basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

LIFE SCIENCES P2

NOVEMBER 2025

MARKS: 150

TIME: 2½ hours

This question paper consists of 17 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 must use a non-programmable calculator, protractor and a compass, where necessary.
11. Write neatly and legibly.

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 is …

A the complete set of chromosomes of an organism.
B a segment on a chromosome, coding for a characteristic.
C the haploid number of chromosomes in a cell.
D a triplet of bases that codes for an amino acid.

1.1.2 The significance of DNA replication is that the cells formed at the end of mitosis will …

A be genetically identical.
B contain half the number of chromosomes.
C be genetically different.
D have double the number of chromosomes.

1.1.3 Which ONE of the following statements is a feature of punctuated equilibrium?

A Individual organisms adapt to changes in the environment.
B The inheritance of acquired characteristics
C There are long periods of little or no change in a population.
D The more a structure is used, the more it develops.

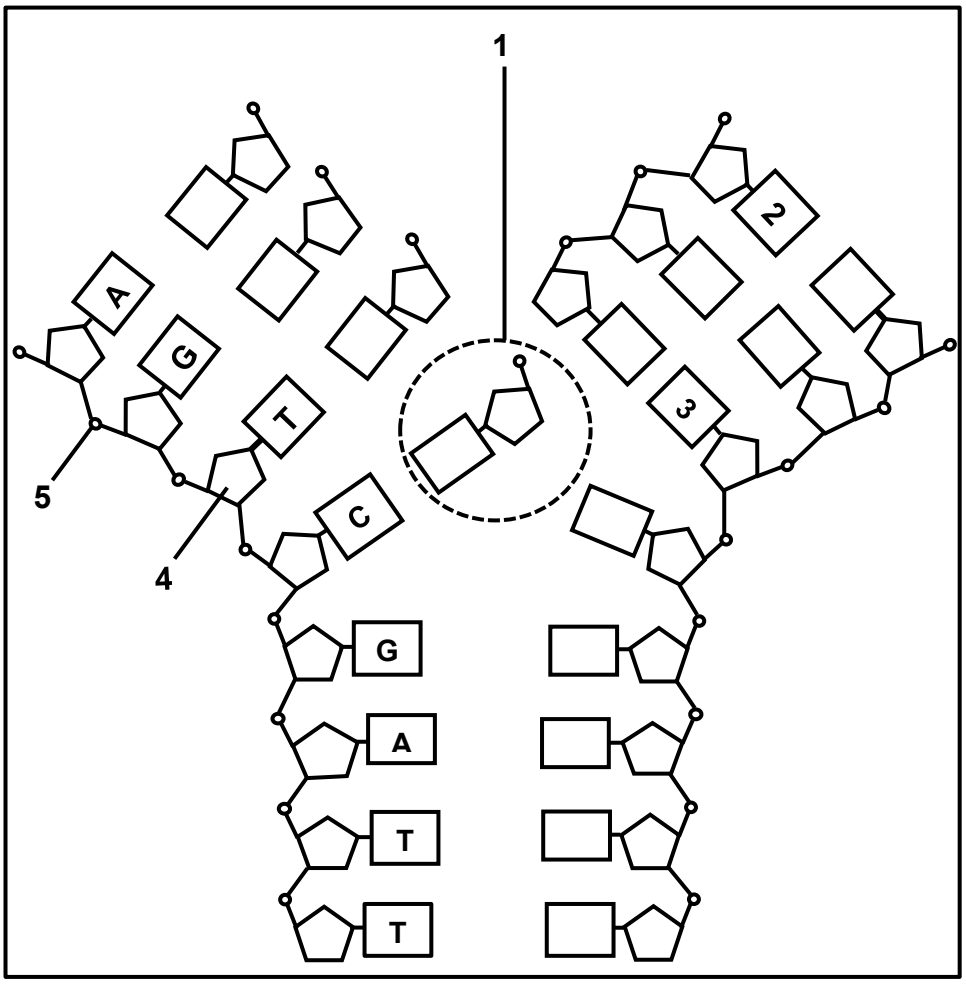
1.1.4 Haemophilia is …

A characterised by the inability to distinguish between red and green.
B caused by a mutation of an allele on the X-chromosome.
C caused by non-disjunction of chromosomes during meiosis.
D caused by an allele carried on an autosome.

1.1.5 Which ONE of the following is an example of a heterozygous genotype?

A X^rX^r
B BB
C RW
D aa

QUESTIONS 1.1.6 AND 1.1.7 REFER TO THE DIAGRAM BELOW THAT REPRESENTS DNA REPLICATION.



1.1.6 Which ONE of the following combinations CORRECTLY identifies molecules **1**, **4** and **5**?

	Molecule 1	Molecule 4	Molecule 5
A	Nucleotide	Deoxyribose	Phosphate
B	Nitrogenous base	Phosphate	Deoxyribose
C	Nucleotide	Phosphate	Deoxyribose
D	Nitrogenous base	Deoxyribose	Phosphate

1.1.7 Which ONE of the following combinations is CORRECT for molecules **2** and **3**?

	Molecule 2	Molecule 3
A	T	A
B	A	A
C	T	G
D	A	C

QUESTIONS 1.1.8 AND 1.1.9 REFER TO THE INFORMATION IN THE DIHYBRID CROSS BELOW.

In a certain plant species, one gene controls stem colour and another controls plant height. The stem colour can be brown (**B**) or red (**b**), while the plant height can be tall (**T**) or short (**t**).

	STEM COLOUR	**PLANT HEIGHT**
Plant 1	Brown	Short
Plant 2	Red	Tall

When plant **1** was crossed with plant **2**, some of their offspring were red and short.

1.1.8 Which ONE of the following represents the genotypes of plant **1** and plant **2**?

	PLANT 1	**PLANT 2**
A	bbtt	BbTt
B	Bbtt	bbTt
C	BbTt	bbtt
D	bbTt	Bbtt

1.1.9 The number of possible **different** genotypes expected in the offspring from this cross is …

A 4.
B 8.
C 9.
D 16.

1.1.10 A rare form of rickets is caused by a dominant allele on the X-chromosome.

Which ONE of the following statements is TRUE about the inheritance of this form of rickets?

A If the father is affected, all his sons will be affected.
B It will be expressed more frequently in males than in females, since males have only one X-chromosome.
C If the father is affected, all his daughters will be affected.
D It will only be expressed in females, since they have two X-chromosomes. (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 1.2.9) in the ANSWER BOOK.

1.2.1 The bond formed between two amino acids during protein synthesis

1.2.2 An organelle that contains DNA which is used in tracing female ancestry

1.2.3 Undifferentiated cells in animals that have the potential to become any type of tissue

1.2.4 A change in the sequence of nitrogenous bases resulting in the formation of a different protein

1.2.5 The natural shape of a DNA molecule

1.2.6 The permanent disappearance of a species from Earth

1.2.7 A type of variation with a range of intermediate phenotypes

1.2.8 An allele that is expressed in a phenotype in the heterozygous condition

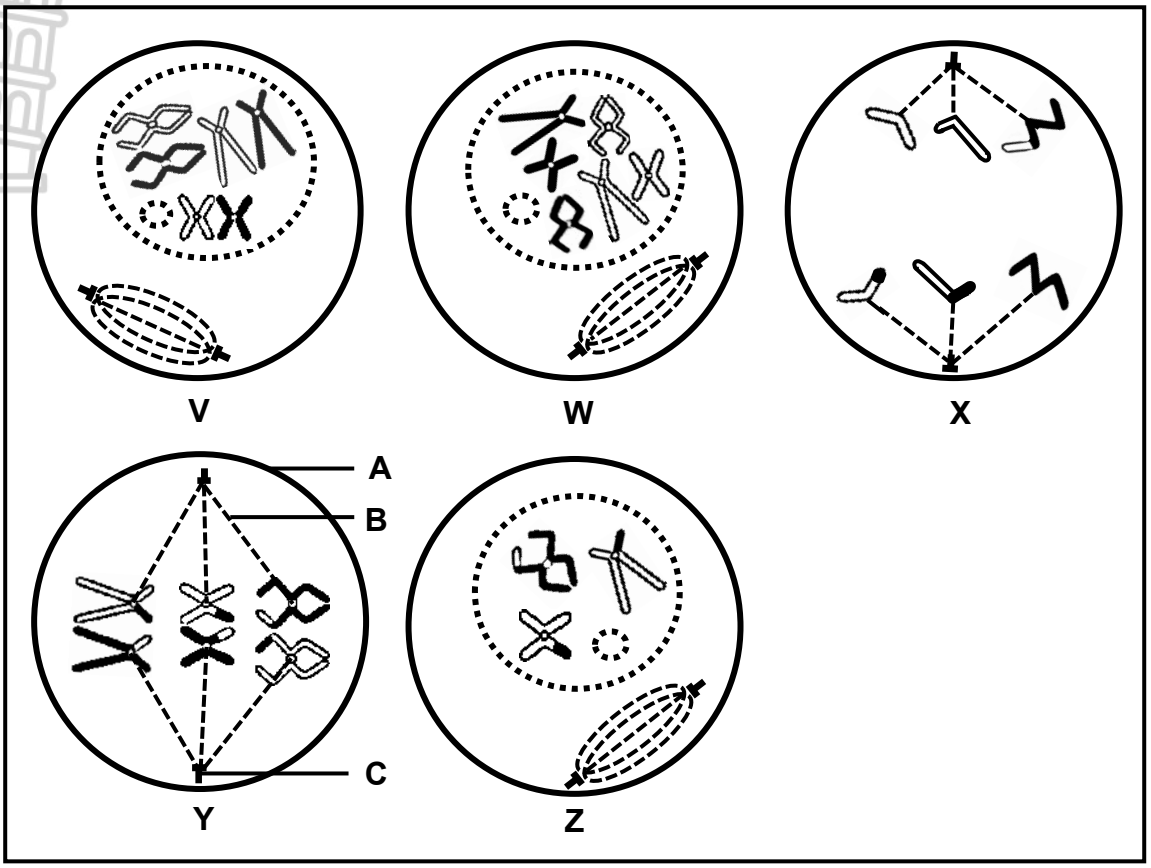
1.2.9 The position of an allele on a chromosome (9 x 1) **(9)**

1.3 Indicate whether each of the descriptions 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 numbers (1.3.1 to 1.3.3) in the ANSWER BOOK.

	COLUMN I	COLUMN II
1.3.1	The phase of meiosis during which non-disjunction can occur	A: Anaphase I B: Anaphase II
1.3.2	A representation of the number, shape and arrangement of all the chromosomes in the nucleus	A: Phylogenetic tree B: Karyotype
1.3.3	The alleles of a gene separate into different gametes during meiosis	A: Law of independent assortment B: Law of segregation

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

1.4 The diagrams below represent cells from the same organism during different phases of mitosis and meiosis.



1.4.1 Identify part:

(a) **A** (1)

(b) **B** (1)

(c) **C** (1)

1.4.2 Which diagram (**V**, **W**, **X**, **Y** or **Z**) represents a cell during:

(a) Prophase of mitosis (1)

(b) Metaphase I (1)

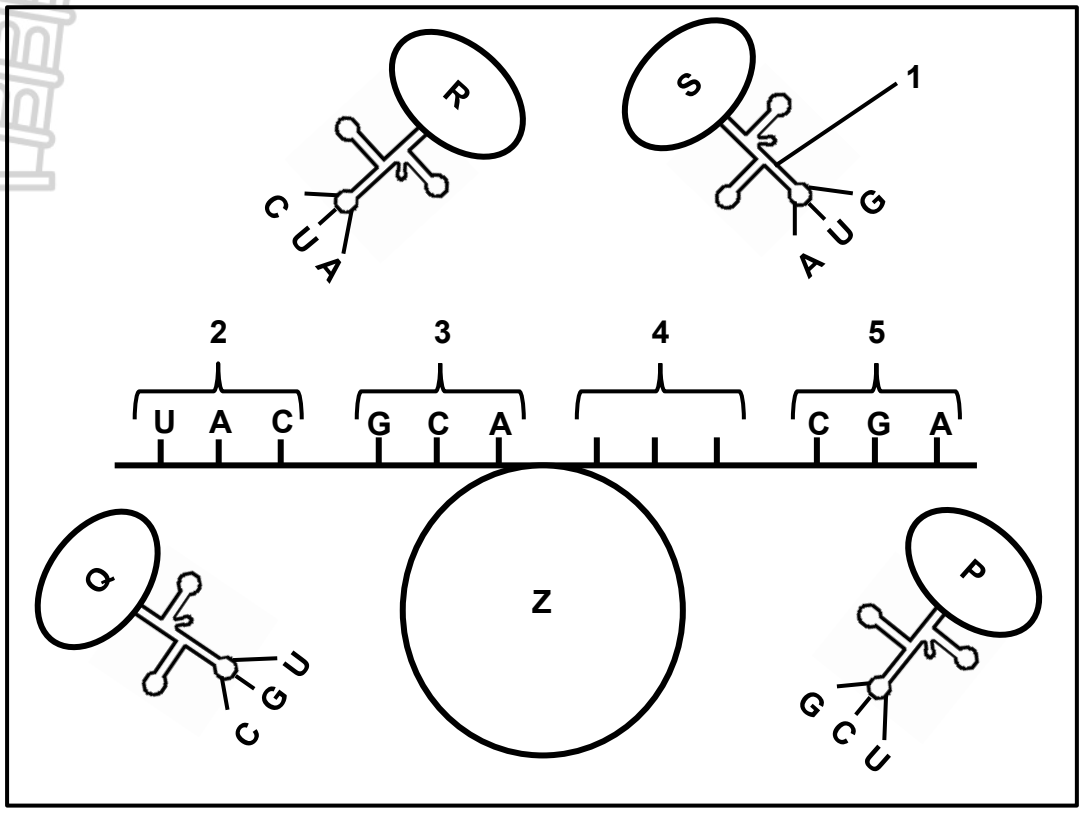
(c) Prophase I (1)

1.4.3 How many chromosomes will there be in each cell at the end of:

(a) Mitosis (1)

(b) Meiosis I (1)
(8)

1.5 The diagram below represents a stage of protein synthesis. Each amino acid (**P**, **Q**, **R** and **S**) is coded for by a different codon on this mRNA molecule.



1.5.1 Identify:

(a) The stage of protein synthesis represented (1)

(b) Molecule **1** (1)

(c) Organelle **Z** (1)

1.5.2 State the sequence of nitrogenous bases on the DNA molecule for codon:

(a) **3** (1)

(b) **4** (2)

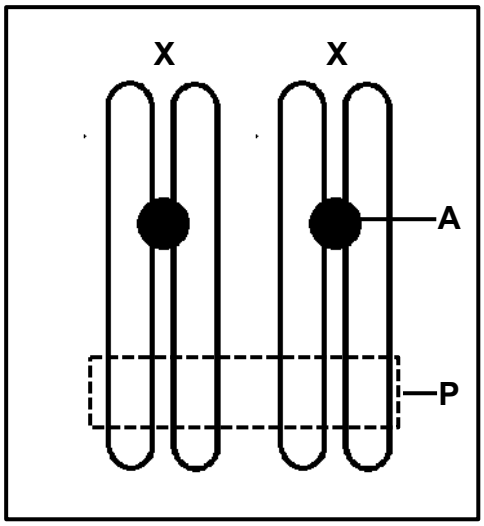
1.5.3 Which amino acid (**P**, **Q**, **R** or **S**) is coded for by codon **5**? (1)
(7)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 The diagram below represents the sex chromosomes in a female.



2.1.1 Identify structure **A**. (1)

2.1.2 Give the biological term for the sex chromosomes. (1)

2.1.3 Describe how these chromosomes would differ in the somatic cells of a male. (1)

2.1.4 An exchange of genetic material takes place at region **P**.

(a) Name the process above. (1)

(b) Identify the phase during which the process named in QUESTION 2.1.4(a) takes place. (1)

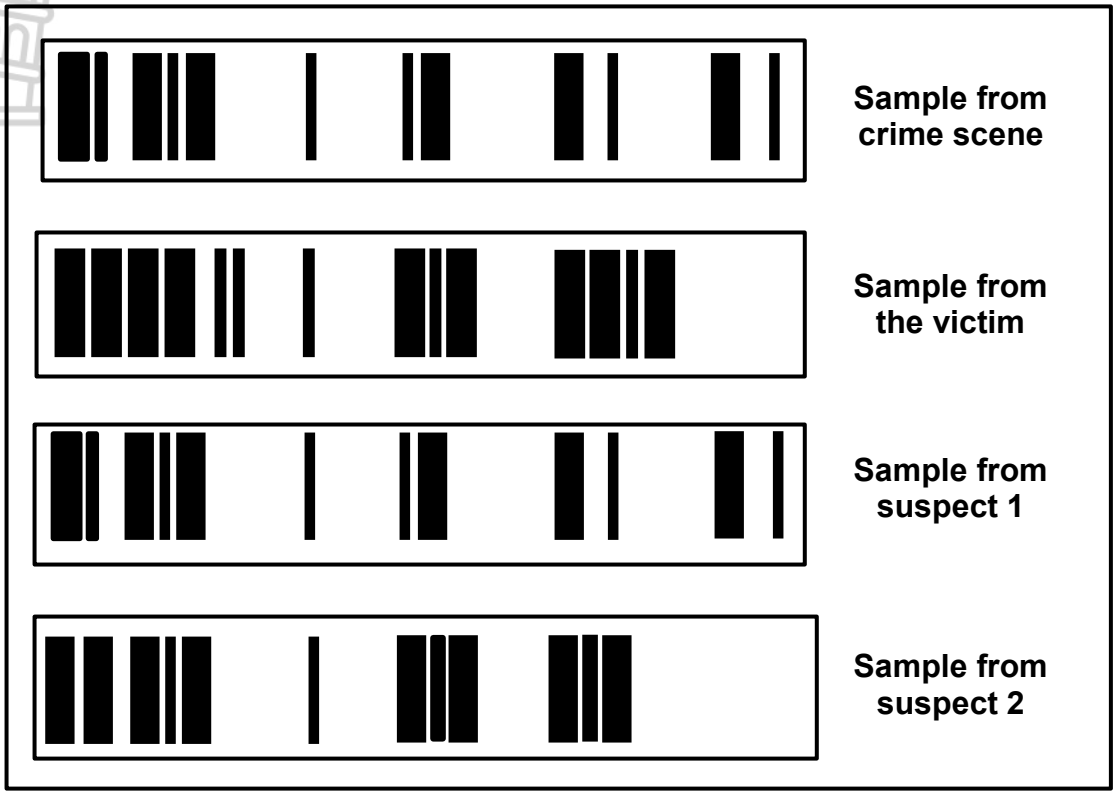
(c) Give ONE reason why the process named in QUESTION 2.1.4(a) is important. (1)

2.1.5 Explain how the structure of the chromosomes would differ at the end of meiosis II. (2)

2.1.6 Non-disjunction of these chromosomes occurred during meiosis and a gamete with an extra chromosome is formed. If this gamete is fertilised by normal gametes, the resulting zygotes will not be normal.

Explain the genetic composition of these zygotes. (3)
(11)

2.2 The diagram below shows the DNA analysis of a sample obtained at a crime scene, a sample from the victim and samples from two suspects. In their investigation, police conducted a comparison of the DNA to identify the criminal.



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

2.2.2 Which ONE of the suspects (**1** or **2**) was at the crime scene? (1)

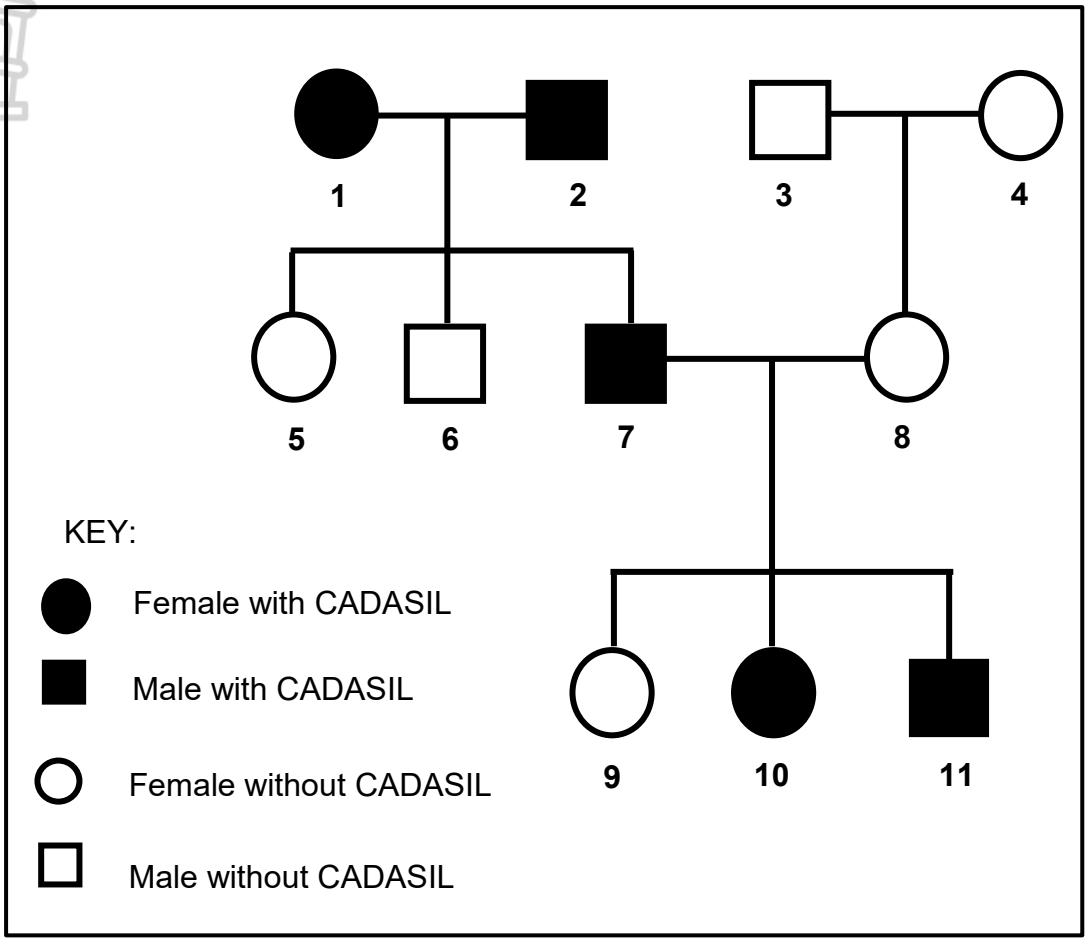
2.2.3 Give ONE observable reason for your answer to QUESTION 2.2.2. (1)

2.2.4 Give TWO possible reasons why the suspect identified in QUESTION 2.2.2 might NOT be convicted if only this evidence is used. (2)

2.2.5 Explain how the technique named in QUESTION 2.2.1 is used in paternity testing. (4)
(9)

2.3 CADASIL is an autosomal genetic disorder caused by a dominant allele (**D**). It results in the thickening of the walls of blood vessels.

The diagram below shows the inheritance of CADASIL in a family.



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

2.3.2 How many offspring do parents **3** and **4** have? (1)

2.3.3 Give the:

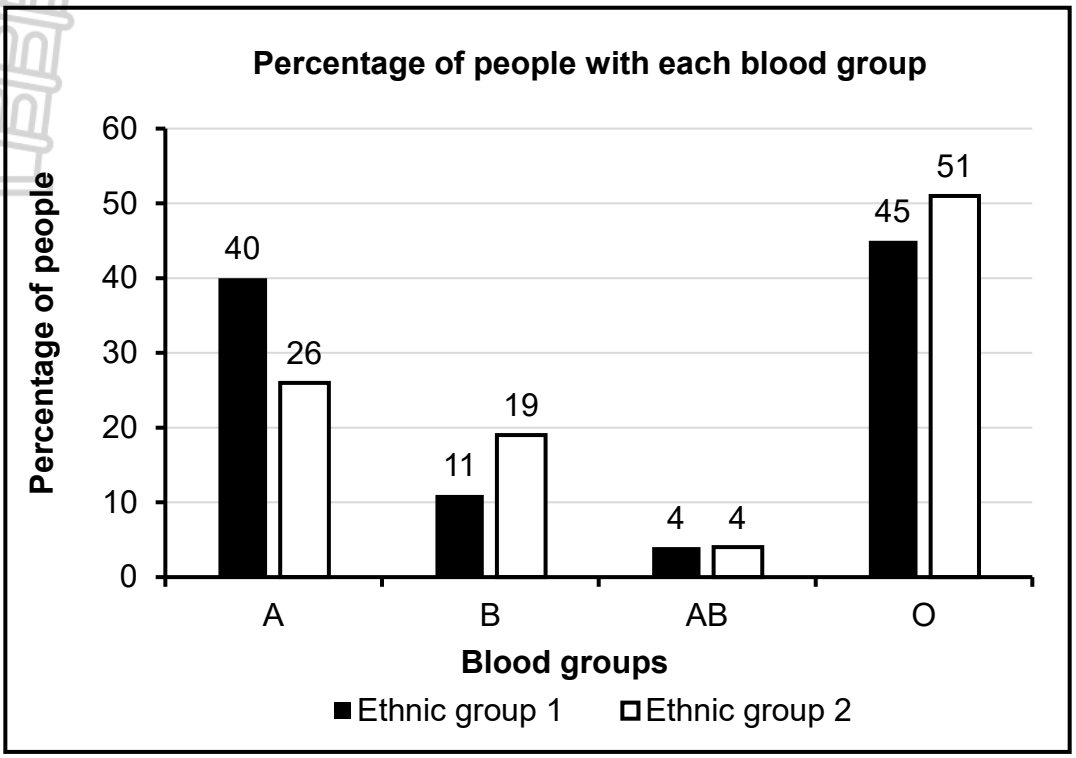
(a) Phenotype of individual **10** (1)

(b) Genotype of individual **5** (1)

2.3.4 Using evidence from the diagram, explain why individuals **1** and **2** are both heterozygous. (4)

2.3.5 What is the percentage chance of parents **7** and **8** having another child with CADASIL? (1)
(9)

2.4 The graph below shows the distribution of blood groups for two ethnic groups (**1** and **2**) in a certain country during 2021.



2.4.1 Which blood group:

(a) Is most common in both ethnic groups (1)

(b) Has a higher percentage in ethnic group **1** than in ethnic group **2** (1)

2.4.2 State ALL the possible genotypes of 11% of the people in ethnic group **1**. (2)

2.4.3 Ethnic group **1** had a population of 360 000 people in 2021.

Which blood group (**A**, **B**, **AB** or **O**) had 39 600 people? (2)

2.4.4 Explain the inheritance of blood group **AB**. (3)
(9)

2.5 Palomino horses are bred by horse breeders for their coat colour. A palomino has a golden-coloured coat. It is the offspring of a horse with a cream-coloured coat (**A**) and a horse with a chestnut-coloured coat (**G**).

2.5.1 Name the type of dominance displayed in the inheritance of coat colour in palomino horses. (1)

2.5.2 Explain your answer to QUESTION 2.5.1. (2)

2.5.3 The breeding of horses with desired characteristics is a type of biotechnology.

(a) Name this type of biotechnology. (1)

(b) Name the TWO phenotypes of the horses that must be interbred for a 100% chance of palomino offspring. (2)

2.5.4 A horse with a cream-coloured coat was crossed with a palomino horse.

Use a genetic cross to show the expected phenotypic ratio of the offspring. (6)
(12)
[50]

QUESTION 3

3.1 Theories of human evolution are based on the similarities between humans and African apes and also on the anatomical differences between them.

3.1.1 State TWO characteristics related to vision that humans share with African apes. (2)

3.1.2 Describe TWO differences between the jaws of humans and African apes. (4)

3.1.3 Explain the significance of the position of the foramen magnum, the shape of the spine and the size of the pelvis in bipedalism. (6)
(12)

3.2 The table below shows the average brain volume of different hominid species.

SPECIES	AVERAGE BRAIN VOLUME (mℓ)
Ardipithecus ramidus	350
Australopithecus africanus	461
Homo habilis	609
Homo erectus	959
Homo sapiens	1 330

3.2.1 How many genera are represented in the table? (1)

3.2.2 Give TWO examples of fossils of *Australopithecus africanus* found in South Africa. (2)

3.2.3 Give the average brain volume (mℓ) of the species that was the first to use tools. (1)

3.2.4 Calculate the percentage increase in the average brain volume between *Homo habilis* and *Homo sapiens.* Show ALL working and round off the answer to TWO decimal places. (3)

3.2.5 The brain decomposes after the organism dies.

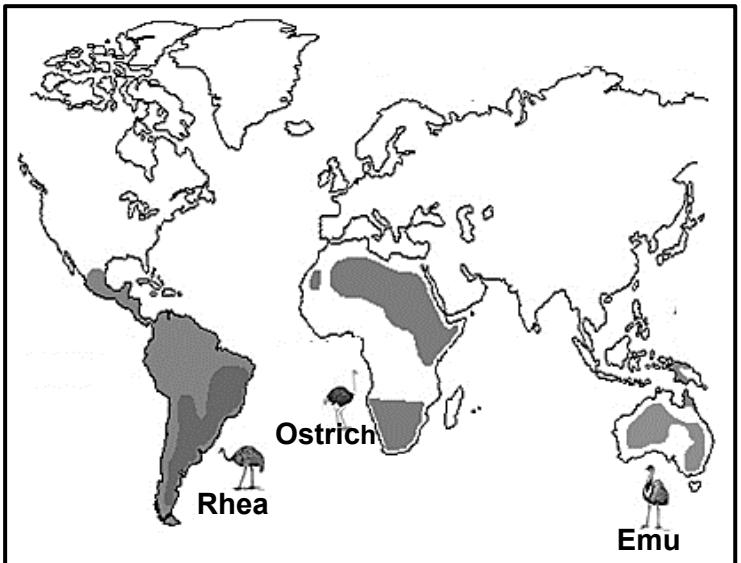
Explain how scientists are able to determine the brain volume of fossils. (3)

3.2.6 Explain the relationship between average brain volume and cultural evidence for human evolution. (3)
(13)

3.3 The extract and diagram below are based on ratites.

BREEDING MONTHS IN RATITES

Ratites are egg-laying flightless birds. The egg-laying months are influenced by many factors such as the temperature, length of the day and availability of food. Ostriches normally lay their eggs in September, rheas between October and March, while emus lay their eggs from November to April.



The present-day distribution of ratite species

3.3.1 The ratites shown in the map are classified as different biological species.

(a) State what is meant by a *biological species*. (2)

(b) Using the information in the extract, explain why the ostrich and emu are considered different species. (2)

(c) Name TWO other reproductive isolation mechanisms that would have prevented the rhea and ostrich from interbreeding if they were in the same habitat. (2)

3.3.2 Identify the evidence for evolution represented in the diagram. (1)

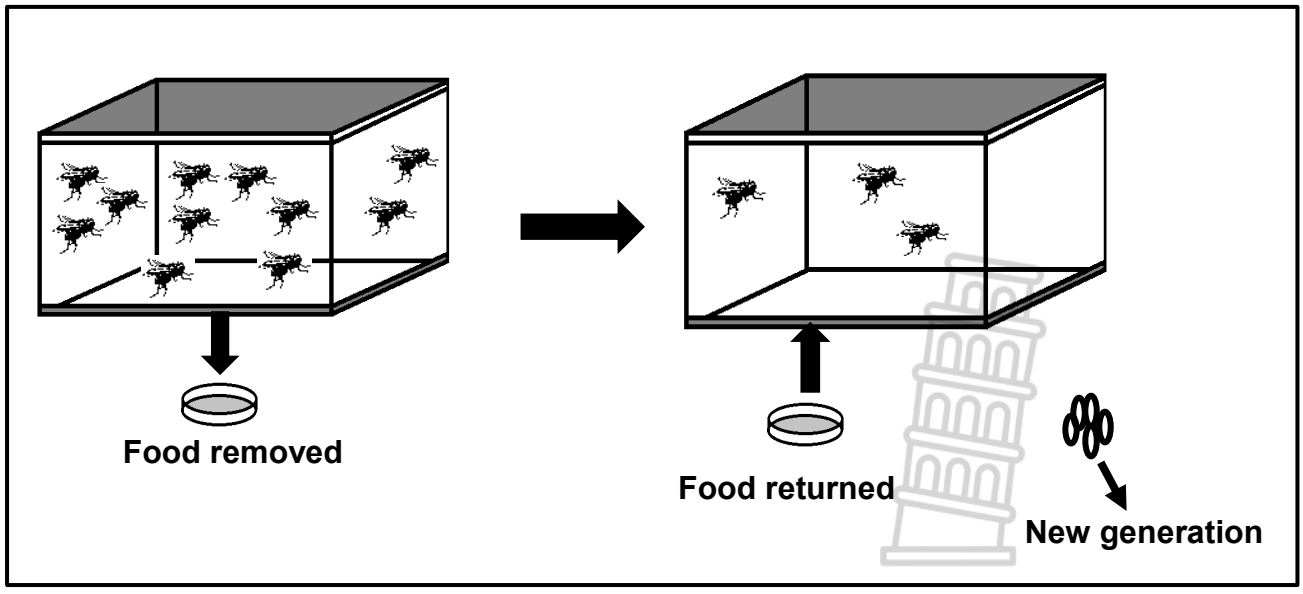
3.3.3 Describe how the evidence identified in QUESTION 3.3.2 supports the theory of evolution. (5)
(12)

3.4 Starvation resistance refers to the period for which an organism can go without food before it dies.

An investigation was conducted to determine the effect of the availability of food on the starvation resistance in fruit flies.

The procedure was as follows:

- 5 000 fruit flies of the same age were used.
- They were all placed in a container suitable for the growth of fruit flies and were given a maltose-based food source.
- The food source was removed after an hour.
- The time it took for 80% of the fruit flies to die from starvation was recorded.
- The dead flies were removed from the container.
- The food source was then returned to the container.
- The remaining fruit flies were allowed to interbreed.
- Their eggs were collected and transferred to a new container with a food source where they were allowed to hatch.
- These fruit flies were allowed to grow to the same age as the 1st generation.
- The food source was then removed again.
- The time it took for 80% of the fruit flies to die from starvation was recorded again.
- This procedure was repeated until the 60th generation of fruit flies was reached.



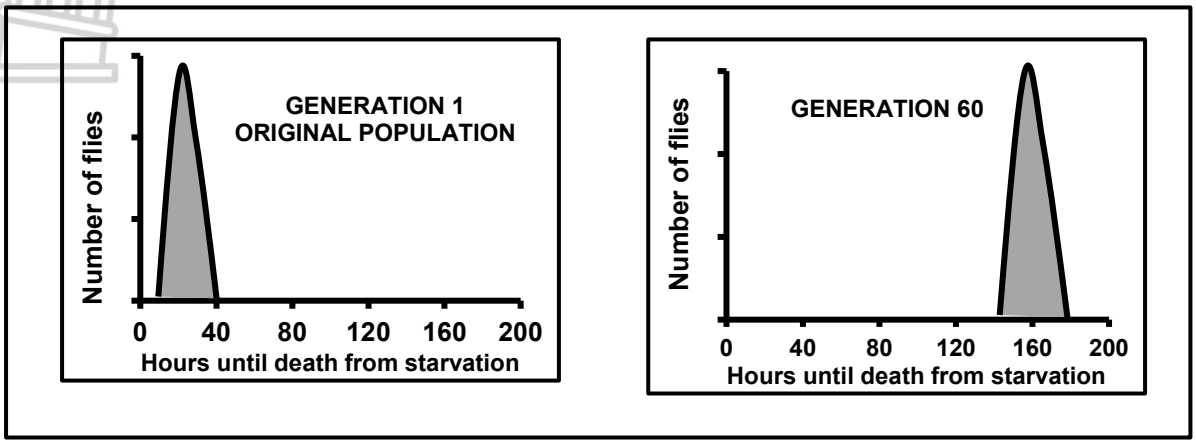
3.4.1 State the independent variable for this investigation. (1)

3.4.2 Describe how the dependent variable was measured. (1)

3.4.3 State ONE controlled variable that was considered when selecting the fruit flies at the beginning of the investigation. (1)

3.4.4 Explain why the investigator gave the fruit flies the same type of food throughout the investigation. (2)

The graphs below show the results obtained for the 1st generation and the 60th generation.



3.4.5 Describe the results obtained in this investigation. (2)

3.4.6 Using Darwin's theory of natural selection, explain the increase in starvation resistance in fruit flies. (6)
(13)
[50]

TOTAL SECTION B: 100
GRAND TOTAL: 150

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