KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

PROVINCIAL STANDARDISED ASSESSMENT

GRADE 12

LIFE SCIENCES P2

PREPARATORY EXAMINATION

SEPTEMBER 2026

MARKS: 150

TIME: 2½ Hours

This question paper consists of 18 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. Do ALL drawings in pencil and label them 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 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 correct answer and write only the letter (A to D) next to the question number (1.1.1 to 1.1.10) in your ANSWER BOOK, for example 1.1.11 D.

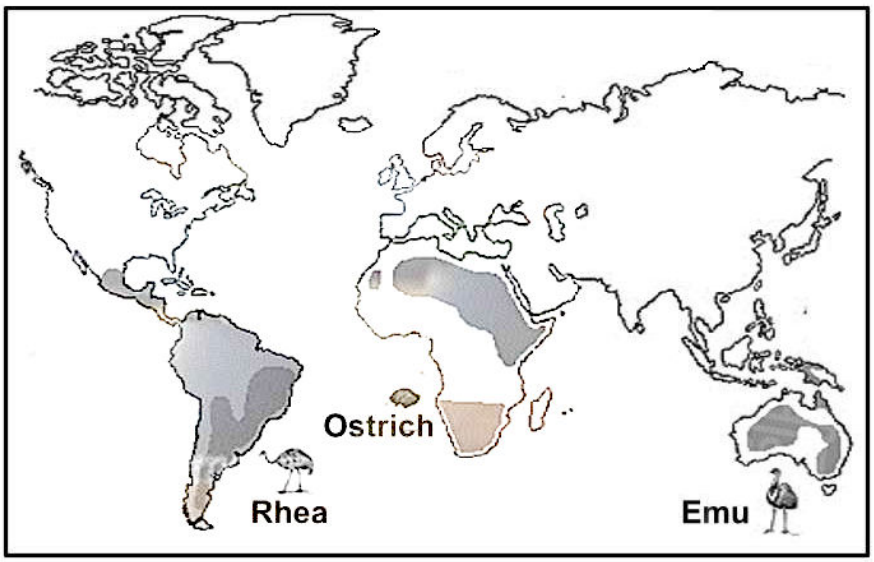
1.1.1 Transcription in the cell takes place in the …

A Cytoplasm
B Ribosome
C Nucleoplasm
D Nucleus

1.1.2 Which ONE of the following refers to the reproductive isolation mechanisms in plants?

A Species-specific courtship behavior
B Infertile hybrid
C Adaptation to different pollinators
D Breeding at different times

1.1.3 The diagram below represents the present-day distribution of ratite species (flightless birds with a relatively flat breastbone)

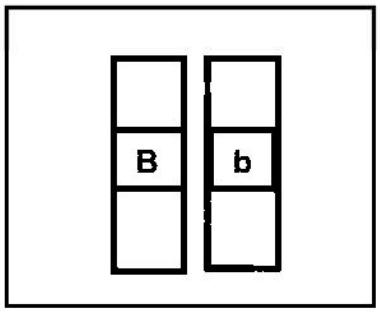


Which evidence of evolution is represented in the diagram?

A Genetic evidence
B Biogeography
C Modification by descent
D Fossil evidence

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1.1.4 The diagram below shows the alleles responsible for black (**B**) and brown (**b**) hair colour in humans.



Which ONE of the following best describes the alleles shown in the diagram?

A Homozygous black
B Homozygous brown
C Heterozygous black
D Heterozygous brown

1.1.5 If 40% of the bases in a DNA molecule are cytosine, what is the ratio of guanine to adenine in the molecule?

A 1 : 4
B 2 : 1
C 4 : 1
D 1 : 1

1.1.6 The list below describes the steps involved in the process of cloning an animal:

(i) Implant the embryo into the uterus of the surrogate mother
(ii) Remove the nucleus from an egg cell of a female organism
(iii) Insert the nucleus from the body cell into the egg cell with its nucleus removed
(iv) Stimulate the egg cell to divide and form an embryo
(v) Remove the nucleus from a body cell of the organism to be cloned

Which ONE of the following combinations shows the CORRECT sequence of the steps?

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

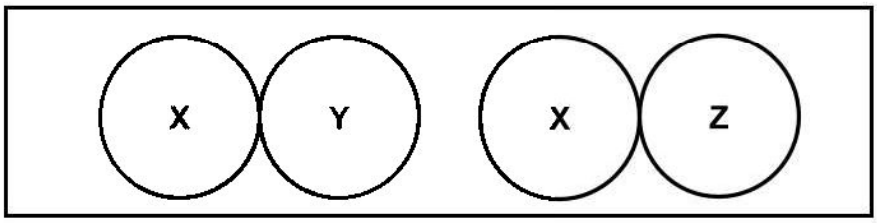
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1.1.7 Four different blood groups are possible in the F_1 generation if the parents are …

A I^AI^A and I^AI^B.
B I^Ai and I^Bi.
C I^Ai and I^AI^B.
D I^AI^A and I^BI^B.

1.1.8 Circles **X**, **Y** and **Z** below represent three populations of lizards.

The attached circles represent populations that are capable of interbreeding and producing fertile offspring.



Which ONE of the following statements is CORRECT?

A Circles **X** and **Y** represent populations of the same species, while **X** and **Z** represent different species.
B Circles **X** and **Z** represent populations of the same species, while **X** and **Y** represent different species.
C Circles **X**, **Y** and **Z** represent populations of different species.
D Circles **X**, **Y** and **Z** represent populations of the same species.

QUESTIONS 1.1.9 AND 1.1.10 REFER TO THE INVESTIGATION BELOW.

Scientists compare the amino acid sequences of the same protein in different organisms to determine their evolutionary relationships.

The table below shows part of the amino acid sequence of the Cytochrome c protein in different organisms.

Species	Amino acid sequence
Human	Val-Glu-Leu-Ser
Baboon	Val-Glu-Leu-Thr
Chimpanzee	Val-Glu-Leu-Ser
Dog	Ile-Asp-Leu-Thr
Cat	Ile-Asp-Leu-Ser

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1.1.9 Which pair of species in the table is most closely related, based on their amino acid sequence?

A Human and baboon
B Dog and cat
C Human and chimpanzee
D Baboon and dog

1.1.10 The amino acid sequences shown in the table, could be used to determine …

A the number of genes in each organism.
B the evolutionary relationships between organisms.
C the number of chromosomes in each organism.
D the type of nitrogenous bases in each organism.

(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 1.2.9) in the ANSWER BOOK.

1.2.1 The process by which the DNA molecule makes an identical copy of itself

1.2.2 The number, shape and arrangement of all chromosomes in the nucleus of a somatic cell arranged in pairs

1.2.3 All the genes that make up an organism

1.2.4 A genetic cross that involves one characteristic

1.2.5 A chromosome that determines the sex of an individual

1.2.6 A genetic disorder characterised by the absence of a clotting factor

1.2.7 The process where humans choose organisms with desirable characteristics to breed

1.2.8 The physical appearance of an organism

1.2.9 The formation of a new species from existing species

(9 x 1) **(9)**

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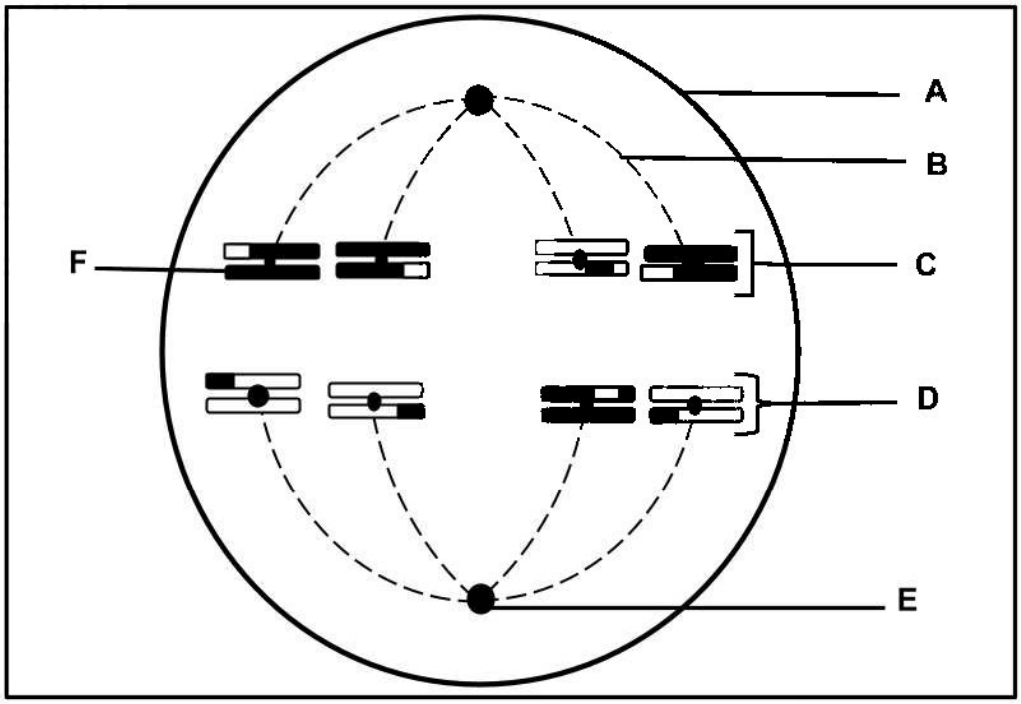
1.3 Indicate whether each of the descriptions in COLUMN I applies to **A ONLY**, **B ONLY**, **BOTH A AND B or NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B,** or **none** next to the question number (1.3.1 to 1.3.3) in the ANSWER BOOK.

	COLUMN I	COLUMN II
1.3.1	A bond that joins amino acids	A: Peptide bond B: Hydrogen bond
1.3.2	Blood group that is an example of codominance	A: Blood group A B: Blood group AB
1.3.3	Site of meiosis in plants	A: Anther B: Ovary

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

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1.4 The diagram below represents a phase in meiosis.



1.4.1 Identify part:

(a) **A** (1)

(b) **D** (1)

(c) **E** (1)

(d) **F** (1)

1.4.2 Name the:

(a) Phase of meiosis represented in the diagram (1)

(b) Phase of meiosis where structure **B** reforms in meiosis **II** (1)

(c) Process that resulted in the appearance of chromosome **C** (1)

1.4.3 How many:

(a) Chromosomes were present before the beginning of meiosis in this cell (1)

(b) Chromatids are present in this cell (1)
(9)

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1.5 In pea plants, round seeds (**R**) are dominant over wrinkled seeds (**r**), and yellow seeds (**Y**) are dominant over green seeds (**y**).

A farmer carried out a cross between the two pea plants.

The Punnett square below shows a part of the results of the cross.

		Parent 2	
	Gametes	RY	**(i)**
Parent 1	RY	RRYY	RRYy
	Ry	RRYy	RRyy
	rY	**(ii)**	RrYy
	ry	RrYy	Rryy

1.5.1 Name the type of genetic cross represented by the Punnett square. (1)

1.5.2 State the:

(a) Type of dominance shown in the Punnett square. (1)

(b) Mendel's law that explains the formation of the gametes represented in the Punnett square. (1)

1.5.3 Give the:

(a) Phenotype of parent **1** (1)

(b) Genotype of gamete **(i)** (1)

(c) Genotype of offspring **(ii)** (1)
(6)

TOTAL SECTION A: 50

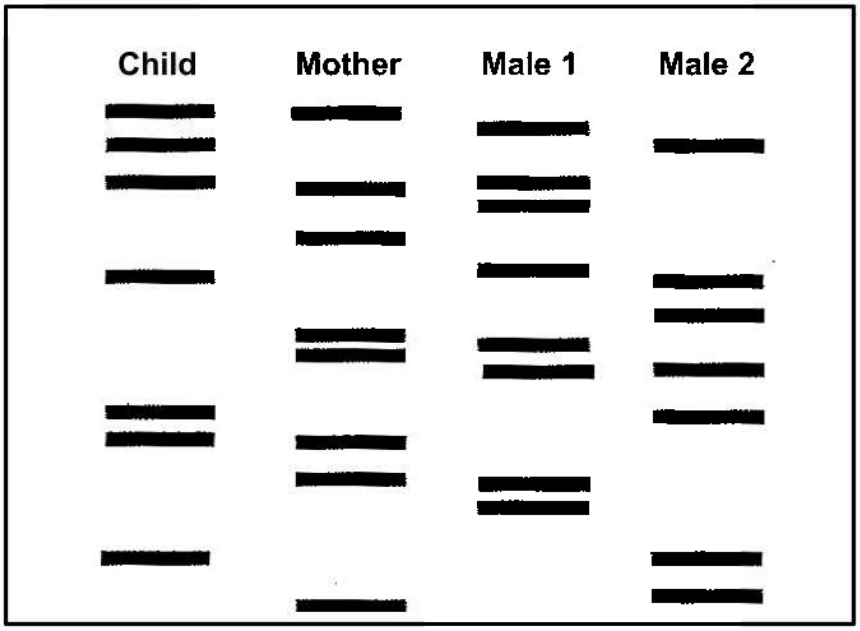
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SECTION B

QUESTION 2

2.1 A woman identified two men as the possible biological fathers of her child. A technique was used to determine which of the two men is the biological father.

The diagram below shows the results of the technique used in paternity testing.



2.1.1 Name the technique used in paternity testing. (1)

2.1.2 Identify the male (**1** or **2**) who is the biological father of the child. (1)

2.1.3 Give ONE reason for your answer in QUESTION 2.1.2. (2)

2.1.4 Explain why the mother's DNA profile was included in the paternity test. (2)
(6)

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2.2 A species of mice contains a type of protein called **myosin**. A mutation occurred, resulting in the formation of mutated myosin instead of normal myosin.

Tables 1 and **2** below show the amino acid sequences and corresponding DNA base triplets that code for portions of normal and mutated myosin.

TABLE 1

PORTION OF NORMAL MYOSIN					
AMINO ACID SEQUENCE	Methionine	Lysine	Leucine	Proline	Glycine
DNA BASE SEQUENCE	TAC	TTT	GAA	GGT	CCG

TABLE 2

PORTION OF MUTATED MYOSIN					
AMINO ACID SEQUENCE	Methionine	Lysine	Isoleucine	Proline	Glycine
DNA BASE SEQUENCE	TAC	TTT	TAA	GGT	CCG

2.2.1 Name the:

(a) Amino acid carried by the tRNA with anticodon UAC (1)

(b) Anticodon for Isoleucine (1)

(c) Codon for proline of **table 1** (1)

2.2.2 How many:

(a) mRNA nucleotides were involved in the formation of mutated myosin (1)

(b) Phosphate groups are present in a DNA base triplet that codes for glycine (1)

2.2.3 State the role of the DNA molecule in the formation of normal myosin. (1)

2.2.4 Name the type of mutation that led to the formation of mutated myosin. (1)

2.2.5 Explain how the mutation named in QUESTION 2.2.4 could have resulted in a change in the structure of the myosin protein. (4)

(11)

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2.3 Mutations and chromosomal abnormalities can arise when errors occur during meiosis. One such error is non-disjunction, which occurs when chromosomes fail to separate correctly. This can result in gametes with an abnormal number of chromosomes and may lead to genetic variation in offspring.

A group of Grade 12 learners conducted an investigation to determine the effect of non-disjunction during meiosis I on the chromosome number of gametes.

The investigation was conducted as follows:

- Twenty-one (21) learners were divided equally into three groups.
- Each group used a model representing a cell containing homologous pairs of chromosomes.
- Each group investigated the separation of one specific homologous chromosome pair during meiosis I.
- Group **1** represented normal chromosome separation, while Groups **2** and 3 represented non-disjunction.

The table below represents the results of the investigation.

GROUP	CHROMOSOME PAIR INVESTIGATED	OBSERVATION AFTER MEIOSIS I	GAMETE EXTRA CHROMOSOME	GAMETE MISSING CHROMOSOME
1	20	Normal chromosome separation	0	0
2	21	Failure of chromosome separation	?	**(i)**
3	22	Failure of chromosome separation	**(ii)**	?

2.3.1 Identify the group whose investigation is most likely to result in the production of an offspring with Down syndrome (1)

2.3.2 State the number of gametes with:

(a) A missing chromosome in **(i)** (1)

(b) An extra chromosome in **(ii)** (1)

2.3.3 Explain:

(a) ONE reason for the inclusion of group **1** in the investigation (2)

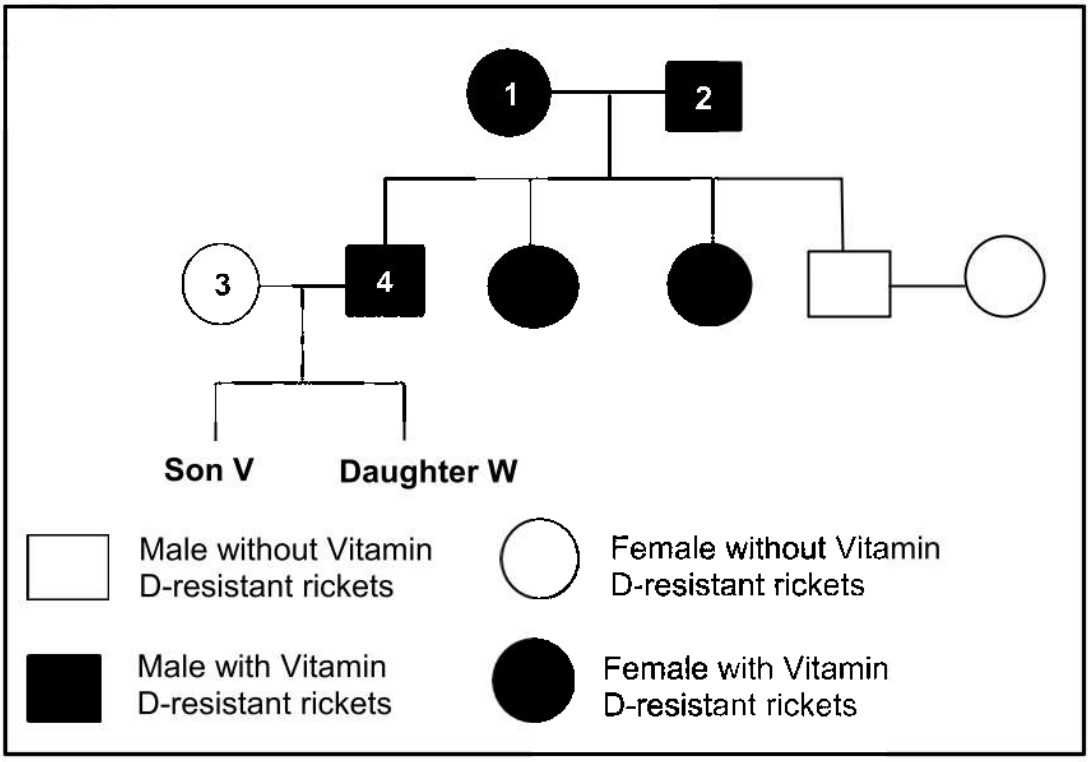
(b) How gametes in group **3** could have received an extra copy of chromosome 22 (4)
(9)

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2.4 Describe the process of *DNA replication*. **(6)**

2.5 Vitamin D-resistant rickets is a sex-linked genetic disorder. It is caused by a dominant allele $\mathbf{X^D}$.

The diagram below represents the inheritance of Vitamin D-resistant rickets in a family.



2.5.1 Name the type of diagram represented above. (1)

2.5.2 How many:

(a) Generations are represented in this diagram (1)

(b) Males are without Vitamin D-resistant rickets in this diagram (1)

2.5.3 Give the:

(a) Phenotype of individual **1** (1)

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

(c) Genotype of individual **2** (1)

2.5.4 Using the inheritance of the $\mathbf{X^D}$ allele, explain the phenotype of daughter **W**. (4)
(10)

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2.6 In rabbits, long ears are determined by the dominant allele **E**, while short ears are determined by the recessive allele **e**.

A breeder crossed a homozygous long-eared rabbit with a homozygous short-eared rabbit. The resulting offspring in the first filial generation **(F_1)** ALL had long ears.

2.6.1 Identify the recessive phenotype for ear length in rabbits. (1)

2.6.2 Give a reason for your answer in QUESTION 2.6.1. (1)

2.6.3 The **F_1** offspring were allowed to interbreed randomly.

Use a genetic cross to determine the percentage chance that an offspring in the **F_2** generation will have short ears. (6)

(8)

[50]

QUESTION 3

3.1 Scientists conducted an investigation to determine the effect of the age of stem cell donors on the proliferation (increase in cell number through cell division) of stem cells.

The procedure was as follows:

- Stem cells were obtained from donors in five different age groups.
- 1 000 viable stem cells were cultured from each group.
- Stem cells were cultured under the same conditions.
- The investigation was repeated five times.
- After seven days, percentage increase in the number of stem cells was determined for each age group.
- An average percentage increase was calculated and recorded.

The table below shows the results of the investigation.

Age group of donor (years)	Percentage increase
10 - 20	220
21 - 30	200
31 - 40	170
41 - 50	130
51 - 60	90

3.1.1 Identify the independent variable in the investigation. (1)

3.1.2 State:

(a) TWO variables that were kept constant during the investigation (2)

(b) ONE reason why the investigation was repeated five times (1)

3.1.3 Calculate the final number of stem cells after seven days for the donor age group of 41 - 50 years. Show ALL working. (3)

3.1.4 Draw a bar graph to show the results in the table. (6)
(13)

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3.2 Read the extract below.

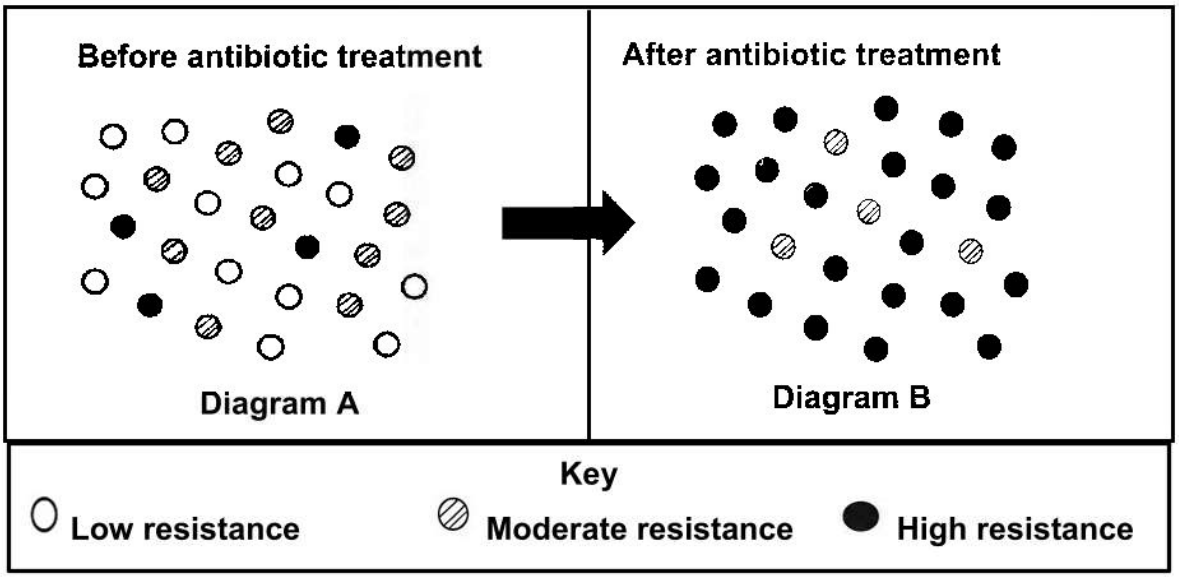
> The rock pocket mouse lives in areas of the south-western United States. Some populations live on pale-coloured rocks, while others live on areas covered by dark volcanic rocks. Rock pocket mice show variation in fur colour, with some mice having pale-coloured fur and others having dark-coloured fur. The mice are preyed upon by birds and other predators.
>
> In areas covered by dark volcanic rocks, mice with dark-coloured fur are better camouflaged and are less likely to be detected by predators. As a result, these mice are more likely to survive and reproduce, passing the alleles for dark fur to their offspring.

3.2.1 Identify the environmental condition that caused the rock pocket mice to develop darker fur, using the extract. (1)

3.2.2 According to Lamarck's theory, explain how dark -coloured fur developed in mice. (4)

3.2.3 State TWO reason for the rejection of Lamarck's theory. (2)
(7)

3.3 The diagrams below represent a bacterial population before and after antibiotic treatment.



3.3.1 Define *population*. (2)

3.3.2 State:

(a) The selection pressure that acted on the bacterial population. (1)

(b) What happened to the number of highly antibiotic-resistant bacteria from Diagram **A** to Diagram **B**. (1)

3.3.3 Using Darwin's theory of natural selection, explain the increase in antibiotic resistance in the bacterial population. (7)
(11)

3.4 Human evolution involved several skeletal adaptations associated with efficient bipedal locomotion and changes in the ability to use and manufacture tools. Bipedalism refers to locomotion using two legs.

Fossils of early hominins provide evidence of these evolutionary changes and also provide information about the origin and migration of members of the genus *Homo*.

3.4.1 Name the early hominin species traditionally associated with the earliest use of stone tools. (1)

3.4.2 State how the fossils of *Australopithecus* and *Homo erectus* support the 'Out of Africa' hypothesis. (3)

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3.4.3 Explain the significance of the following structural features in human bipedalism:

(a) Spine (2)

(b) Pelvis (2)
(8)

3.5 Diagrams **A** and **B** below show the skulls of two organisms.

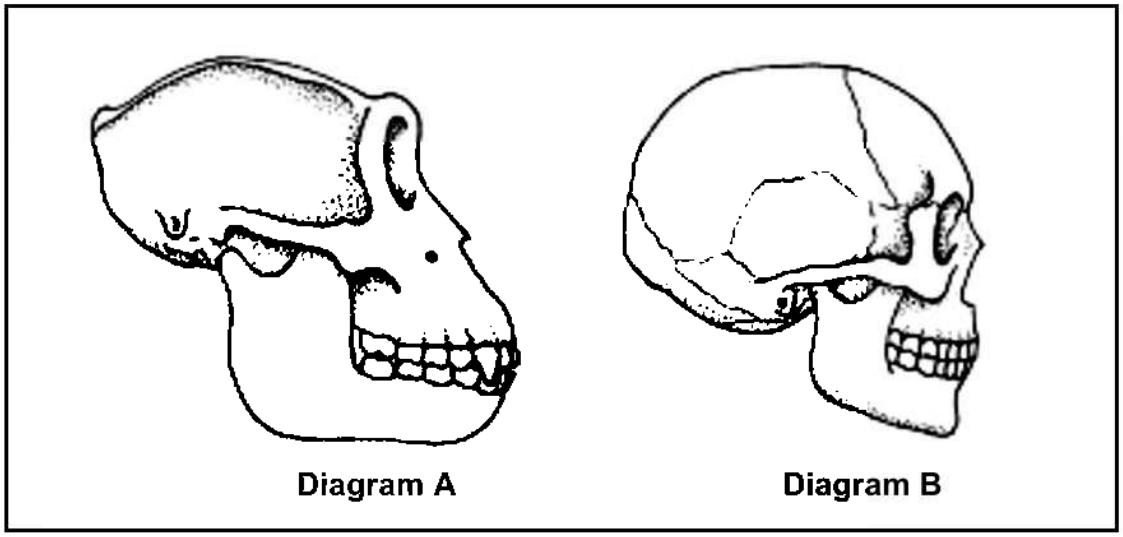


Diagram A **Diagram B**

3.5.1 Name the genus to which the skull in diagram **B** belongs. (1)

3.5.2 Which diagram (**A** or **B**) shows a skull with a foramen magnum positioned towards the back of the skull? (1)

3.5.3 Tabulate TWO visible differences between the skulls shown in diagrams **A** and **B** with reference to the brow ridge and jaws. (5)

3.5.4 With reference to trends in human evolution, explain the significance of the following features in diagram **B**:

(a) Size of the teeth (2)

(b) Cranial capacity (2)
(11)

TOTAL SECTION B: 100

GRAND TOTAL: 150

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