Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 12

SEPTEMBER 2022

LIFE SCIENCES P2

MARKS: **150**

TIME: **2½ hours**

This question paper consists of 16 pages.

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. 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. All calculations to be rounded off to TWO decimal spaces.
12. Write neatly and legibly.

SECTION A

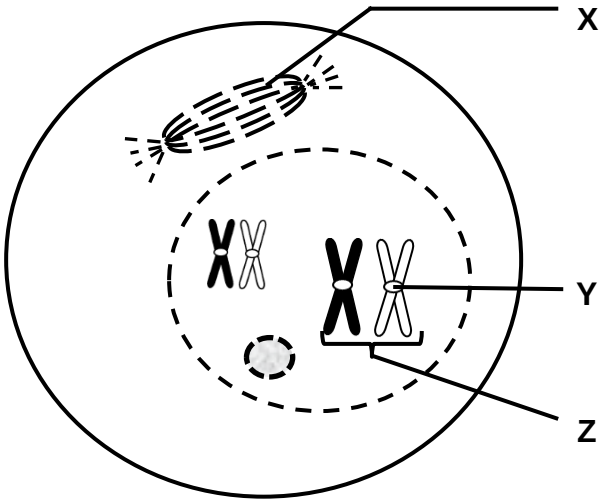
QUESTION 1

1.1 Various options are provided as possible answers to the following questions. Choose the correct answer and write only the letter (A–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 Which ONE of the following CORRECTLY describes the four cells produced by meiosis?

A Haploid and are genetically different
B Diploid and are genetically identical
C Diploid and are genetically different
D Haploid and are genetically identical

1.1.2 The diagram below shows a cell during Prophase 1.



Which ONE of the following are the correct labels for X, Y and Z in the diagram?

A X – Spindle fibre; Y – centriole; Z – chromosome
B X – Centriole; Y – chiasma; Z – homologous chromosomes
C X – Spindle fibre; Y – centromere; Z – homologous chromosomes
D X – Centromere; Y – centriole; Z – chromosome

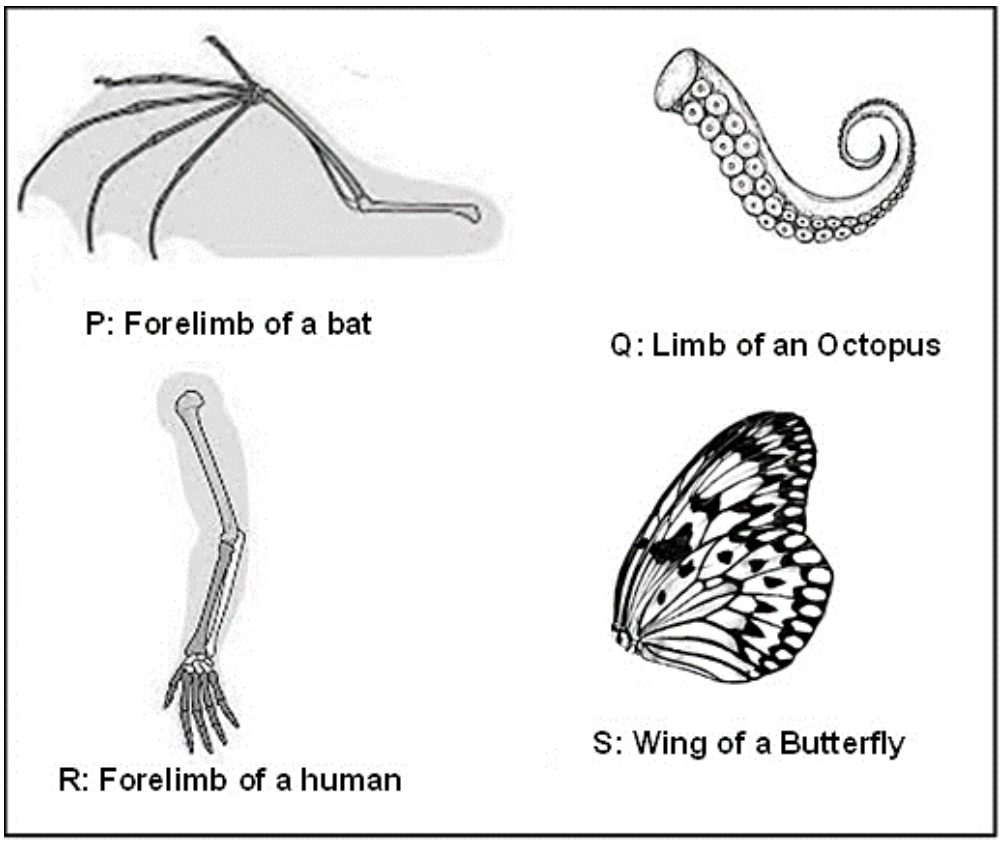
1.1.3 Which ONE of the following is the biological importance of meiosis?

A Repairs worn out cells
B Production of gametes in humans
C Production of somatic cells in humans
D Responsible for growth in organisms

1.1.4 How many mRNA nucleotides code for a protein made up of 120 amino acids?

A 30
B 40
C 360
D 120

1.1.5 The diagram below represents the appendages of the four different organisms.



Which TWO limbs are homologous structures?

A P and Q
B Q and R
C P and R
D P and S

1.1.6 Speciation has occurred when …

A two populations can no longer interbreed and produce fertile offspring.
B populations are separated by a geographical barrier.
C populations go extinct.
D a mutation has occurred in an individual organism.

1.1.7 The chromosome complements in a cell of an individual who inherits an X chromosome from the father is …

A 44 and XX.
B 44 and XY.
C 46 and XX.
D 46 and XY.

QUESTIONS 1.1.8 AND 1.1.9 REFER TO THE FOLLOWING DIHYBRID CROSS.

In rabbits, fur colour and fur length are controlled by two genes. Black fur (**B**) is dominant over white fur (**b**) and long fur (**L**) is dominant over short fur (**l**). Two rabbits, 1 and 2, were mated.

The table below shows the possible gametes that can be produced by each rabbit.

	Possible gametes			
Rabbit 1	bl	bl	bl	bl
Rabbit 2	BL	Bl	bL	bl

1.1.8 Which ONE of the following is the phenotype of rabbit **2**?

A White with short fur
B Black with short fur
C White with long fur
D Black with long fur

1.1.9 Which ONE of the following are possible genotypes of the offspring of rabbit **1** and **2**?

A bbll, BbLl, Bbll, bbLl
B BbLL, Bbll, bbll, BBLL
C BBLL, BbLl, Bbll, bbll
D BbLl, Bbll, BbLL, bbLL

1.1.10 A woman with blood group **A** married a man and had four children with blood groups as shown in the table below.

Child 1	**Child 2**	**Child 3**	**Child 4**
A	O	A	B

The genotype of the man is …

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

(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 1.2.8) in the ANSWER BOOK.

1.2.1 A point where chromatids overlap during crossing over

1.2.2 A segment of DNA that codes for a particular protein

1.2.3 A phase before cell division during which DNA replication takes place

1.2.4 Genetic material that is used to trace female ancestry

1.2.5 A pattern of dark bands derived from genetic material and that is unique to each individual

1.2.6 Evolution characterised by long periods of little or no change followed by short periods of rapid change

1.2.7 A group of organisms with similar characteristics, occupying the same habitat at the same time and are able to interbreed to produce fertile offspring

1.2.8 The change in the genetic composition of a species over time

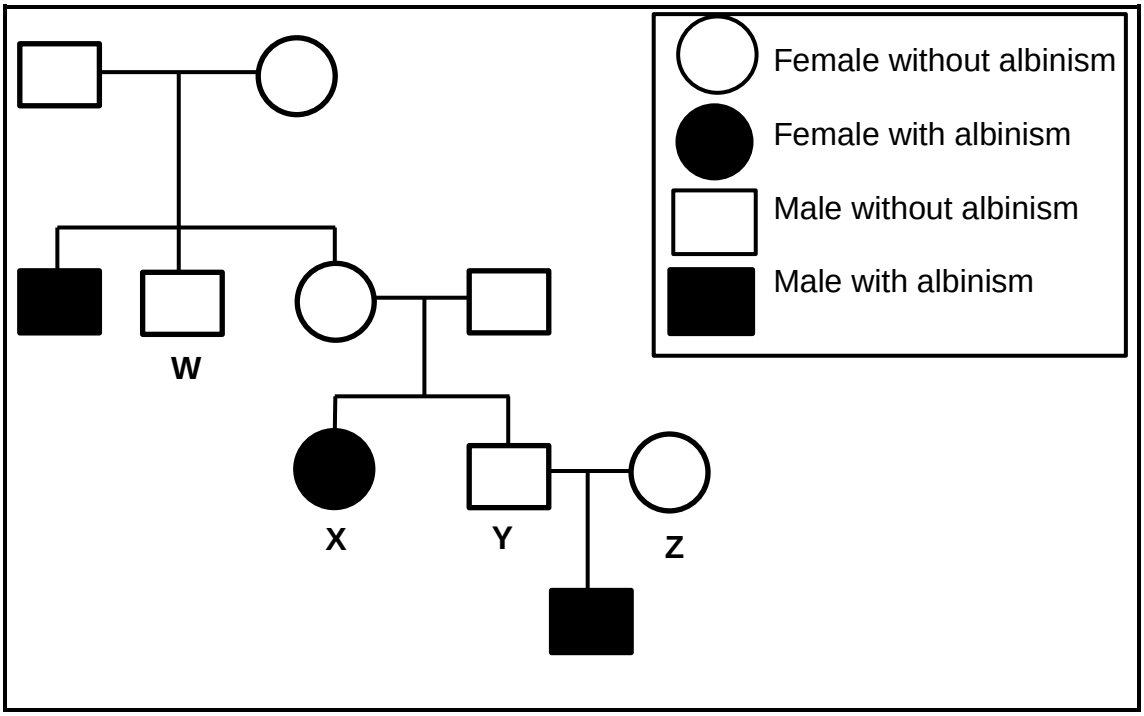
(8 x 1) (8)

1.3 Indicate whether each of the statements 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	As evidence for evolution	A: B:	Biogeography Meiosis
1.3.2	Site of meiosis	A: B:	Uterus Ovaries
1.3.3	An event that occurs during Metaphase II	A: B:	Crossing over Random arrangement of chromosomes

(3 x 2) (6)

1.4 Albinism is a skin disorder caused by a recessive allele on an autosome. The pedigree diagram below represents the inheritance of albinism in a family. Use **N** for normal skin colour and **n** for albinism**.**



1.4.1 How many generations are represented in the pedigree diagram? (1)

1.4.2 Give the:

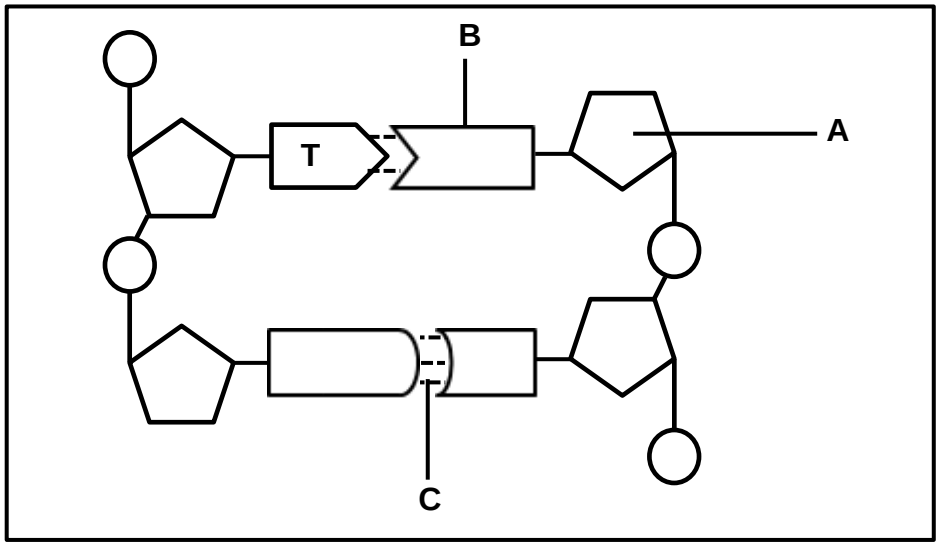
(a) Phenotype of individual **W** (1)

(b) Genotype of individual **X** (2)

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

1.4.3 What is the percentage chance of individuals **Y** and **Z** having a child without albinism? (2)

1.5 The diagram below shows a short section of a DNA molecule.



1.5.1 What is the natural shape of a DNA molecule? (1)

1.5.2 Identify:

(a) Sugar **A** (1)

(b) The nitrogenous base **B** (full name required) (1)

(c) Bond **C** (1)

1.5.3 Give TWO visible reasons why the diagram above represents a DNA molecule. (2)

1.5.4 Name TWO structures in a non-dividing human cell where DNA is found. (2)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 A sequence of nitrogenous bases in a DNA molecule is shown below.

CCC – GGT – TCA

2.1.1 Write down the mRNA codon sequence that reads from left to right from the DNA sequence above. (2)

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

Anticodon	Amino Acids
CAA	Valine
CCC	Glycine
CGU	Alanine
AAA	Phenylalanine
UUA	Asparagine
UAC	Methionine
GGU	Proline
ACC	Tryptophan
UCA	Serine

Write down the amino acids (in the correct sequence) that would be coded for by the DNA molecule above. (3)

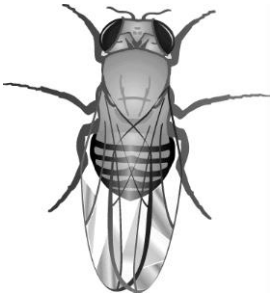
2.1.3 During transcription the first triplet in the DNA sequence changed from **CCC** to **ACC**.

Explain how this would affect the protein that is formed. (4)

2.1.4 Describe the role of tRNA in translation. (2)

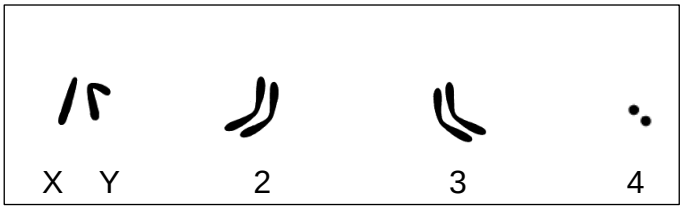
2.1.5 Tabulate TWO differences between the process of DNA replication and transcription. (5)

2.2 The diagram below shows the karyotypes of male and female fruit flies.

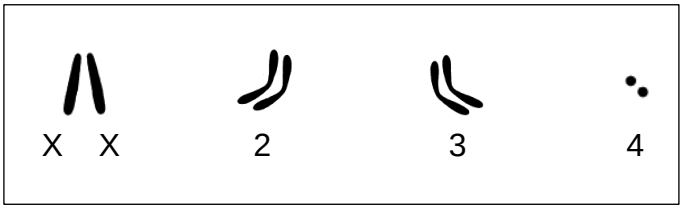


Fruit Fly

Karyotype of a male fruit fly



Karyotype of a female fruit fly



2.2.1 State what is meant by the term *karyotype*. (2)

2.2.2 What is the diploid number of chromosomes of this species of fruit fly? (1)

2.2.3 Describe how sex determination in fruit flies is similar to humans. (2)

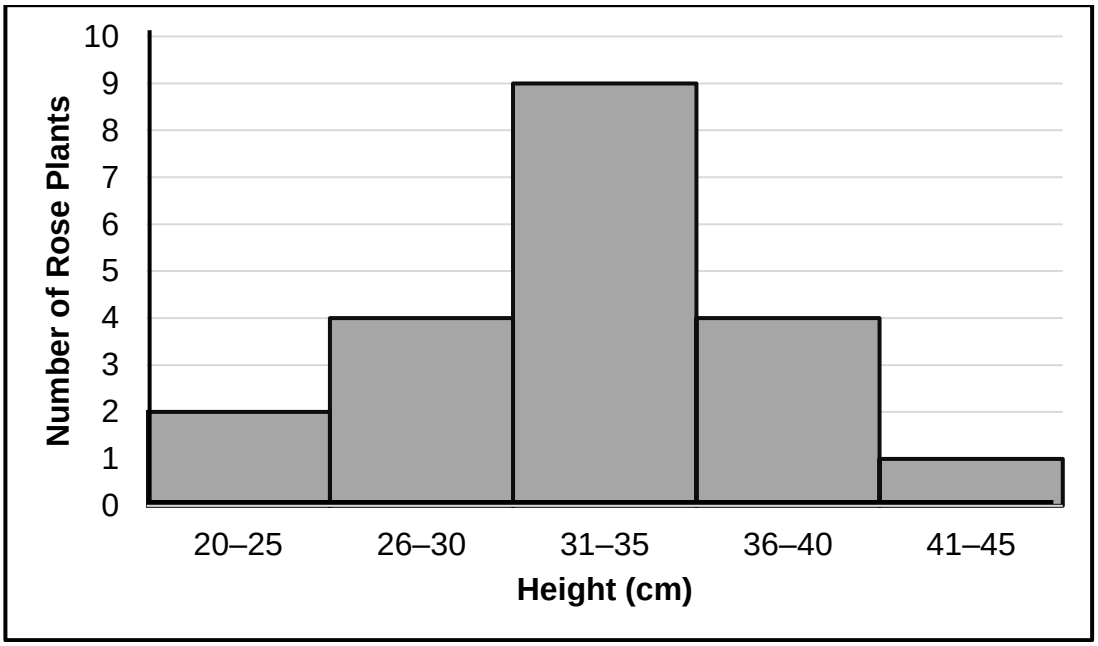
2.3 The gene for eye-colour in fruit flies is carried on the X-chromosome and therefore is sex linked. The allele for red eye colour is dominant ($\mathbf{X^R}$) over the allele for white eye colour ($\mathbf{X^r}$).

2.3.1 State Mendel's Law of dominance. (2)

2.3.2 A heterozygous female is mated with a white-eyed male.

Use a genetic cross to show the possible genotypes and phenotypes of the offspring. (7)

2.4 The histogram below shows the range of heights in a sample of rose plants.



2.4.1 What type of variation is shown by the height of rose plants? (1)

2.4.2 Give a reason for your answer in QUESTION 2.4.1. (2)

2.4.3 Rose flowers with long stems sell for the highest price because the long-stemmed flowers look beautiful in a vase.
Plant breeders select plants with the longest stems to interbreed. And these long-stemmed plants do not necessarily survive in the wild because wind can bend and break them.

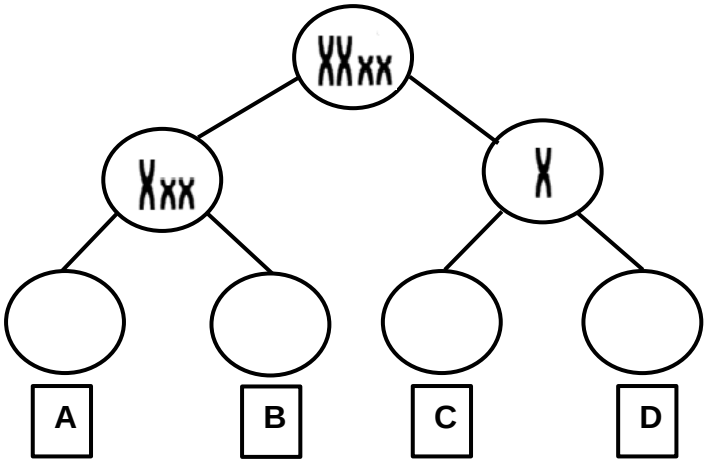
Explain how this practice of interbreeding long-stemmed flowers is an example of artificial selection and not natural selection. (4)

2.4.4 When rose plants with yellow flowers are crossed with rose plants with red flowers, the offspring all have orange flowers.

What is this type of dominance called? (1)

2.4.5 A plant breeder **only** has plants with **orange** flowers. Can she produce red offspring from these flowers? Explain your answer. (3)

2.5 The diagram below shows a cell which has undergone a non-disjunction of chromosomes during meiosis.



2.5.1 During which phase of meiosis did this non-disjunction of chromosomes occur? (1)

2.5.2 Name the type of mutation that will result from non-disjunction of chromosomes. (1)

2.5.3 Explain the disorder that will result from non-disjunction of chromosome pair 21 in humans. (4)

2.5.4 Draw cell **A** to show the chromosome composition after meiosis 2 of this cell division. (2)

2.5.5 Name the type of cells that will be produced in a male at the end of meiosis. (1)

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QUESTION 3

3.1 Cloning is used to produce a variety of domestic animals. However, the cost to produce a cloned animal can be up to R300 000.

Scientists conducted an investigation to determine the success rate of cloning in different animals.

The success rate is determined as the percentage of young born live from the embryos transferred to the mother.

The table below shows the number of embryos transferred to the surrogate mother and the number of young that were born live from cloned embryos.

Animal	Number of embryos transferred to the surrogate mother	Number of young born live	Percentage success rate
Sheep	110	50	46
Cattle	250	70	28
Goats	26	8	31
Pigs	9	5	56

3.1.1 State ONE reason why these results are considered reliable. (1)

3.1.2 Identify the dependent variable in this investigation. (1)

3.1.3 Draw a bar graph to compare the percentage success rate in the different animals. (6)

3.1.4 State ONE benefit of cloning. (1)

3.1.5 Using the information given, explain TWO disadvantages of cloning cattle for meat production. (4)

3.2 Read the extract below.

A MOVE TOWARDS NO TUSKS – AN ELEPHANT'S STORY OF NATURAL SELECTION

The study of African elephants in Gorongosa National Park, Mozambique, found that a genetic condition which resulted in tuskless females had become more common after the 15-year civil war. Over 90% of Mozambique's elephant population were killed and the ivory used to finance the war.

Before the war only two out of every hundred female African elephants were born tuskless. But that figure has risen, 33% of the 91 female elephants born since the end of the war were tuskless.

Elephants normally eat grass, leaves, fruit, bark of trees and the roots of legumes. However, the tuskless elephants are shifting their diet. Without long tusks to peel bark from trees and dig up roots, the females eat mostly grass.

Now the scientists are studying how this will affect the species and its environment.

Elephant with tusks

Tuskless Elephant

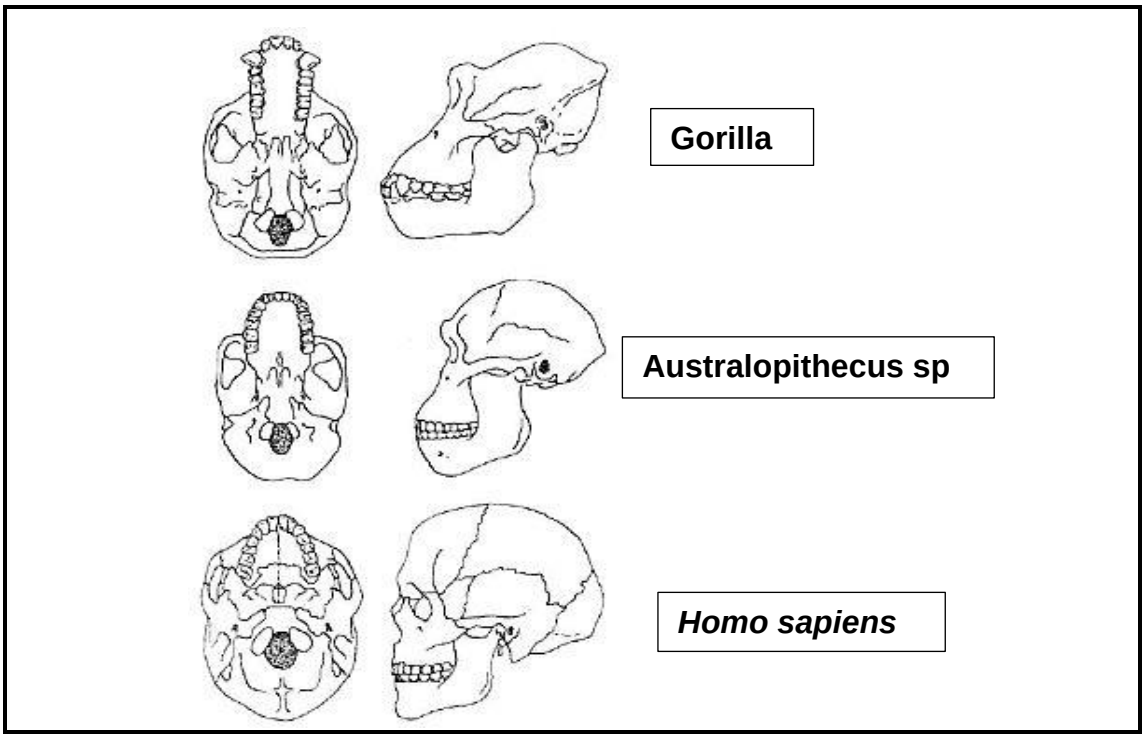
3.2.1 From the extract, write down a sentence that explains the natural diet of elephants WITH TUSKS. (1)

3.2.2 Calculate the number of tuskless female elephants born since the end of the war. (3)

3.2.3 Explain the evolution of the tuskless elephant population, using Darwin's theory of natural selection. (5)

3.2.4 Explain how the change in the elephant's diet will affect the vegetation, if the number of tuskless elephants increases. (2)

3.3 The diagram below shows the skulls of the three hominids.



3.3.1 Give TWO structural features of the Australopithecus sp. skull that are more similar to the gorilla than *Homo sapiens*. (2)

3.3.2 Explain how the size of the canines in gorilla is used as evidence for their diet. (2)

3.3.3 What is a *foramen magnum*? (1)

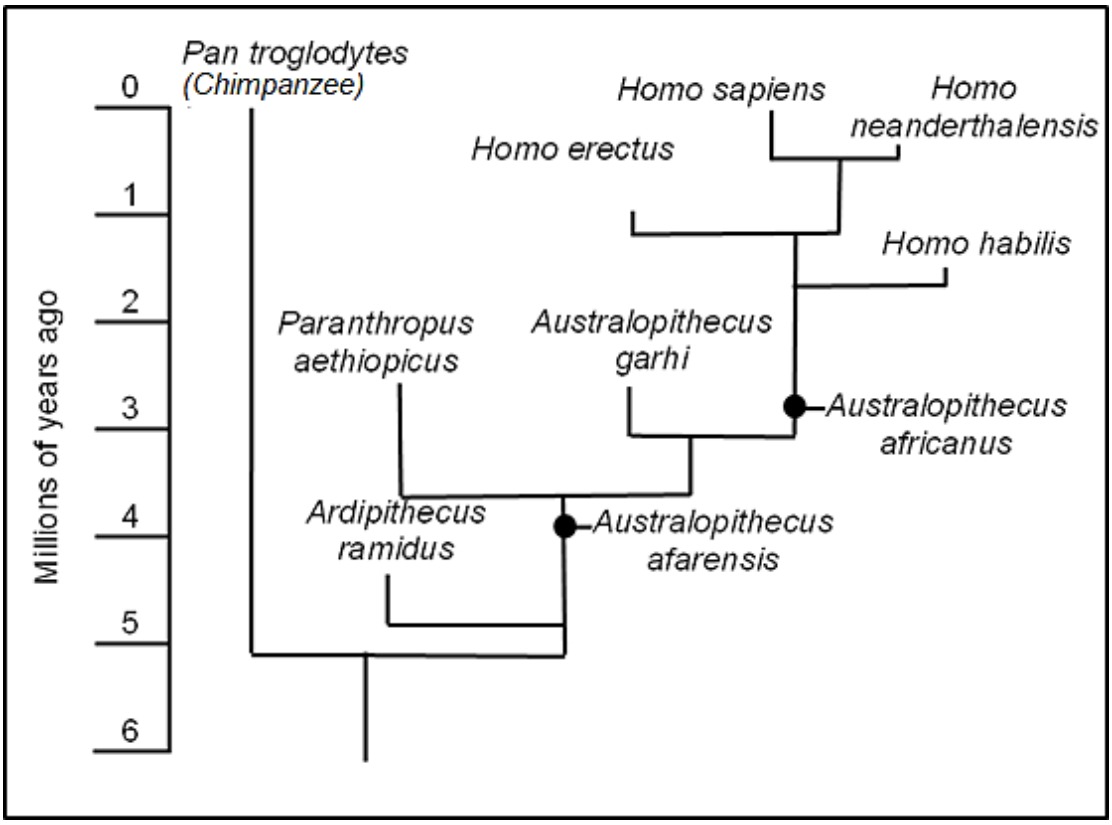
3.3.4 The position of the foramen magnum in *Homo sapiens* differs from the position in a gorilla.

Explain what this tells us about the way that these two hominids moved around. (4)

3.3.5 Explain the significance of an increased cranium size in the evolution of *Homo sapiens.* (2)

3.4 Describe how the age and location of hominid **fossils** support the 'Out of Africa' hypothesis. (5)

3.5 The diagram below shows possible evolutionary relationships amongst some hominids.



3.5.1 What is this type of diagram called? (1)

3.5.2 How many genera are represented in this diagram? (1)

3.5.3 When did *Homo erectus* become extinct? (1)

3.5.4 Name the most recent common ancestor of all the Homo species. (1)

3.5.5 Explain why *Homo erectus* cannot be seen as the direct ancestor for *Homo sapiens*. (2)

3.5.6 According to the diagram above, name ONE species that may have been outcompeted by *Homo sapiens.* (1)

3.5.7 Name the scientist who discovered *Australopithecus sediba* in the Malapa Caves – in the Cradle of Humankind. (1)

3.5.8 Name TWO sites where *Australopithecus africanus* fossils were discovered in South Africa. (2)

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TOTAL SECTION B: 100
GRAND TOTAL: 150