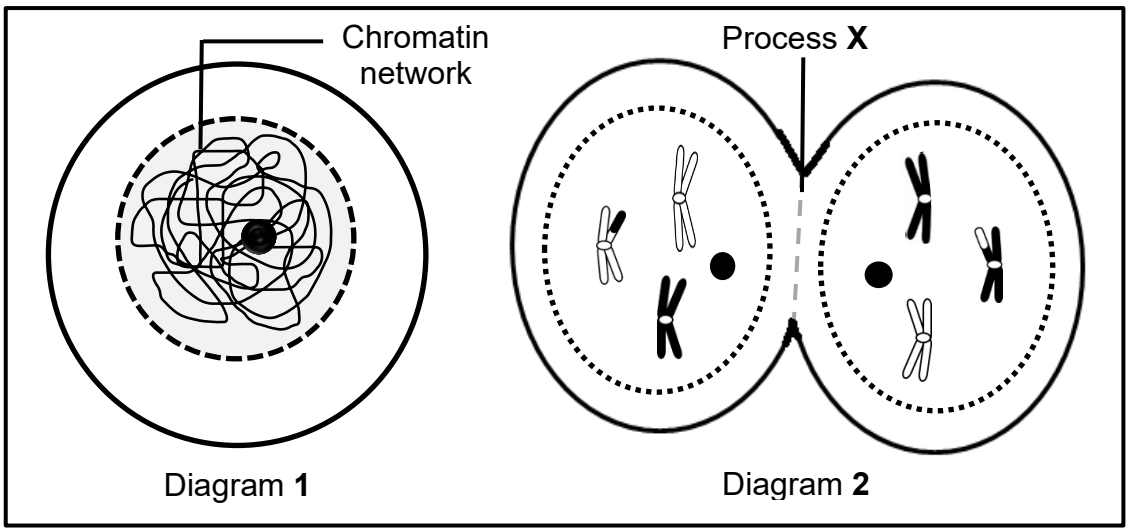
2.1.4 State TWO other uses of DNA profiling in the medical field. (2)

2.1.5 Describe how DNA profiling is used to solve criminal cases. (3)

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2.2 The diagrams below show different phases before and during cell division.



2.2.1 Identify the phase in the cell division represented by diagram **2**. (1)

2.2.2 State what happens to the:

(a) Chromatin network in diagram **1** in preparation for cell division (1)

(b) DNA molecule during the phase shown in diagram **1** (1)

2.2.3 Describe the genetic composition of chromosomes after the DNA molecule has undergone the process in QUESTION 2.2.2(b). (4)

2.2.4 Give ONE reason why the chromosomes at the end of meiosis II will be single stranded. (2)

2.2.5 Aurora B kinase is a gene that regulates normal cell division during process **X**. Mutation on this gene may lead to cells failing to separate.

(a) Name process **X** in diagram **2**. (1)

(b) Explain how gene mutations on the Aurora B kinase gene differ from the mutation that leads to Down syndrome. (3)

2.3 The karyotype of a human somatic cell normally has 46 chromosomes.

Explain why a sperm cell produced by the individual with this karyotype would contain a different number of chromosomes. (4)

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2.4 Read the passage below.

The PAH gene found on chromosomes 12 carries instructions for making the enzyme phenylalanine hydroxylase. This enzyme, made-up of 452 amino acids is mainly responsible for converting the amino acid phenylalanine into tyrosine in the liver. Phenylalanine is found in protein rich foods and plays a vital role in producing neurotransmitters.

A single mutation at position 408 on the PAH gene can lead to a condition called PKU. In PKU, the amino acid phenylalanine is not converted into tyrosine. This phenylalanine amino acid build-up in the blood can cause intellectual disability in humans.

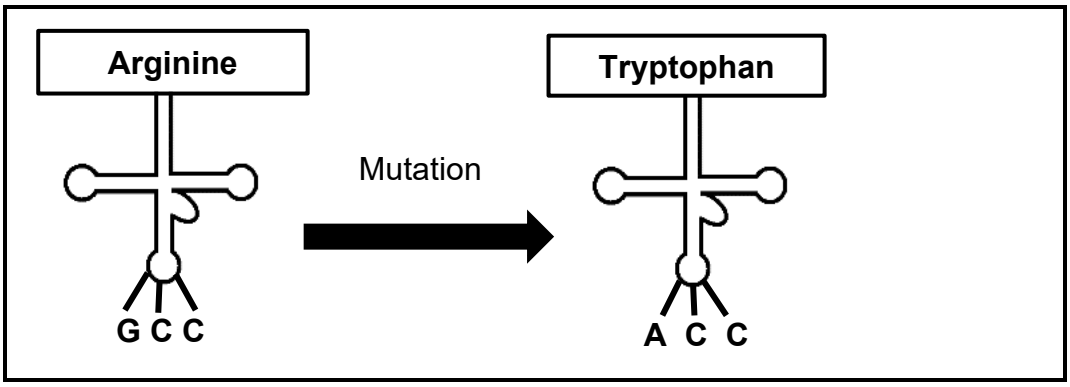
2.4.1 Determine the number of nucleotides that code for the phenylalanine hydroxylase enzyme. (2)

2.4.2 Give evidence from the passage that the:

(a) PKU condition is an autosomal inheritance (1)

(b) Phenylalanine amino acid has a negative effect on the brain (1)

2.4.3 The diagram below shows the tRNA molecule and the amino acid corresponding to the PAH gene at position 408 before and after mutation.



(a) Identify the stage of protein synthesis represented by the diagram above. (1)

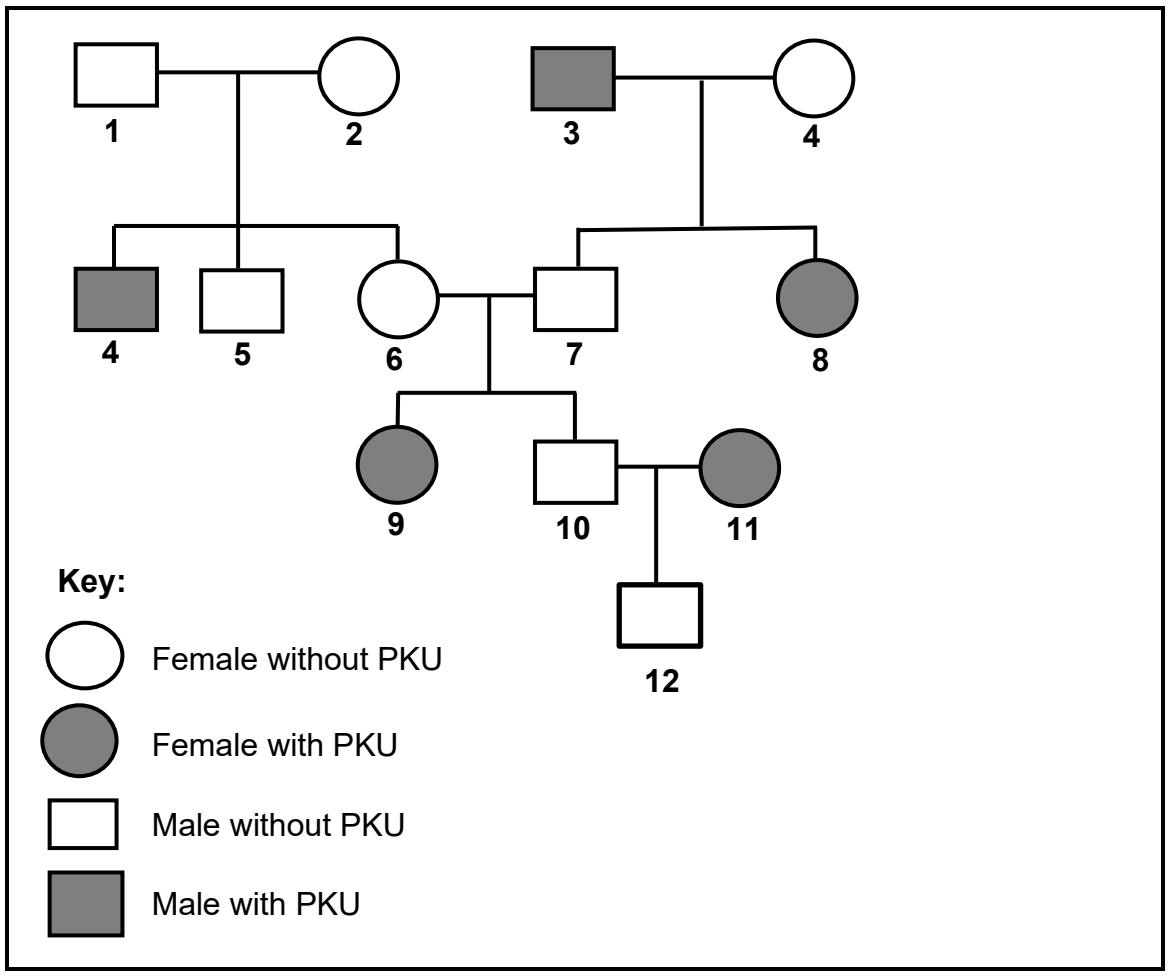
(b) Define a *gene mutation.* (1)

(c) Using the information provided, describe how the Phenylalanine hydroxylase enzyme functions was affected by the mutation on a DNA molecule at position 408 on the PAH gene. (4)

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2.5 The pedigree diagram below shows the inheritance of PKU in a family which is caused by a recessive allele **n** on **chromosome 12.**



2.5.1 What is the biological term for the genotype **nn**? (1)

2.5.2 Give the:

(a) Number of different parents in this pedigree (1)

(b) Genotype of individual **6** (1)

(c) Phenotype of individual **3** (1)

2.5.3 Using Mendel's Law of Dominance, explain how the presence of dominant alleles affects the occurrence of PKU in this pedigree. (3)

2.5.4 Individual **12** plans to marry a female without a family history of PKU.

Use a genetic cross to show the percentage chance of them having a child with heterozygous genotype. (6)

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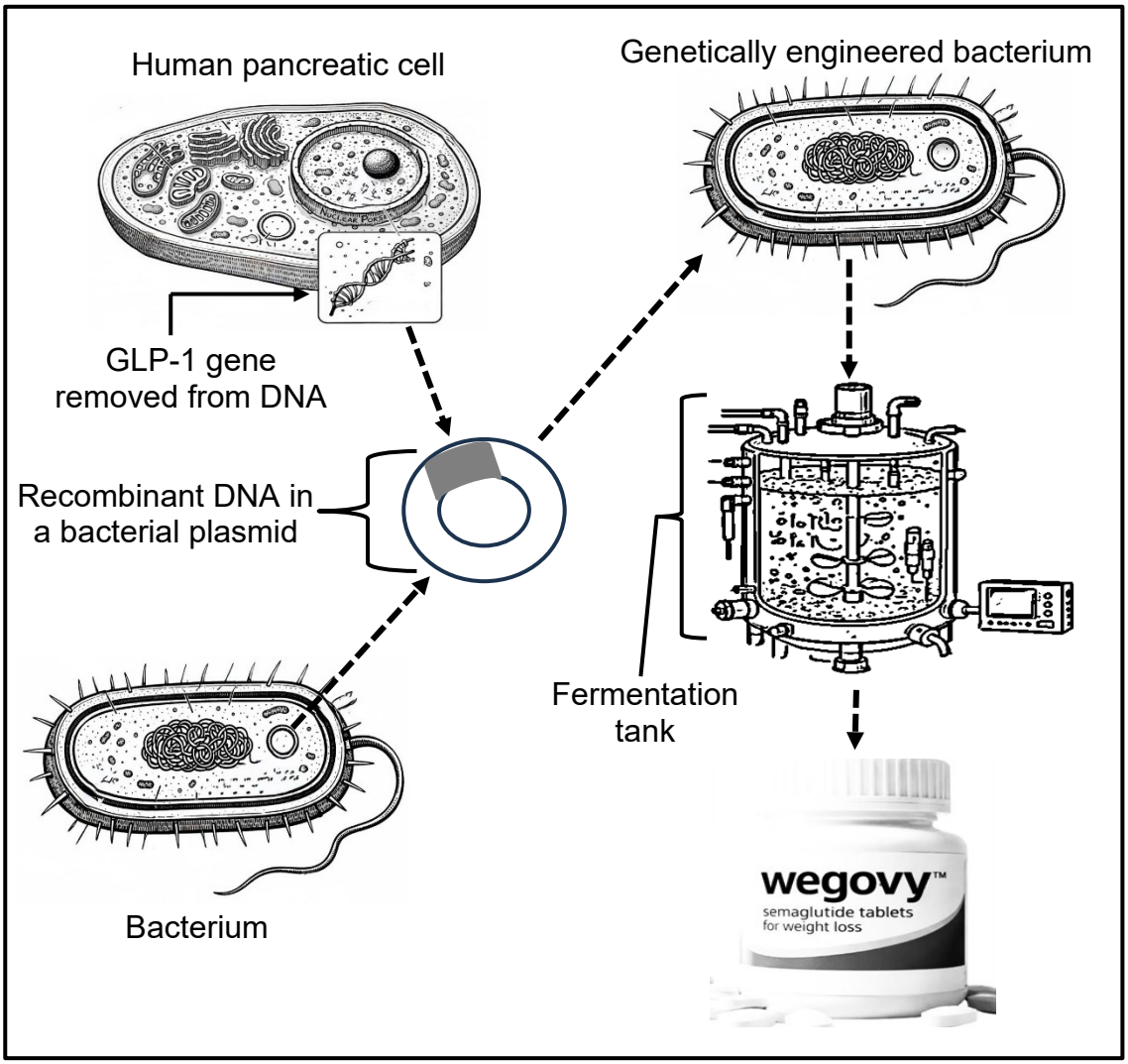
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QUESTION 3

3.1 *Wegovy pill* is a prescription medication given to people who have obesity or are overweight to help them lose weight and reduce risks of heart problems. This pill contain *semaglutide*, a GLP-1 receptor that copies the role of a hormone that decreases appetite and makes a person feel full.

The diagram below shows a schematic illustration on how the *Wegovy pill* is made through genetic engineering.



3.1.1 Name ONE application of genetic engineering that is not related to medicine. (1)

3.1.2 State TWO ways on how *semaglutide* functions in helping obese people in weight loss. (2)

3.1.3 Describe the steps involved in genetic engineering that allowed scientists to produce *Wegovy pills*. (5)

3.1.4 Give ONE reason why most people would prefer taking the Wegovy drug as an oral pill rather than as an injection. (2)

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3.2 Chimpanzees do not drink beer or any other alcoholic beverages like humans do, but they consume alcohol naturally by eating fermented fruits from the forests that surrounds them. These chimpanzees, however, do not show any signs of intoxication from this alcohol intake.

Scientists carried out an investigation to determine the effect of consuming natural fermented fruit on the blood alcohol concentration (BAC) of chimpanzees.

The procedure was as follows:

- 17 different chimpanzees were used to record 70 feeding events from April to July of 2022.
- Fruit species commonly eaten by chimpanzees in the national parks of Guinea were identified.
- Ripe fermented fruits from 20 species were collected from beneath the feeding trees.
- The amount of fermented fruit consumed by an individual chimpanzee was recorded.
- The alcohol concentration/amount in fruit pulp was measured by:
  - Measuring the alcohol vapour inside the fruit
  - Chemical tests that change colour when ethanol (alcohol) is present
- A calculation of the estimated daily ethanol (alcohol) intake based on the fruit consumption and ethanol concentration showed that wild chimpanzees consumed 3% alcohol of the average 470 **g** daily fruit consumed.
- Blood samples were collected at regular intervals after ingestion of fruit and tested for alcohol concentration
- Urine samples were also tested for concentration of alcohol breakdown products.

3.2.1 For this investigation, give the:

(a) Independent variable (1)

(b) Reason for recording 70 feeding events in chimpanzees (1)

3.2.2 Describe TWO steps that were performed to measure the alcohol content of fruit. (2)

3.2.3 Explain how the inclusion of a control group would improve the validity of this investigation. (2)

3.2.4 Calculate the amount of alcohol **(g)** in the average daily fruit consumed by chimpanzees based on the percentage of alcohol consumed. Show ALL calculations and round off to one decimal. (3)

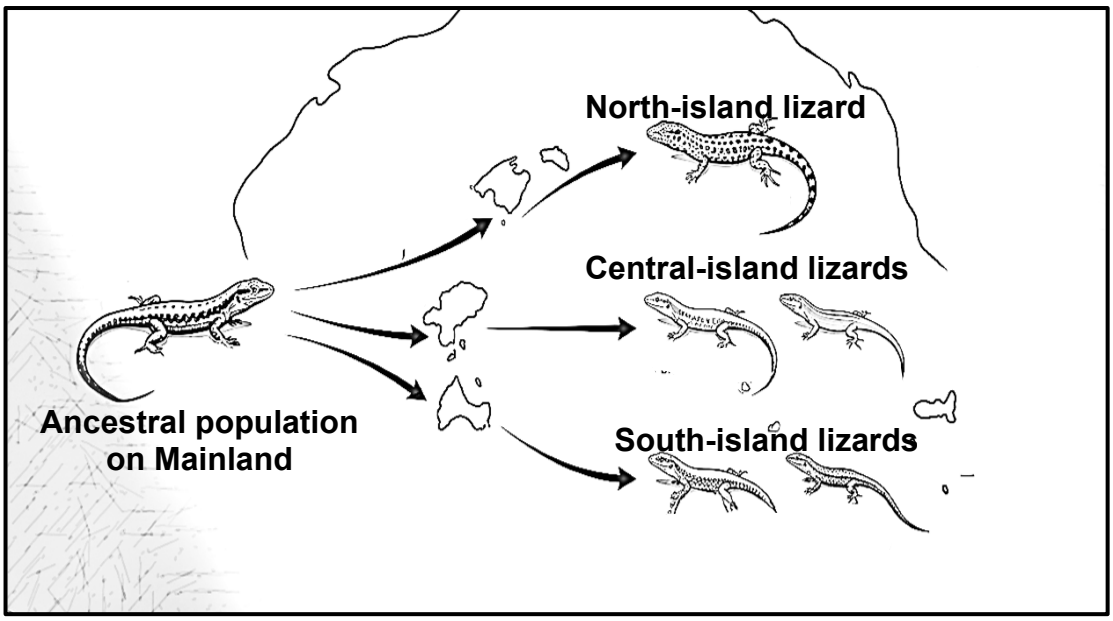
3.2.5 Suggest TWO possible reasons why these chimpanzees evolved to not show any signs of intoxication (drunkenness') from the alcohol in fruits. (2)

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3.3 The diagram below shows the distribution of different species of the Italian wall lizards (*Podarcis siculus*) in different islands.

These lizards were accidentally introduced by humans to different islands where they became exposed to different environmental pressures. Over many generations, Italian wall lizards accumulated many genetic differences leading to reproductive isolation.



3.3.1 Name the:

(a) Type of evidence for evolution shown by the diagram above (1)

(b) Process occurring to lizards on these islands (1)

3.3.2 Name and describe ONE visible reproductive isolating mechanism that would prevent these lizards from reproducing with each other. (2)

3.3.3 Changes in diet from eating mostly insect material to eating more tough plant material on the South-island forced lizards to evolve larger heads with strong jaws for a stronger bite force.

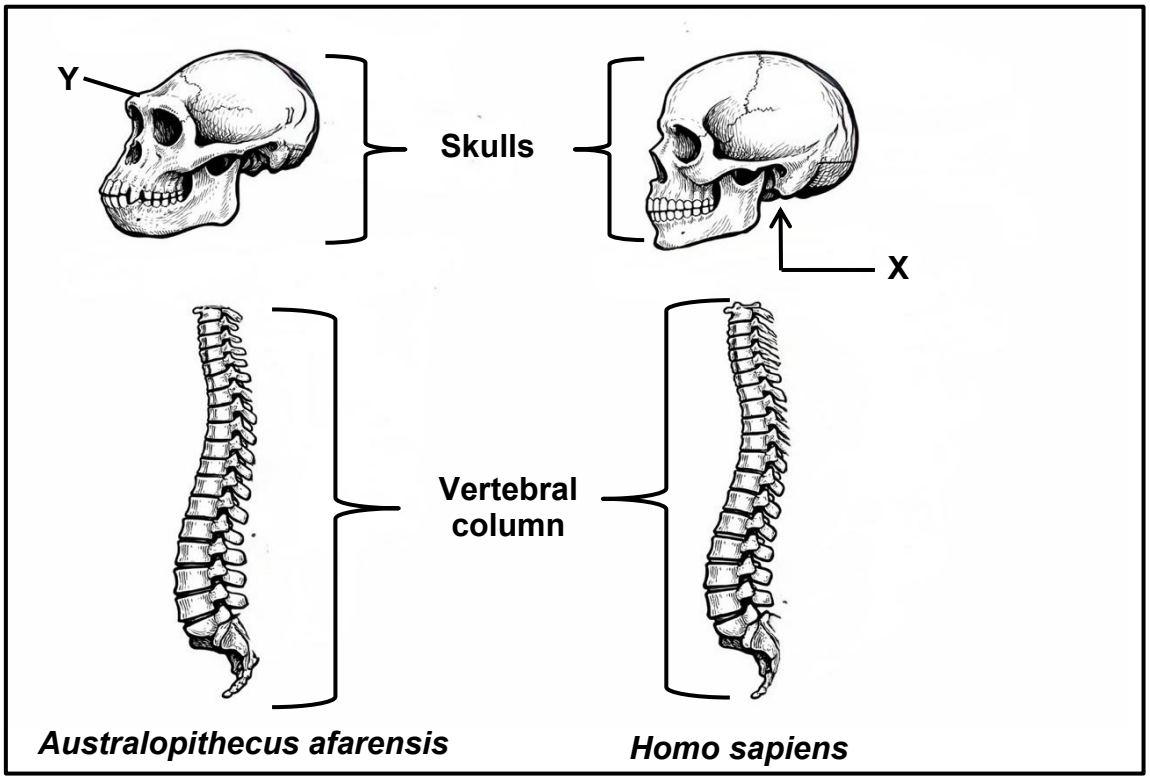
Describe how the evolution of larger heads with a stronger bite force in South-island lizards could be explained through *Lamarckism*. (5)

3.3.4 Explain how the process named in QUESTION 3.3.1(b) could have occurred in the population of the Italian wall lizard. (6)

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3.4 The diagrams below show the skulls and vertebral columns of hominins who have played a role in the 'Out-of-Africa' hypothesis.



3.4.1 Name the:

(a) Hole labelled **X**, where the vertebral column enters the skull vertically (1)

(b) Labelled structure **Y**, that is more pronounced in *A. afarensis* (1)

3.4.2 List THREE similarities between the hands of the two species in the diagram above. (3)

3.4.3 Explain how the shape of the vertebral column of *A. afarensis* indicates that this organism may be a transitional species between *H. sapiens* and other primitive hominids. (2)

3.4.4 Based on their dentition, tabulate ONE difference between the diet eaten by *A. afarensis* and *H. sapiens*. (3)

3.4.5 Explain how the fossils of the two *genera* represented by the diagrams above are used to support the 'Out-of-Africa' hypothesis. (4)

[50]

TOTAL SECTION B: 100
GRAND TOTAL: 150

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