education

Department:
Education
North West Provincial Government
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

LIFE SCIENCES P2

SEPTEMBER 2024

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 the ANSWER BOOK.
3. Start the answer 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, tabels or flow charts only when asked to do so.
8. The diagrams in this question paper are NOT necessarily all drawn to scale.
9. Do NOT use graph paper.
10. You must use a non-programmable calculator, protractor and 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 1.1.9) in the ANSWER BOOK, e.g 1.1.10 D.

1.1.1 During which phase of meiosis do homologous chromosomes split and move to the poles?

A Anaphase II
B Telophase I
C Anaphase I
D Prophase I

1.1.2 The list below describes features of evolutionary theories:

(i) Organisms show a great deal of variation
(ii) Long periods of time during which species do not change
(iii) Frequent use of organs results in them becoming stronger, better and bigger
(iv) Favourable characteristics are passed on to the next generation

Which ONE of the following combinations of features gives the CORRECT characteristics of natural selection?

A (i) and (iv) only
B (iii) and (iv) only
C (ii) and (iii) only
D (i) and (iii) only

1.1.3 The table below shows the DNA triplets that code for some amino acids.

DNA triplet	Amino acids
ACA	Cysteine
CTT	Glutamic acid
TGT	Threonine
TTA	Asparagine
GAA	Leucine
TAC	Methionine

The anticodon for the amino acid leucine will be …

A ACA.
B CUU.
C GAA.
D AGA.

1.1.4 In humans, brown eye colour is dominant over blue eye colour.

When one parent has blue eyes and the other parent has brown eyes and both are homozygous for the trait, what are the chances that their children will have blue eyes?

A 100%
B 75%
C 50%
D 0%

1.1.5 Which ONE of the following monohybrid crosses will result in a phenotypic ratio of 1 **:** 1?

A Both parents are homozygous for the dominant characteristic.
B Both parents are homozygous.
C One parent is heterozygous and the other parent is homozygous dominant.
D One parent is heterozygous and the other parent is homozygous recessive.

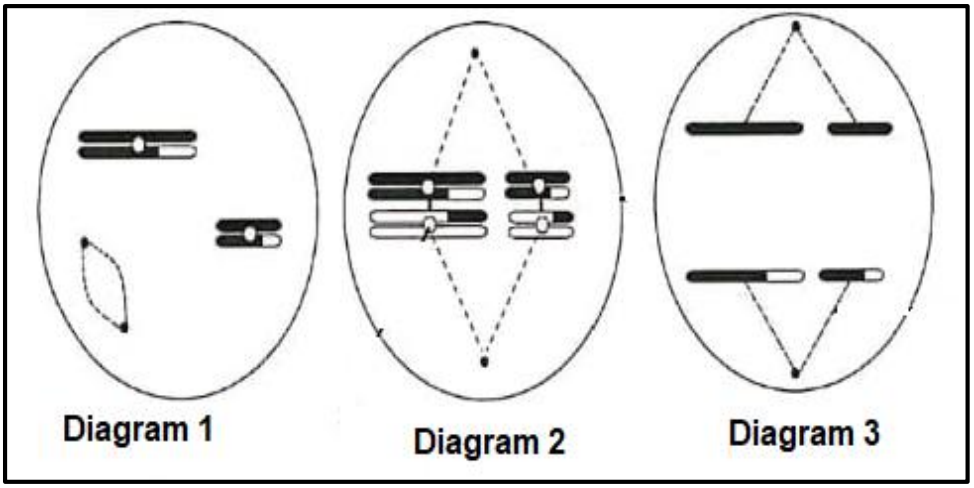
1.1.6 The characteristics that appear in both humans and African apes are …

A opposable thumb, sexual dimorphism and bipedalism.
B opposable thumb, sexual dimorphism and quadrupedalism.
C large cranium, small canines and prognathous jaw.
D small cranium, large canines and prognathous jaw.

1.1.7 The first primate to use tools constantly was …

A *Homo neanderthalensis*.
B *Homo sapiens*.
C *Homo floresiensis*.
D *Homo habilis*.

1.1.8 The diagram below represents different phases of meiosis.



The sequence in which the phases of meiosis occur are diagrams …

A 1, 3 and 2.
B 3, 1 and 2.
C 2, 1 and 3.
D 1, 2 and 3.

1.1.9 A sample of DNA has 80 guanine bases and 40 adenine bases.

How many phosphate molecules would you expect in ONE strand of this sample of DNA?

A 40
B 60
C 120
D 240

(9 x 2) **(18)**

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 type of vision present in both apes and humans that allows for depth perception

1.2.2 The monomers of nucleic acids

1.2.3 An explanation describing evolution as consisting of long phases of little change alternating with short phases of rapid change

1.2.4 The phase in the cell cycle during which DNA replication occurs

1.2.5 The type of variation in a population in which there is no range of intermediate phenotype

1.2.6 A sub-group of the hominids that includes only modern humans and early human ancestors

1.2.7 Undifferentiated cells that can develop into any type of cell, tissue or organ

1.2.8 The characteristics that are influenced by alleles carried on the gonosomes

1.2.9 The biotechnological production of genetically identical offspring

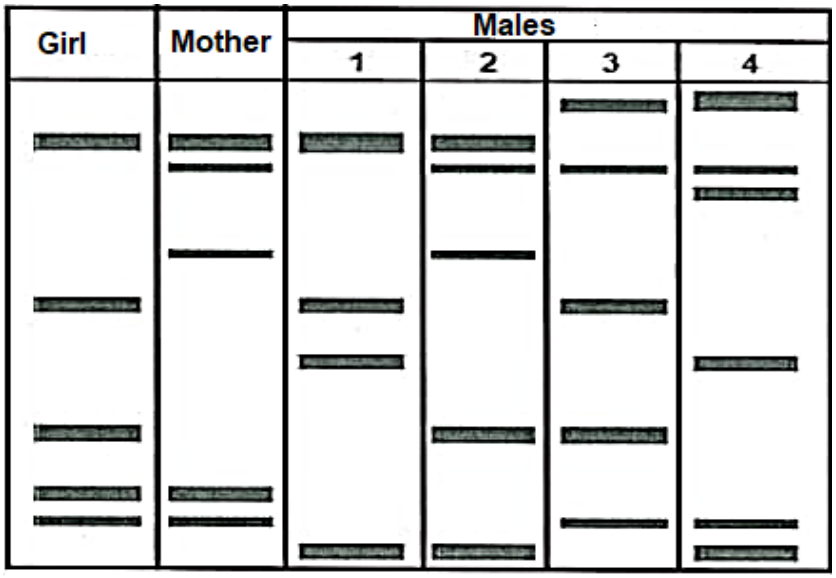
(9 x 1) **(9)**

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 numbers (1.3.1 to 1.3.3) in the ANSWER BOOK.

COLUMN I		COLUMN II	
1.3.1	The genotype of a male with colour blindness	A: B:	X^dY X^dX^d
1.3.2	Evidence of evolution	A: B:	Modification by descent Fossil record
1.3.3	Discovered the structure of the DNA molecule	A: B:	Raymond Dart Watson and Crick

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

1.4 The diagram below shows the DNA profiles of a girl, her mother and four males.



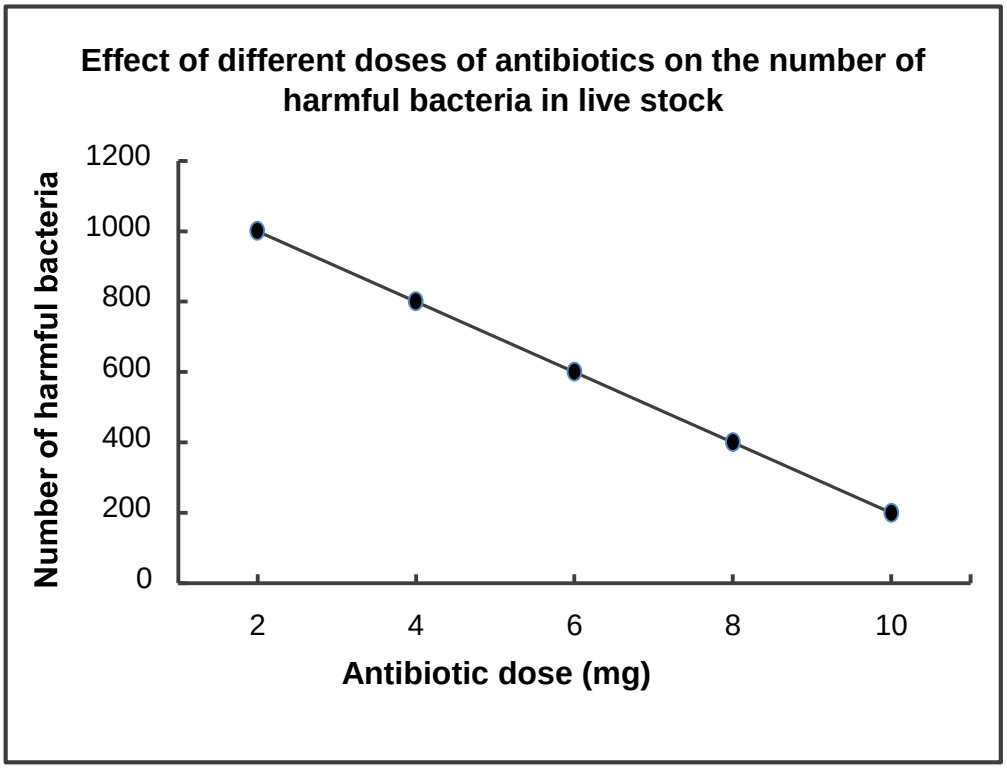
1.4.1 Which male is the girl's biological father? (1)

1.4.2 Explain your answer in QUESTION 1.4.1. (2)

1.4.3 State TWO other functions of DNA profiling. (2)
(5)

1.5 Some farmers add low doses of antibiotics to the cattle feed which could result in the evolution of antibiotic resistant bacteria.

The graph below shows the effect of different doses of antibiotics on the number of harmful bacteria.



1.5.1 Name the type of evolution that could result in the evolution of antibiotic resistant bacteria. (1)

1.5.2 Identify the:

(a) Independent variable (1)

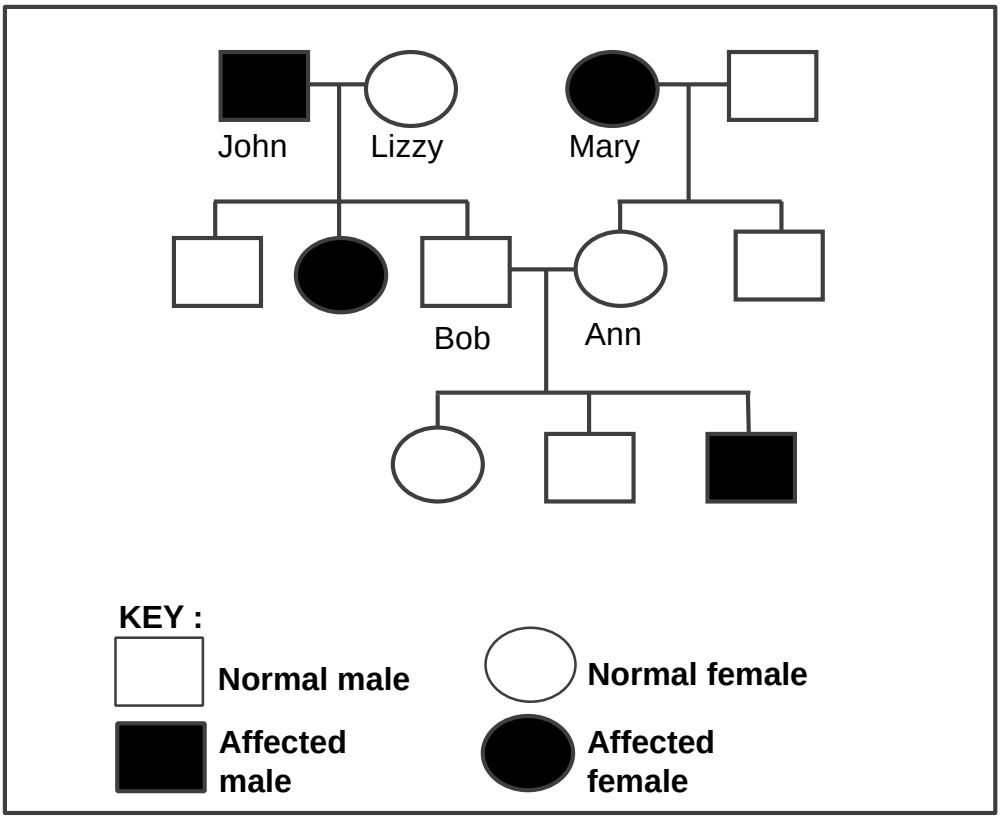
(b) Dependent variable (1)

1.5.3 Describe the trend observed in the graph. (2)

1.5.4 Use evidence from the graph above to explain why higher doses of antibiotics will benefit the farmer economically. (2)
(7)

1.6 Albinism is caused by an autosomal recessive allele (**a)**.

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



1.6.1 Give:

(a) Mary's phenotype (1)

(b) Lizzy's genotype (1)

(c) John's genotype (1)

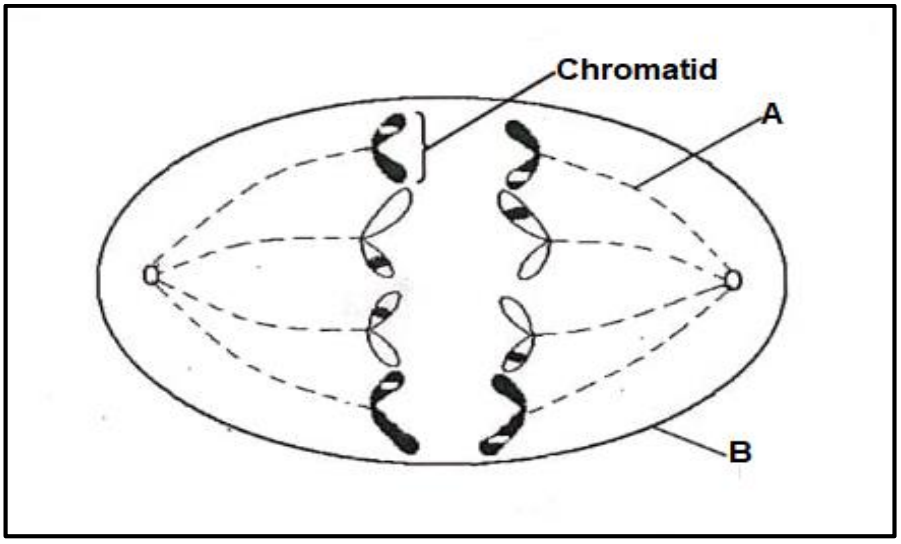
1.6.2 Explain why Bob and Ann are both heterozygous for albinism. (2)
(5)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 The diagram below represents an animal cell in a phase of meiosis.



2.1.1 Name structure:

(a) **A** (1)

(b) **B** (1)

2.1.2 Identify the phase represented in the diagram above. (1)

2.1.3 Give a reason for your answer to QUESTION 2.1.2. (2)

2.1.4 Which phase occurred before to the one represented in diagram? (1)

2.1.5 Explain the consequences if the process, causing variation, did not occur between chromatids from the cell above. (3)

2.1.6 How many cells will be formed at the end of this cell division? (1)

2.1.7 Tabulate TWO differences between Meiosis I and Meiosis II (5)
(15)

2.2 Lamarck's theory of evolution is based on TWO Laws or Principles.

The **Law of use and disuse** and the **Law of inheritance of acquired characteristics**

2.2.1 Explain the Law of inheritance of acquired characteristics according to Lamarckism. (2)

2.2.2 Explain why Lamarck's ideas are NOT accepted in the science community today. (2)
(4)

2.3 There are four blood groups in humans.

Blood group A, B, AB and O are regarded as phenotypes.

2.3.1 Explain why blood groups are controlled by multiple alleles. (2)

2.3.2 How many of these alleles can an individual inherit in the genotype? (1)

2.3.3 Explain the role of blood grouping in paternity testing. (2)
(5)

2.4 Scientists wanted to determine what type of genetic disorder are found mostly in cats.

To do this they took 200 cats of the same breed suffering from various genetic disorders.

The table below represent the types of genetic disorders and percentage of each:

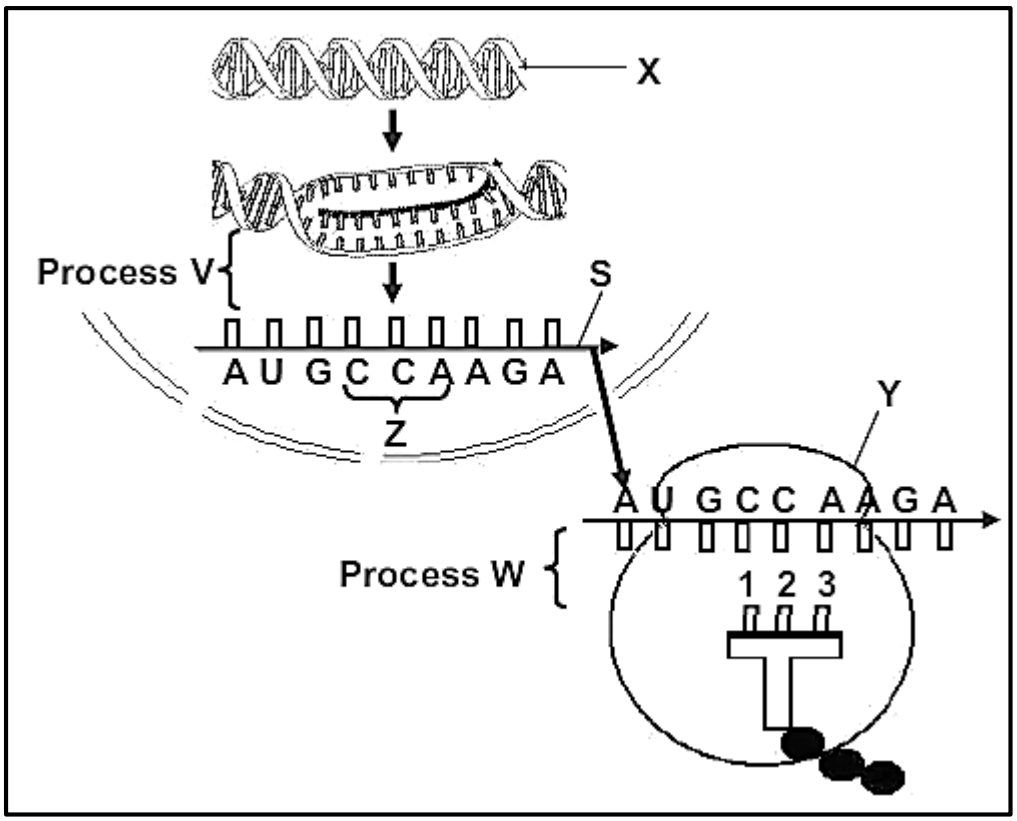
Type of genetic disorders	**Percentage of genetic disorders**
Diabetes	45
Polycystic Kidney Disease	25
Deafness	20
Other	10

2.4.1 Explain the concept *gene mutation*. (2)

2.4.2 State ONE way in which the reliability of the investigation was achieved. (1)

2.4.3 Draw a pie chart to represent the data in the table above. (6)
(9)

2.5 The diagram below shows the process of protein synthesis.



2.5.1 Identify:

(a) Process **V** (1)

(b) Two places where molecule **X** is found (2)

(c) Nitrogenous base **A** (1)

2.5.2 Describe the process occurring at **Y.** (6)

2.5.3 Give the anticodon for the nitrogenous bases labelled **Z.** (1)

2.5.4 If the 3rd base on the molecule **S** changed to **C**, explain the consequences to the protein that will be formed. (3)

2.5.5 The table below shows the amino acids that correspond to different DNA codes.

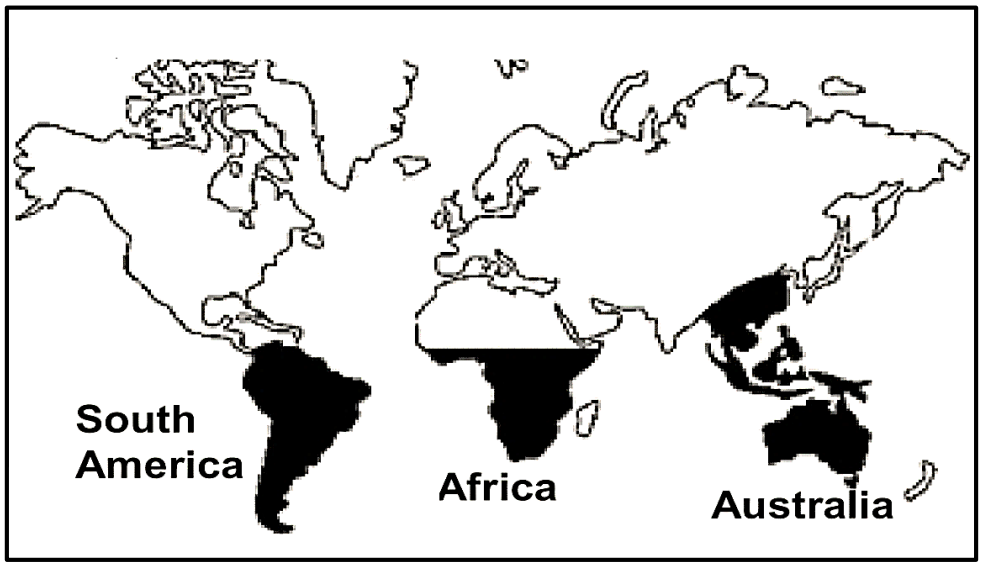
Amino acid	DNA code
Glycine	GGT
Arginine	TCT
Methionine	TAC

Write down the sequence from left to right of amino acids coded by molecule **S.** (3)

(17)
[50]

QUESTION 3

3.1 Shrubs of the family Proteaceae can be found in Australia, South America and parts of Africa as shown on the map below.

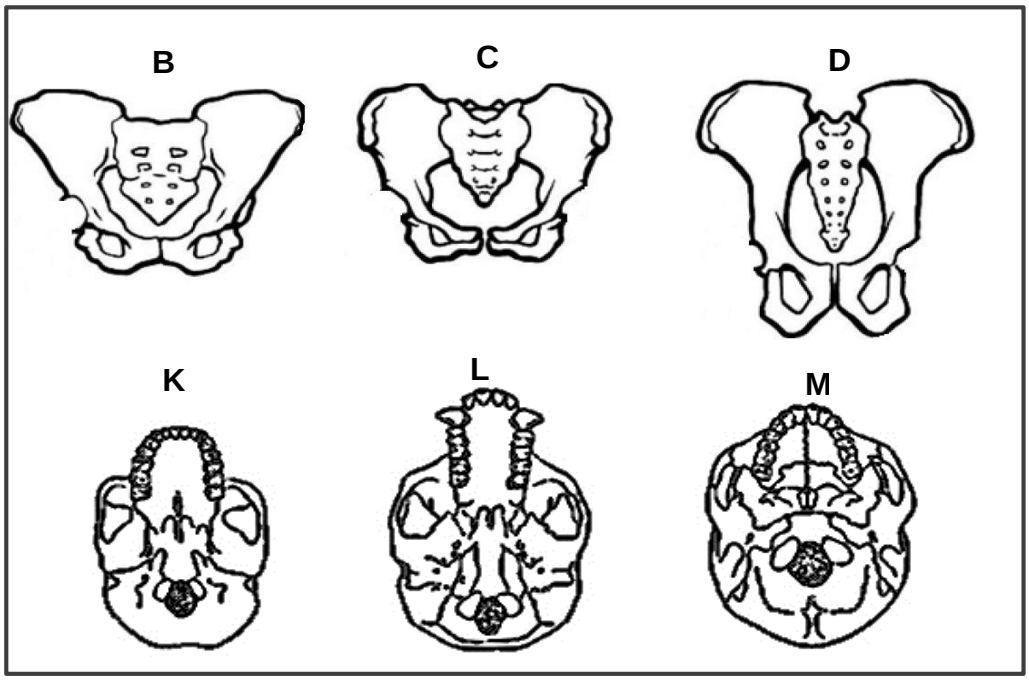


3.1.1 Define the term *species*. (3)

3.1.2 Explain how the different species of shrubs could have evolved in South America, Africa and Australia. (7)

3.1.3 Mention TWO reproductive isolation mechanisms that keep species separated. (2)
(12)

3.2 The diagrams below represent the pelvic structure and the ventral view of the skulls of three organisms.



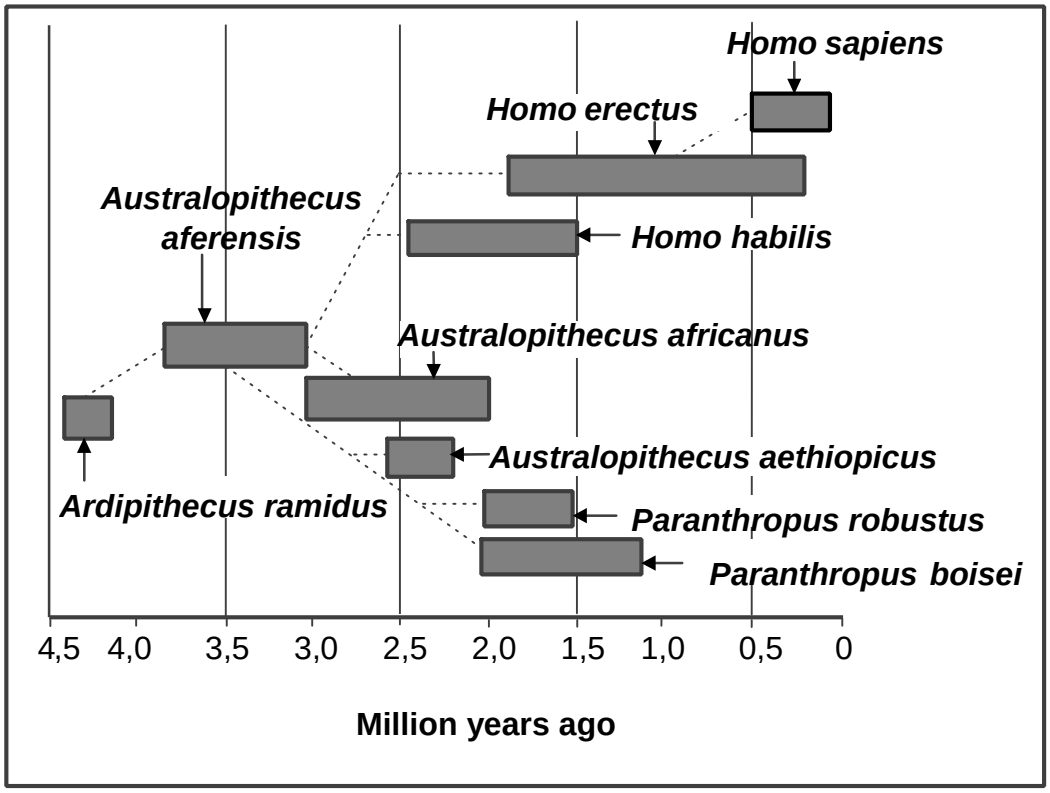
3.2.1 Write down the LETTER of the skull that shows a foramen magnum of *H. sapiens.* (1)

3.2.2 Explain your answer to QUESTION 3.2.1. (2)

3.2.3 Describe how pelvis **D** is representative of a quadrupedal organism. (2)

3.2.4 Describe TWO visible differences between the jaws of skull **K** and **L**. (4)
(9)

3.3 The diagram below shows a possible representation of human evolution.



3.3.1 Name the type of diagram shown above. (1)

3.3.2 How long ago did *Australopethicus afarensis* become extinct? (1)

3.3.3 Identify TWO species that coexisted with *Homo erectus.* (2)

3.3.4 State ONE advantage of a larger cranial capacity in *H. sapiens*. (2)

3.3.5 Calculate the time difference between the evolution of *Homo erectus* and *Homo sapiens.* (2)

3.3.6 Describe how the fossils of the species in the diagram provide evidence for the Out of Africa hypothesis. (2)
(10)

3.4 In rabbits, brown fur (**B**) is dominant to white fur (**b**) and long ears (**E**) are dominant to short ears (**e**).

A rabbit that is heterozygous for both characteristics is crossed with a rabbit with white fur and short ears.

3.4.1 How many genes of the rabbits are considered in this cross? (1)

3.4.2 State the genotypes of the parents. (2)

3.4.3 Give:

(a) Phenotype of rabbit that is dominant for both characteristics (2)

(b) All the possible genotypes in the gametes of the heterozygous parent (2)

3.4.4 State Mendel's Law of independent assortment. (2)
(9)

3.5 Read the information below

> Familial hypercholesterolemia, a disorder that is passed down through families, causes LDL (bad) cholesterol level to be very high. This disorder shows incomplete dominance.
>
> Allele H^N codes for normal LDL receptor. Allele H^S codes for the inability to make a LDL receptor. Individuals with genotype H^NH^N are normal and those with genotype H^SH^S have severe hypercholesterolemia. Heterozygous (H^NH^S) individuals have a mild form of the disease.

3.5.1 Describe what is meant by *incomplete dominance.* (2)

3.5.2 Give evidence from the information above that shows that inheritance of familial hypercholesterolemia is an example of incomplete dominance. (2)

3.5.3 A man, heterozygous for familial hypercholesterolemia marries a woman who has normal LDL receptors.

In a genetic cross show the percentage chance of them having children with severe hypercholesterolemia. (6)
(10)
[50]

TOTAL SECTION B: 100
GRAND TOTAL: 150

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