education

MPUMALANGA PROVINCE

REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

LIFE SCIENCES P2

SEPTEMBER 2026

MARKS: 150

TIME: 2½ HOURS

This question paper consists of 16 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 A gene codes for the production of…

A a chromosome.
B a protein.
C an allele.
D DNA.

1.1.2 The centromere splits, separating chromosomes during…

A anaphase II.
B anaphase I.
C telophase II.
D telophase I.

1.1.3 The importance of meiosis is to…

A create diploid gametes.
B half the chromosomes during meiosis to overcome the doubling effect of fertilization.
C make sure individuals are identical from one generation to the next.
D maintain a changing chromosome number in every generation.

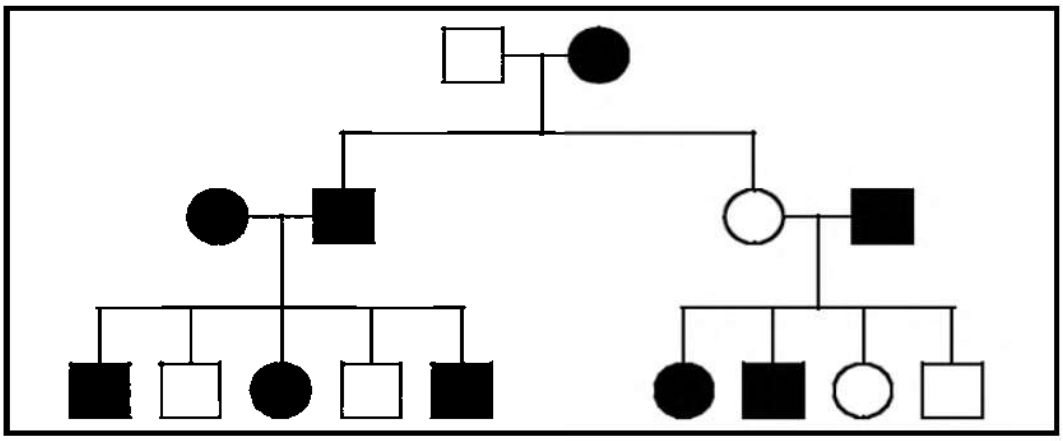
1.1.4 Hypophosphatemia is inherited as an X-linked dominant trait. A male with hypophosphatemia marries a normal female.

Which ONE of the following predictions is true about the inheritance of this disorder?

A All of their sons would inherit the disorder.
B All of their daughters would inherit the disorder.
C About 50% of their sons would inherit the disorder.
D About 50% of their daughters would inherit the disorder.

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1.1.5 Which ONE of the following patterns of inheritance best explains the transmission of the trait?



A Sex-linked dominant
B Sex-linked recessive
C Autosomal dominant
D Autosomal recessive

1.1.6 A homozygous black rabbit was crossed with a homozygous white rabbit. All the offspring had grey fur.

Which ONE of the following combinations was the genotype of the parents and the offspring?

	BLACK RABBIT	WHITE RABBIT	GREY FUR RABBIT
A	BB	bb	Bb
B	BW	BW	BW
C	BB	WW	BW
D	Bb	Bb	BB

1.1.7 An example of continuous variation can be found in…

A blood grouping.
B genders.
C eye colour.
D running speed.

1.1.8 Which theory is used to describe a sudden change in the environment leading to the rapid development of new species?

A Punctuated equilibrium
B Darwinism
C Lamarckism
D Natural selection

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1.1.9 Jean Baptiste de Lamarck explained evolution as…

A survival of the fittest.
B inheritance of acquired characteristics from previous generations.
C long periods of time where species do not change.
D competition leading to some organisms less suited to die before reproduction.

1.1.10 The isolation mechanism explaining why male animals are often brighter coloured than females of the same species, is known as…

A breeding at different times of the year.
B prevention of fertilization.
C species specific courtship behaviour.
D infertile offspring. (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 number (1.2.1 to 1.2.10) in the ANSWER BOOK.

1.2.1 The fluid of the nucleus where free nucleotides are found

1.2.2 A type of nucleic acid used in tracing female ancestry

1.2.3 The cell division resulting in genetically identical cells in order to heal wounds

1.2.4 A process during which chiasma is formed

1.2.5 The biotechnological process that produces genetically identical organisms

1.2.6 The type of inheritance involving alleles that are equally expressed in the phenotype of heterozygous offspring

1.2.7 The non-sex chromosomes in humans

1.2.8 An opening at the base of the skull determining bipedalism

1.2.9 The type of evidence for human evolution that includes tools, artefacts and rituals

1.1.10 The process responsible for creating all the different breeds of domesticated dogs (10 x 1) **(10)**

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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 1.3.3) in the ANSWER BOOK.

COLUMN I		COLUMN II	
1.3.1	The DNA containing material in the nucleus of a non-dividing cell	A: B:	Chromatin Chromatids
1.3.2	A prognathous jaw is indicative of…	A: B:	Bipedalism Quadrupedalism
1.3.3	A disorder caused by a gene mutation	A: B:	Colour-blindness Haemophilia

(3 x 2) **(6)**

1.4 In a certain species of snail, shell colour is controlled by a gene with three alleles. The shell may be brown, pink or yellow. The allele for brown colour, C^B, is dominant over the other two alleles. The allele for pink, C^P, is dominant over the allele for yellow, C^Y.

A cross between two pink-shelled snails only produced pink-shelled and yellow-shelled snails.

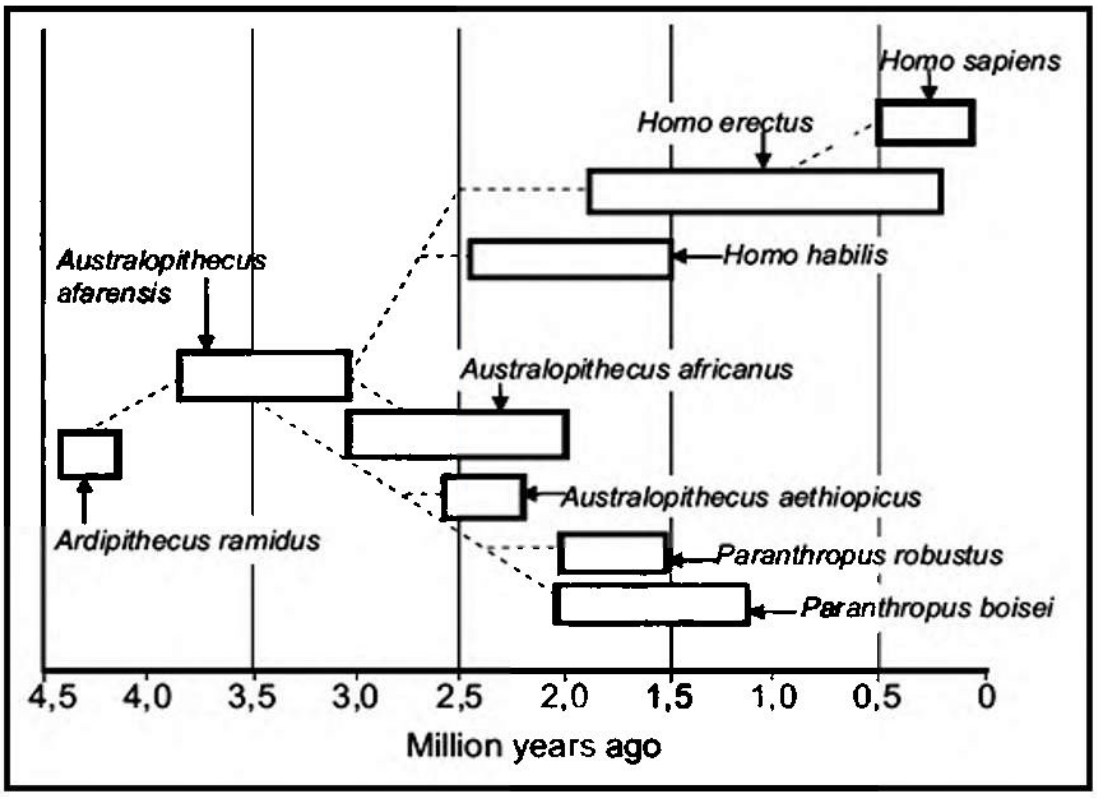
1.4.1 Give:

(a) The genotype(s) of the parent snails. (2)

(b) All possible genotypes of the offspring. (3)

(c) The ratio of phenotypes in the offspring. (2)
(7)

1.5 The following diagram represents the evolution of humans and our ancestors.



1.5.1 Identify the diagram represented above. (1)

1.5.2 How many genera are represented in the above diagram. (1)

1.5.3 To which family does the organisms represented in this diagram belong? (1)

1.5.4 Which species is the oldest according to this diagram? (1)

1.5.5 When did *Australopithecus africanus* first appear on earth? (1)

1.5.6 Which species co-existed with *Homo sapiens*? (1)

1.5.7 When did the species known as the "handy man" go extinct? (1)
(7)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 The DNA profiles below were taken at two crime scenes. The first crime was a house that had been broken into and burgled. The second crime scene was a flat where a man was found murdered two weeks later.



2.1.1 Name the technique used in this criminal investigation. (1)

2.1.2 (a) Using the evidence provided, suggest who robbed the house. (2)

(b) Give a reason for your answer. (1)

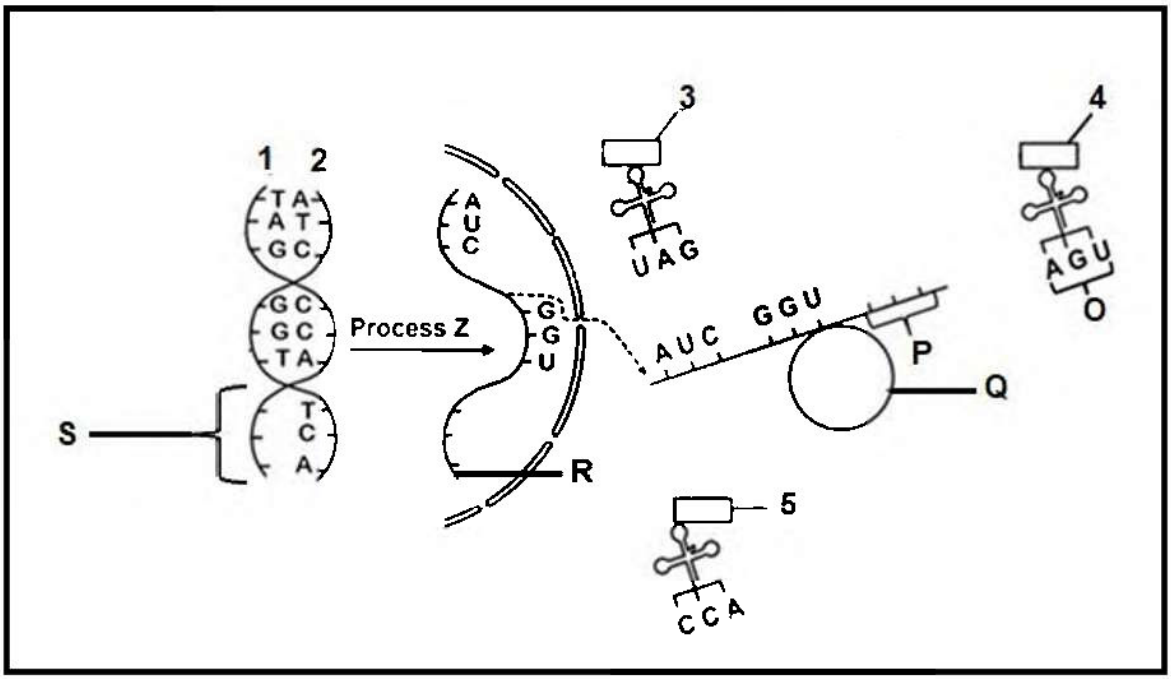
2.1.3 (a) Using the evidence provided, suggest who murdered the man in the flat. (1)

(b) Give a reason for your answer. (1)

2.1.4 State the evidence shown in the DNA profiles that could have been used by the police to work out that the two crimes were connected. (2)
(8)

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2.2 The diagram below is a schematic representation of protein synthesis.



2.2.1 Identify:

(a) Molecule **R** (1)

(b) Process **Z** (1)

2.2.2 Determine the sequence of the nitrogenous bases at area **S**. (1)

2.2.3 Which amino acid will be brought to area **P**? (1)

2.2.4 Name the type of sugar that forms part of the structure of molecule **R**. (1)
(5)

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2.3 *Homo sapiens* are more efficient water seekers than our closest extinct relatives due to an enzyme called ADSL. This enzyme has 484 amino acids.

The table below shows the amino acids and their corresponding anticodons.

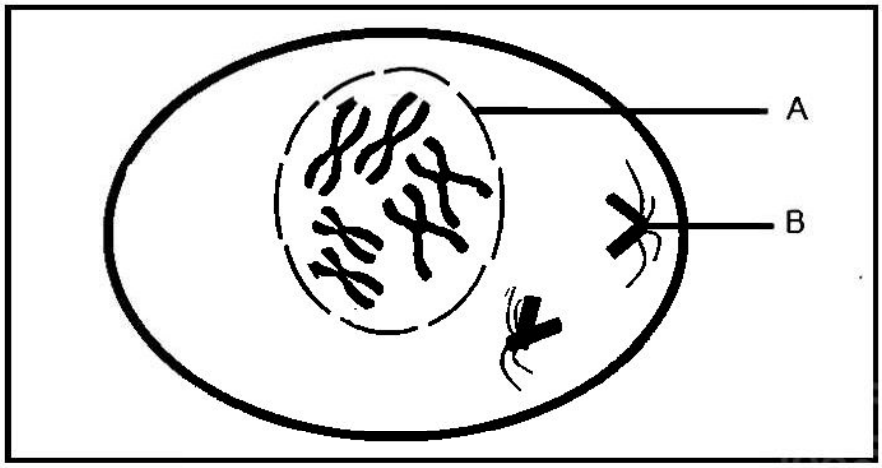
Anticodons	Amino acid
AGU	Serine (Ser)
GUU	Valine (Val)
CUU	Leucine (Leu)
GCU	Alanine (Ala)
ACA	Proline (Pro)

2.3.1 How many anticodons code for 484 amino acids? (1)

2.3.2 A mutation occurs during replication. The mutation results in the amino acid alanine (Ala) being replaced by valine (Val).

Use the table and explain how this mutation will affect the protein that is synthesized. (7)
(8)

2.4 The diagram below represents a human cell during meiosis.



2.4.1 Identify the phase represented above. (1)

2.4.2 Provide labels for the following structures:

(a) **A** (1)

(b) **B** (1)

2.4.3 Describe the composition of a chromosome. (3)

2.4.4 Does this cell represent a gamete or somatic cell? (1)

2.4.5 Give a reason for your answer in Question 2.4.4. (1)
(8)

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2.5 The extract below describes the development of Klinefelter syndrome in males.

> During meiosis a mutation in the sex determining chromosomes can result in a male having XXY chromosomes leading to the development of Klinefelter syndrome. It is characterised by a tall stature, small testes, low testosterone (hypogonadism), infertility, language-based learning delays, and sometimes social/emotional challenges like shyness.

2.5.1 Give the biological term for sex determining chromosomes. (1)

2.5.2 Identify the type of mutation described in the above extract. (1)

2.5.3 Explain how a mutation during spermatogenesis can result in a son with Klinefelter syndrome. (5)
(7)

2.6 In cats, one gene controls fur colour and another controls fur length. The colour can be black (**B**) or Siamese (**b**). Hair length can be short (**T**) or long (**t**).

A cat breeder crosses a short-fur Siamese coloured female with a long-fur black male.

2.6.1 State the characteristics that are being investigated. (2)

2.6.2 Give (the):

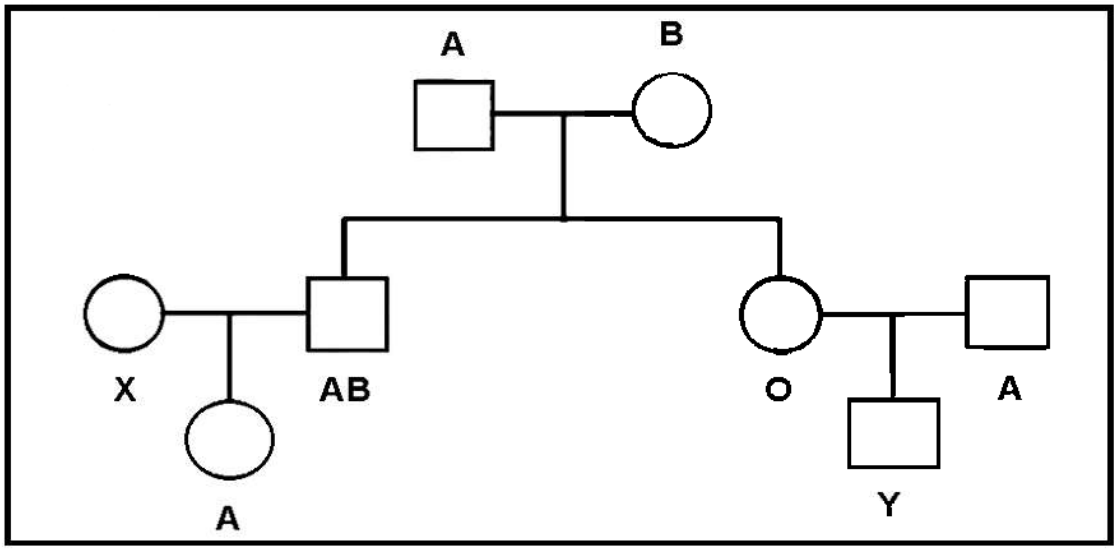
(a) Phenotypes of the offspring with TtBb genotype. (2)

(b) ALL the possible genotypes of the gametes produced by a heterozygous short-fur Siamese female. (2)

2.6.3 State Mendel's law of independent assortment. (2)
(8)

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2.7 The diagram below shows the pattern of blood groups inheritance in a family.



2.7.1 Give the number of genes that control the blood groups. (1)

2.7.2 Blood groups are controlled by multiple alleles.

Explain what is meant by multiple alleles. (1)

2.7.3 State ALL the possible genotypes of individual **Y**. (2)

2.7.4 Explain why the use of blood groups for paternity is not conclusive. (2)

(6)

[50]

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QUESTION 3

3.1 Brown enamel of the teeth is a sex-linked trait. A dominant allele on the X chromosome causes brown teeth in humans.

3.1.1 Explain why more males than females have white teeth. (2)

3.1.2 A man with brown teeth married a woman with white teeth.

Use a genetic cross to show the possible phenotypic ratios of their children. Use **B** for brown teeth and **b** for white teeth. (6)
(8)

3.2 Scientists think genetic engineering may be one solution for the food security problem. They genetically engineered golden rice to contain beta carotene which the body can use to make vitamin A.

The following steps were used in the process:

- The gene for beta carotene is removed from the DNA of daffodils.
- The gene is replicated and then inserted into a plasmid.
- Plasmid is inserted into bacteria.
- The bacteria are added to a petri dish containing rice embryos. They 'infect' the embryos and transfer the gene.
- Genetically engineered rice plants are crossed with types of rice that grow locally.

3.2.1 What is genetic engineering? (1)

3.2.2 Explain why it is important that only the gene that is required from the daffodil is removed from the daffodil DNA. (2)

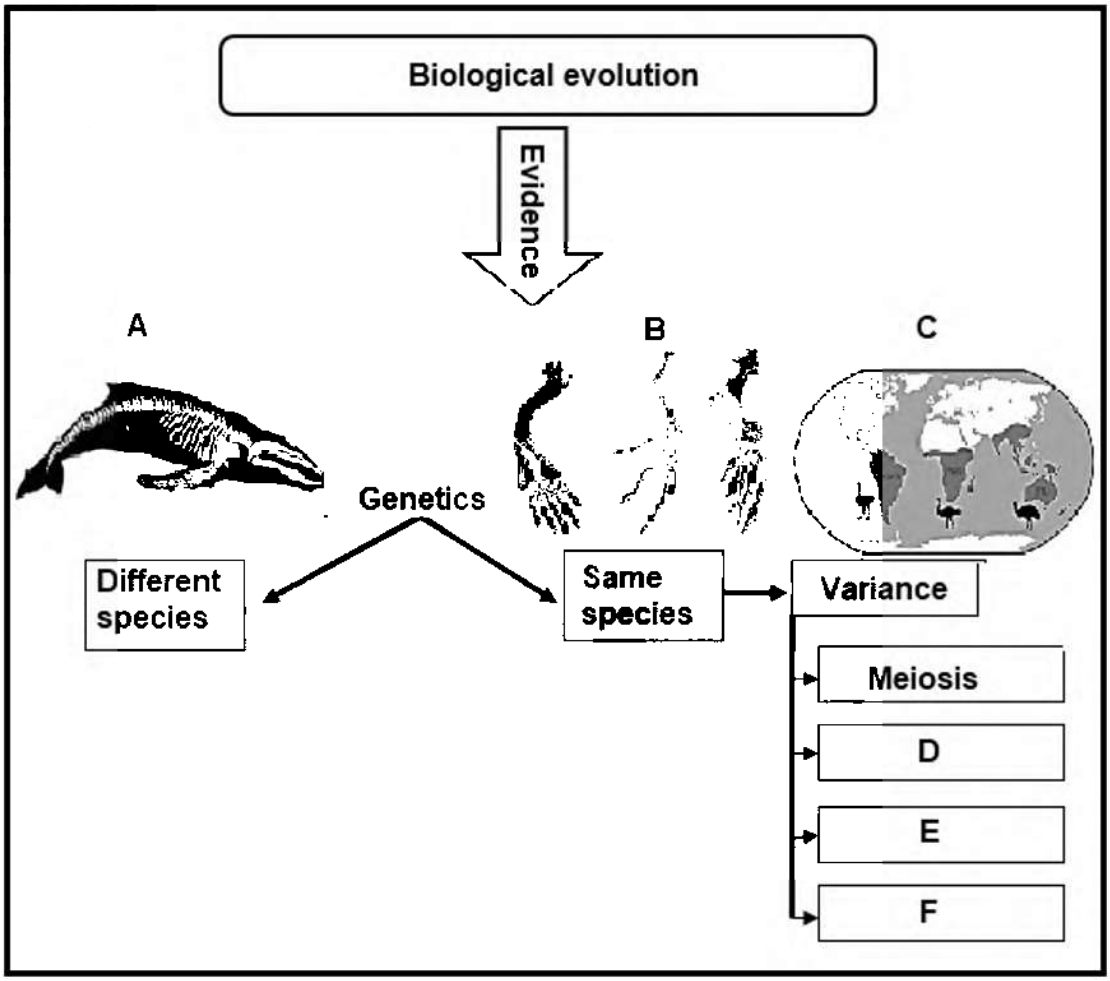
3.2.3 Explain why the scientists replicate the genes that have been isolated before inserting them into the plasmid. (2)

3.2.4 Name the vector that is used to genetically engineer golden rice. (1)

3.2.5 Why are the genetically engineered golden rice plants are crossed with types of rice that already grow locally. (2)
(8)

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3.3 The diagram below represents some core concepts of evolution.



3.3.1 Define the term biological evolution. (1)

3.3.2 Provide the evidence for evolution represented by **A**, **B** and **C**. (3)

3.3.3 Define same species. (1)

3.3.4 Identify the factors, **D**, **E** and **F**, contributing to genetic variance among individuals of the same species. (3)
(8)

3.4 Describe the process of natural selection according to Darwin. **(6)**

3.5 Species adapted for upright walking have longer legs, while species adapted for climbing and suspension have longer arms.

Scientist wanted to measure and compare arm and leg lengths in hominins and apes and calculate limb proportion ratios as evidence for evolutionary adaptation and common ancestry.

Arm-to-Leg Ratio = Arm Length ÷ Leg Length

- Ratios near or above **1.0**, indicating longer arms for climbing ability
- Ratios well below **1.0**, reflecting longer legs adapted for walking and running.

This table compares estimated arm and leg proportions across major hominid species.

Species	Estimated Arm Length (cm)	Estimated Leg Length (cm)	Arm-to-Leg Ratio
Australopithecus afarensis	85	75	1.13
Pan troglodytes	95	80	1.30
Homo habilis	80	85	0.94
Homo erectus	78	92	0.85
Australopithecus africanus	82	80	1.03
Homo sapiens	75	95	**X**

3.5.1 Name THREE upper limb characteristics shared amongst hominids. (3)

3.5.2 Calculate *Homo sapiens* arm to leg ratio at **X**. (2)

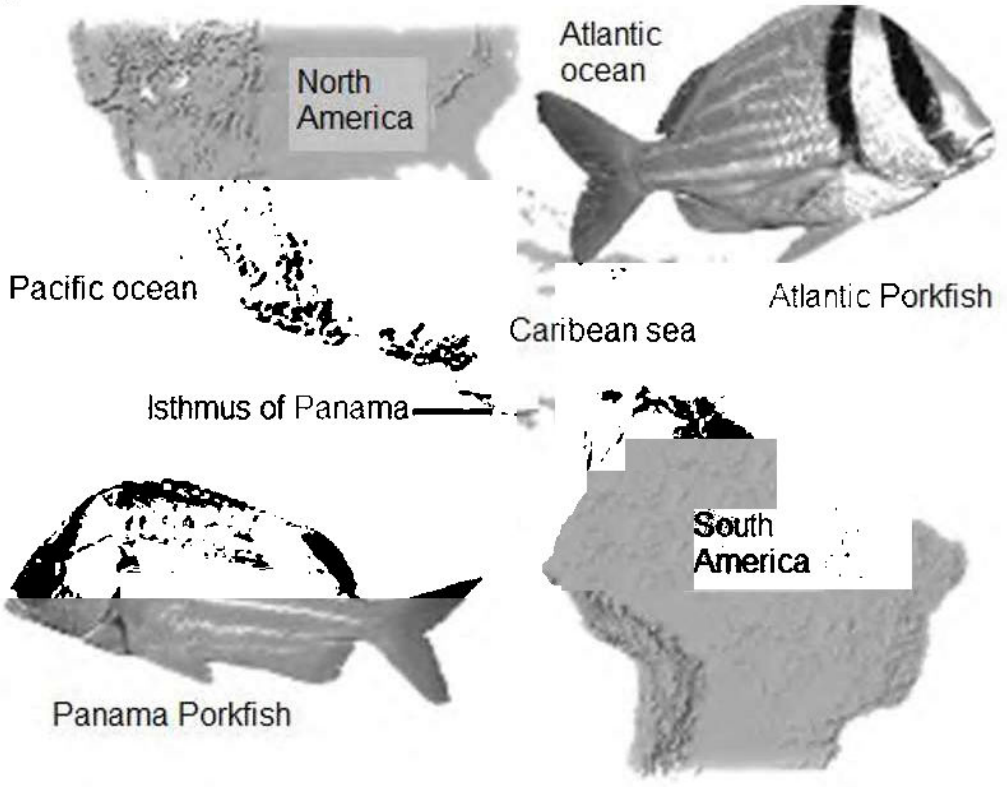
3.5.3 Draw a bar graph to represent the arm to leg ratios of the different species from the oldest to the youngest. (6)

3.5.4 What evolutionary trend can be observed from the graph? (1)
(12)

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3.6 The extract below shows the impact of the Isthmus of Panama on the porkfish species.

The formation of the Isthmus of Panama (land strip connecting two continents and separating two water bodies) around 3.5 million years ago created a land bridge, physically separating ancestral porkfish populations that once lived in the same region. Today the Porkfish species found in the Atlantic and Pacific oceans are no longer able to interbreed.



3.6.1 Describe the speciation of porkfish now found in the different oceans. **(8)**

[50]

TOTAL SECTION B: 100

GRAND TOTAL 150

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